z/OS

UNIX System Services Command Reference

Version 2 Release 1

SA23-2280-01

Note
Before using this information and the product it supports, read the information in "Notices" on page 1047.

This edition applies to Version 2 Release 1 of z/OS (5650-ZOS) and to all subsequent releases and modifications until otherwise indicated in new editions.

Contents

Tables xi

About this document xiii
Using this document xiii
z/OS information xiii

How to send your comments to IBM . . xv
If you have a technical problem xv

Summary of changes xvii
Summary of changes for z/OS Version 2 Release 1 (V2R1) as updated February, 2015 xvii
z/OS Version 2 Release 1 summary of changes xvii

Chapter 1. Introduction to shell commands and DBCS. 1
Reading the command descriptions. 1
Using the double-byte character set (DBCS) 7

Chapter 2. Shell command descriptions 11
alias — Display or create a command alias 11
amblist — Display formatted information from object and executable files for diagnostic purposes . 14
ar — Create or maintain library archives 16
as — Use the HLASM assembler to produce object files 19
asa — Interpret ASA/FORTRAN carriage control. . 23
at — Run a command at a specified time 24
autoload — Indicate function name not defined . . 28
automount — Configure the automount facility . . 28
awk — Process programs written in the awk language 35
basename — Return the nondirectory components of a path name 52
batch — Run commands when the system is not busy. 53
bc — Use the arbitrary-precision arithmetic calculation language 54
bg — Move a job to the background 70
bpxmtext — Display reason code text 71
bpxtrace — Activate or deactivate traces for processes 71
break — Exit from a loop in a shell script 77
c++ — Compile C and C++ source code, link-edit and create an executable file. 77
c89 — Compiler invocation using host environment variables 78
c99 — Compile C source code, link-edit and create an executable file 117
cal — Display a calendar for a month or year . . 118
calendar — Display all current appointments. . . 118
cancel - Cancel print queue requests (stub command) 120
captoinfo — Print the terminal entries in the terminfo database 120
cat — Concatenate or display text files 122
cc — Compile C source code, link-edit and create an executable file 125
cd — Change the working directory. 125
ceebldtx — Transform message source files into assembler source files 128
chaudit — Change audit flags for a file. 130
chcp — Set or query ASCII/EBCDIC code pages for the terminal. 133
chgrp — Change the group owner of a file or directory 135
chlabel — Set the security label of files and directories 137
chmod — Change the mode of a file or directory 138
chmount — Change the mount attributes of a file system 141
chown — Change the owner or group of a file or directory 143
chroot — Change the root directory for the execution of a command 144
chtag — Change file tag information 146
cksum — Calculate and display checksums and byte counts 149
clear — Clear the screen of all previous output . . 151
cmp — Compare two files 152
col — Remove reverse line feeds 154
: (colon) — Do nothing, successfully 156
comm — Show and select or reject lines common to two files 157
command — Run a simple command 160
compress — Lempel-Ziv file compression 161
confighfs — Invoke the vfs_pfsctl function for HFS file systems 163
configstk — Configure the AF_UEINT stack . . . 165
configstrm — Set and query the STREAMS physical file system configuration 167
continue — Skip to the next iteration of a loop in a shell script 168
copytree — Make a copy of a file hierarchy while preserving all file attributes 168
cp — Copy a file 170
cpio — Copy in/out file archives. 183
cron daemon — Run commands at specified dates and times 186
crontab — Schedule regular background jobs. . . 189
csplit — Split text files 191
ctags — Create tag files for ex, more, and vi . . . 194
cu — Call up another system (stub only) 196
cut — Cut out selected fields from each line of a file 196
cxx — Compile C and C++ source code, link-edit and create an executable file 199
date — Display the date and time 200
dbgld — Create a module map for debugging . . 203

dbx — Use the debugger 205
? subcommand for dbx: Search backward for a pattern 210
/ subcommand for dbx: Search forward for a pattern 211
alias subcommand for dbx: Display and assign subcommand aliases 211
args subcommand for dbx: Display program arguments 212
assign subcommand for dbx: Assign a value to a variable 212
case subcommand for dbx: Change how dbx interprets symbols 213
catch subcommand for dbx: Start trapping a signal 213
clear subcommand for dbx: Remove all stops at a specified source line 214
cleari subcommand for dbx: Remove all breakpoints at an address 214
condition subcommand for dbx: Display a list of active condition variables 215
cont subcommand for dbx: Continue program execution 216
delete subcommand for dbx: Remove traces and stops 216
detach subcommand for dbx: Continue program execution without dbx control 217
display memory subcommand for dbx: Display the contents of memory 218
down subcommand for dbx: Move the current function down the stack 220
dump subcommand for dbx: Display the names and values of variables in a procedure 220
edit subcommand for dbx: Invoke an editor . . . 221
file subcommand for dbx: Change the current source file 222
func subcommand for dbx: Change the current function 222
goto subcommand for dbx: Run a specified source line 223
gotoi subcommand for dbx: Change the program counter address 223
help subcommand for dbx: Display a subcommand synopsis 224
history subcommand for dbx: Display commands in a history list 224
ignore subcommand for dbx: Stop trapping a signal 224
list subcommand for dbx: Display lines of the current source file 225
listfiles subcommand for dbx: Display the list of source files 226
listfuncs subcommand for dbx: Display the list of functions 227
listi subcommand for dbx: List instructions from the program 227
map subcommand for dbx: Display load characteristics 228
move subcommand for dbx: Display or change the next line to be shown with the list command . . . 229
multproc subcommand for dbx: Enable or disable multiprocess debugging 229
mutex subcommand for dbx: Display a list of active mutex objects 230
next subcommand for dbx: Run the program up to the next source line 231
nexti subcommand for dbx: Run the program up to the next machine instruction 232
object subcommand for dbx: Load an object file 232
onload subcommand for dbx: Evaluate stop/trace after DLL load 233
plugin subcommand for dbx: Pass the specified command to the plug-in parameter 233
pluginload subcommand for dbx: Load the specified plug-in 234
pluginunload subcommand for dbx: Unload the specified plug-in 234
print subcommand for dbx: Print the value of an expression 235
prompt subcommand for dbx: Change the dbx command prompt 235
quit subcommand for dbx: End the dbx debugging session 236
readwritelock subcommand for dbx: Display a list of active read/write lock objects 236
record subcommand for dbx: Append user's commands to a file 237
registers subcommand for dbx: Display the value of registers 238
rerun subcommand for dbx: Begin running a program with the previous arguments 238
return subcommand for dbx: Continue running a program until a return is reached. 239
run subcommand for dbx: Run a program. 240
set subcommand for dbx: Define a value for a dbx variable 240
sh subcommand for dbx: Pass a command to the shell for execution 245
skip subcommand for dbx: Continue from the current stopping point 245
source subcommand for dbx: Read subcommands from a file 246
status subcommand for dbx: Display the active trace and stop subcommands 246
step subcommand for dbx: Run one or more source lines 247
stepi subcommand for dbx: Run one or more machine instructions 247
stop subcommand for dbx: Stop execution of a program 248
stopi subcommand for dbx: Stop at a specified location 249
thread subcommand for dbx: Display a list of active threads 249
trace subcommand for dbx: Print tracing information 251
tracei subcommand for dbx: Turn on tracing . . . 251
unalias subcommand for dbx: Remove an alias . . 252
unset subcommand for dbx: Delete a variable . . 253
up subcommand for dbx: Move the current function up the stack 253
use subcommand for dbx: Set the list of directories to be searched 254

whatis subcommand for dbx: Display the type of program components 254
where subcommand for dbx: List active procedures and functions 255
whereis subcommand for dbx: Display the full qualifications of symbols 256
which subcommand for dbx: Display the full qualification of an identifier 257
dd — Convert and copy a file 257
df — Display the amount of free space in the file system 261
diff — Compare two text files and show the differences 263
dircmp — Compare directories 269
dirname — Return the directory components of a path name 272
. (dot) — Run a shell file in the current environment. 273
dspcat — Display all or part of a message catalog 274
dspmsg — Display selected messages from message catalogs 275
du — Summarize usage of file space 276
echo — Write arguments to standard output . . . 277
ed — Use the ed line-oriented text editor 278
edcmtext — Display errnojr reason code text . . . 288
egrep — Search a file for a specified pattern . . . 290
env — Display or set environment variables for a process 290
eval — Construct a command by concatenating arguments 291
ex — Use the ex text editor. 292
exec — Run a command and open, close, or copy the file descriptors. 295
exit — Return to the shell's parent process or to TSO/E 297
expand — Expand tabs to spaces. 298
export — Set a variable for export 300
expr — Evaluate arguments as an expression. . . 301
exrecover daemon — Retrieve vi and ex files. . . 304
extattr — Set, reset, and display extended attributes for files 307
false — Return a nonzero exit code 309
fc — Process a command history list 310
fg — Bring a job into the foreground 312
fgrep — Search a file for a specified pattern . . . 313
file — Determine file type 313
find — Find a file meeting specified criteria . . . 320
filecache — Manage file caches 328
fold — Break lines into shorter lines. 328
functions — Display or assign attributes to functions 329
fuser — List process IDs of processes with open files 330
gencat — Create or modify message catalogs. . . 331
getconf — Get configuration values 334
getfacl — Display owner, group, and access control list (ACL) entries 338
getopts — Parse utility options 340
grep — Search a file for a specified pattern . . . 343
hash — Create a tracked alias 347
head — Display the first part of a file 348
history — Display a command history list. . . . 351
iconv — Convert characters from one code set to another 352
id — Return the user identity 354
inetd daemon — Provide service management for networks 355
infocmp — Compare or print the terminal description 358
integer — Mark each variable with an integer value 362
ipcrm — Remove message queues, semaphore sets, or shared memory IDs 362
ipcs — Report status of the interprocess communication facility 363
jobs — Return the status of jobs in the current session 370
join — Join two sorted textual relational databases 372
kill — End a process or job, or send it a signal . . 374
[(left bracket) — Test for a condition 377
ld — Link object files. 377
let — Evaluate an arithmetic expression 385
lex — Generate a program for lexical tasks . . . 387
line — Copy one line of standard input 389
link — Create a hard link to a file 390
ln — Create a link to a file 391
locale — Get locale-specific information 395
localedef — Define the locale environment . . . 400
logger — Log messages 402
logname — Return a user's login name. 404
lp — Send a file to a printer 405
lpstat — Show status of print queues (stub command) 406
ls — List file and directory names and attributes 407
mail — Read and send mail messages 413
mailx — Send or receive electronic mail 416
make — Maintain program-generated and interdependent files 436
makedepend — Generate source dependency information 457
man — Display sections of the online reference manual 464
mesg — Allow or refuse messages 468
mkcatdefs — Preprocess a message source file . . 469
mkdir — Make a directory 471
mkfifo — Make a FIFO special file 472
mknod — Make a FIFO or character special file 473
more — Display files on a page-by-page basis . . 475
mount — Logically mount a file system 481
mv — Rename or move a file or directory. . . . 485
newgrp — Change to a new group 497
nice — Run a command at a different priority . . 499
nl — Number lines in a file 500
nm — Display symbol table of object, library, or executable files 502
nohup — Start a process that is immune to hang ups. 505
obrowse — Browse a z/OS UNIX file 506
od — Dump a file in a specified format 507
oedit — Edit files in a z/OS UNIX file system . . 511
pack — Compress files by Huffman coding . . . 512

passwd — Change user passwords or password phrases 514
paste — Merge corresponding or subsequent lines of a file 515
patch — Change a file using diff output 518
pathchk — Check a path name 522
pax — Interchange portable archives 523
pcat — Unpack and display Huffman packed files 554
pg — Display files interactively 555
pr — Format a file in paginated form and send it to standard output 559
print — Return arguments from the shell 562
printenv — Display the values of environment variables 563
printf — Write formatted output 564
ps — Return the status of a process 566
pwd — Return the working directory name . . . 575
r — Process a command history list 575
read — Read a line from standard input 576
readonly — Mark a variable as read-only 578
renice — Change priorities of a running process 579
return — Return from a shell function or . (dot) script 580
rlogind — Validate rlogin requests 581
rm — Remove a directory entry 583
rmdir — Remove a directory 584
runcat — Pipe output from mkcatdefs to gencat 585
script — Makes a typescript of a terminal session 586
sed — Start the sed noninteractive stream editor 588
set — Set or unset command options and positional parameters. 595
setfacl — Set, remove, and change access control lists (ACLs) 599
sh — Invoke a shell 604
shedit — Interactive command and history editing in the shell 633
shift — Shift positional parameters 640
sleep — Suspend execution of a process for an interval of time. 641
skulker — Remove old files from a directory . . . 642
sort — Start the sort-merge utility 646
spell — Detect spelling errors in files 651
split — Split a file into manageable pieces. . . . 654
stop — Suspend a process or job 655
strings — Display printable strings in binary files 656
strip — Remove unnecessary information from an executable file 659
stty — Set or display terminal options 660
su — Change the user ID associated with a session 667
submit — Submit a batch job for background processing 670
sum — Calculate and display checksums and block counts. 671
suspend — Send a SIGSTOP to the current shell 673
sysvar — Display static system symbols 674
tabs — Set tab stops 674
tail — Display the last part of a file 676
talk — Talk to another user. 679
tar — Manipulate the tar archive files to copy or back up a file 681
tcsh — Invoke a C shell 689
@ (at) built-in command for tcsh: Print the value of tcsh shell variables 733
% (percent) built-in command for tcsh: Move jobs to the foreground or background 733
alloc built-in command for tcsh: Show the amount of dynamic memory acquired 734
bindkey built-in command for tcsh: List all bound keys 734
builtins built-in command for tcsh: Prints the names of all built-in commands 736
bye built-in command for tcsh: Terminate the login shell 736
chdir built-in shell command for tcsh: Change the working directory 736
complete built-in command for tcsh: List completions 736
dirs built-in command for tcsh: Print the directory stack 740
echotc built-in command for tcsh: Exercise the terminal capabilities in args 741
filetest built-in command for tcsh: Apply the op file inquiry operator to a file 742
glob built-in command for tcsh: Write each word to standard output 742
hashstat built-in command for tcsh: Print a statistic line on hash table effectiveness 743
hup built-in command for tcsh: Run command so it exits on a hang-up signal. 743
limit built-in command for tcsh: Limit consumption of processes 743
log built-in command for tcsh: Print the watch tcsh shell variable 745
login built-in command for tcsh: Terminate a login shell 745
logout built-in command for tcsh: Terminate a login shell 746
ls-F built-in command for tcsh: List files 746
notify built-in command for tcsh: Notify user of job status changes 747
onintr built-in command for tcsh: Control the action of the tcsh shell on interrupts. 747
popd built-in command for tcsh: Pop the directory stack 748
pushd built-in command for tcsh: Make exchanges within directory stack 748
rehash built-in command for tcsh: Recompute internal hash table. 749
repeat built-in command for tcsh: Execute command count times 750
sched built-in command for tcsh: Print scheduled event list 750
setenv built-in command for tcsh: Set environment variable name to value 751
settc built-in command for tcsh: Tell tcsh shell the terminal capability cap value 751
setty built-in command for tcsh: Control tty mode changes 751
source built-in command for tcsh: Read and execute commands from name 752
telltc built-in command for tcsh: List terminal capability values 752

uncomplete built-in command for tcsh: Remove completions whose names match pattern 753
unhash built-in command for tcsh: Disable use of internal hash table. 753
unlimit built-in command for tcsh: Remove resource limitations 753
unsetenv built-in command for tcsh: Remove environmental variables that match pattern . . . 754
watchlog built-in command for tcsh: Print the watch shell variable 754
where built-in command for tcsh: Report all instances of command 754
which built-in command for tcsh: Display next executed command 755
tee — Duplicate the output stream 755
test — Test for a condition 756
tic — Put terminal entries in the terminfo database 760
time — Display processor and elapsed times for a command 761
times — Get process and child process times . . . 762
touch — Change the file access and modification times 763
tput — Change characteristics of terminals . . . 765
tr — Translate characters 767
trap — Intercept abnormal conditions and interrupts. 770
true — Return a value of 0 771
tso — Run a TSO/E command from the shell . . 772
tsocmd — Run a TSO/E command from the shell (including authorized commands) 777
tsort — Sort files topologically. 779
tty — Return the user's terminal name 780
type — Tell how the shell interprets a name . . . 780
typeset — Assign attributes and values to variables 781
uconvdef — Create binary conversion tables . . . 784
ulimit — Set process limits 784
umask — Set or return the file mode creation mask 786
unalias — Remove alias definitions 787
uname — Display the name of the current operating system 788
uncompress — Undo Lempel-Ziv compression of a file 790
unexpand — Compress spaces into tabs 791
uniq — Report or filter out repeated lines in a file 793
unlink — Removes a directory entry 797
unmount — Remove a file system from the file hierarchy 798
unpack — Decode Huffman packed files 800
unset — Unset values and attributes of variables and functions 801
uptime — Report how long the system has been running 803
uucc — Compile UUCP configuration files . . . 803
uucico daemon — Process UUCP file transfer requests 804
uucp — Copy files between remote UUCP systems 806
uucpd daemon — Invoke uucico for TCP/IP connections from remote UUCP systems 810
uudecode — Decode a transmitted binary file . . 811
uuencode — Encode a file for safe transmission 812
uulog — Display log information about UUCP events 813
uuname — Display list of remote UUCP systems 815
uupick — Manage files sent by uuto and uucp . . 816
uustat — Display status of pending UUCP transfers 818
uuto — Copy files to users on remote UUCP systems 821
uux — Request command execution on remote UUCP systems 823
uuxqt daemon — Carry out command requests from remote UUCP systems 826
vi — Use the display-oriented interactive text editor 828
wait — Wait for a child process to end 860
wall — Broadcast a message to logged-in users . . 861
wc — Count newlines, words, and bytes 862
whence — Tell how the shell interprets a command name 864
who — Display information about current users 865
whoami — Display your effective user name . . . 867
write — Write to another user 867
writedown — Set or display user's write-down mode 869
xlc — Compiler invocation using a customizable configuration file 870
Invocation commands 870
Setting up the compilation environment . . . 872
Setting up a configuration file 877
Invoking the compiler 885
Invoking the binder 886
Supported options. 886
Specifying compiler options 892
xlC — Compile C and C++ source code, link-edit and create an executable file 895
xlc++ — Compile C and C++ source code, link-edit and create an executable file 895
xargs — Construct an argument list and run a command 895
yacc — Use the yacc compiler 899
zcat — Uncompress and display data 903
zlsof — Displays information about open files, sockets, and pipes 904

Chapter 3. TSO/E commands. 909

BPXBATCH — Run shell commands, shell scripts, or executable files 910
| BPXMTEXT - Display reason code text 912
| BPXTRACE - Activate or deactivate traces for
| processes 912
ISHELL — Invoke the ISPF shell 912
MKDIR — Make a directory 914
MKNOD — Create a character special file 915
MOUNT — Logically mount a file system 916
OBROWSE — Browse a z/OS UNIX file 923
OCOPY — Copy an MVS data set member or z/OS UNIX file to another member or file. . . . 923
OEDIT — Edit a z/OS UNIX file 928
OGET — Copy z/OS UNIX files into an MVS data set 929

OGETX — Copy z/OS UNIX files from a directory to an MVS PDS or PDSE 933
OMVS — Invoke the z/OS shell 937
OPUT — Copy an MVS data set member into a z/OS UNIX file 949
OPUTX — Copy members from an MVS PDS or PDSE to a z/OS UNIX system directory 952
OSHELL — Invokes BPXBATCH from TSO/E . . 955
OSTEPLIB — Build a list of files 956
UNMOUNT — Remove a file system from the file hierarchy 957
ZLSOF - Displays information about open files, sockets, and pipes 960

Chapter 4. REXX system commands 961
bpxmtext - Display reason code text 961
zlsof - Display information about open files, sockets, and pipes 961

Appendix A. Summary of z/OS UNIX shell commands 963
General use 963
Controlling your environment 963
Daemons 964
Managing directories 964
Managing files 965
Printing files 966
Computing and managing logic 966
Controlling processes 967
Writing shell scripts 967
Developing or porting application programs . . . 967
Communicating with the system or other users . . 968
Working with archives 968
Working with UUCP 968

Appendix B. Summary of tcsh shell commands 969
General use 969
Controlling your environment 969
Managing directories 970
Computing and managing logic 970
Managing files 970
Controlling processes 970

Appendix C. Regular expressions (regexp) 971
Regular expressions (regexp) 975

Appendix D. Running shell scripts or executable files under MVS environments 981
BPXBATCH 981
Using OSHELL to run shell commands and scripts from MVS 989

Appendix E. BPXCOPY: Copying a sequential or partitioned data set or PDSE member into an HFS file 991
BPXCOPY 991

Appendix F. Localization 997

Appendix G. Stub commands 1001

Appendix H. File formats 1003
cpio — Format of cpio archives 1003
magic — Format of the /etc/magic file 1004
pax — Format of pax archives and special header summary files 1007
queuedefs — Queue description for at, batch, and cron 1011
tags — Format of the tags file 1012
tar — Format of tar archives 1012
utmpx — Format of login accounting files . . . 1014
uucp — Format of UUCP working files 1015

Appendix I. Format of the TZ environment variable 1021
Command format 1021

Appendix J. Environment variables 1023

Appendix K. Specifying MVS data set names in the shell environment . . . 1025
Utilities that support MVS data set names . . . 1025

Appendix L. Controlling text conversion for z/OS UNIX shell commands 1027
Using automatic code set conversion 1027
Shell redirection and automatic conversion . . . 1027
Disabling automatic conversion 1027
Specifying the text conversion 1028
Using the _TEXT_CONV environment variable 1029
Commands that prevent automatic conversion by default 1031

Appendix M. Additional dbx documentation 1033
execution: Controlling execution. 1033
files: Accessing source files 1033
scope: Scope 1033
threads: Thread display and control 1033
usage: Basic command usage 1034
variables: "Set" variables 1035

Appendix N. Shell commands changed for UNIX03 1039

Appendix O. Accessibility 1043
Accessibility features 1043
Consult assistive technologies 1043

Keyboard navigation of the user interface . . . 1043
Dotted decimal syntax diagrams 1043

Notices 1047
Policy for unsupported hardware 1048
Minimum supported hardware 1049
Programming Interface Information 1049
Standards 1049
Trademarks 1049
Acknowledgments 1050

Index 1051

Tables

1. Locales supplied by z/OS UNIX 4
2. Allocation-spec keywords for allocany and allocuser 31
3. The order of operations for awk 40
4. Reference documentation for programs invoked by c89, cc, and c++ commands . . . 78
5. Possible txtflag / CCSID combinations 149
6. Automatic conversion and file tagging behavior for cp: Copying files to files . . . 175
7. Automatic conversion and file tagging behavior for cp: Copying MVS data sets to files 175
8. Automatic conversion and file tagging behavior for cp: Copying files to MVS data sets 176
9. Options allowed for cp: File to File and File ... (multiple files) to directory 178
10. Copies allowed for cp: File to File. 179
11. Copies allowed for cp: File... (multiple files) to Directory 179
12. Rules for testing files 317
13. Output messages of the file utility 318
14. Fields in the configuration file (inetd daemon) 357
15. Explanation of the ipcs command listing 364
16. Internal table sizes (lex command) 388
17. Output of the mount -q and -v options 482
18. Automatic conversion and file tagging behavior for mv: Moving files to files . . . 489
19. Automatic conversion and file tagging behavior for mv: Moving files to MVS data sets 490
20. Options allowed for mv: File to File and File ... (multiple files) to directory 492
21. Moves allowed for mv: File to File 493
22. Moves allowed for mv: File... (multiple files) to directory 493
23. String values for exthdr.name 529
24. String values for globexthdr.name. 530
25. USTAR defaults. 533
26. Maximum UID and GID values for tar, USTAR, cpio and pax 539
27. Charset standards 541
28. Shell operators (sh command) 618
29. Built-in shell variables (sh command) 624
30. Shell variables for automatic conversion (sh command) 628
31. Recommended options for the USTAR format 682
32. Standard input/output syntax for the tcsh shell 708
33. tcsh built-in shell variables 717
34. tcsh environment variables 729
35. Symbols used in the vi command description 828
36. Example of using -M and -MF 890
37. Compiler option conflict resolution 892
38. Various formats of the OMVS CONVERT command (OMVS command) 938
39. Locales, their conversion tables, and default escape characters (OMVS command). . . . 939
40. Regular Expression Features (regexp) 974
41. Regular Expression Features (regexp) 978
42. Archive file: ASCII header 1003
43. Archive file: UNIX-compatible format 1013
44. Archive file: USTAR format 1013
45. Commands that disallow automatic conversion by default 1031
46. UNIX shell commands and _UNIX03 1039

About this document

This document presents the information you need to use a z/OS system with the shell and utilities feature as well as TSO/E (Time Sharing Option Extensions) commands for using z/OS UNIX System Services (z/OS UNIX). These features provide an application program interface (API) and a shell interface based on open systems standards.

z/OS UNIX gives the z/OS operating system an open standards interface. It consists of two features:

- **Shell and Utilities**, which you can use to enter shell commands, write shell scripts, and work with the file system.
- **Debugger**, which an application programmer can use to debug a z/OS UNIX application program written in the C or C++ languages.

This document describes how to use the shell commands, utilities, and TSO/E commands.

For information about utilities related to ported applications, see http://www.ibm.com/systems/z/os/zos/features/unix/l.

Using this document

This document is for application programmers, system programmers, and end users working on a z/OS system and using the shell. It contains information about z/OS UNIX commands.

This document also assumes that you are using Security Server for z/OS. RACF® is a component of the Security Server for z/OS. Instead of RACF, you could use an equivalent security product if it supports the system authorization facility (SAF) interfaces required by z/OS UNIX, which are documented in *z/OS Security Server RACF Callable Services*.

z/OS information

This information explains how z/OS references information in other documents and on the web.

When possible, this information uses cross document links that go directly to the topic in reference using shortened versions of the document title. For complete titles and order numbers of the documents for all products that are part of z/OS, see *z/OS Information Roadmap*.

To find the complete z/OS® library, go to the IBM Knowledge Center (http://www.ibm.com/support/knowledgecenter/SSLTBW/welcome).

IBM Systems Center publications

IBM® Systems Centers produce IBM Redbooks® publications that can be helpful in setting up and using z/OS UNIX. See the IBM Redbooks site at IBM Redbooks (http://www.ibm.com/redbooks).

These documents have not been subjected to any formal review nor have they been checked for technical accuracy, but they represent current product understanding at the time of their publication and provide information on a wide range of topics. You must order them separately. A selected list of these documents is on the z/OS UNIX website at http://www.ibm.com/systems/z/os/zos/features/unix/library/.

Porting information for z/OS UNIX

A *Porting Guide* is available at z/OS UNIX System Services Porting Guide (http://www.ibm.com/systems/z/os/zos/features/unix/bpxa1por.html). It covers a range of useful topics, including sizing a port, setting up a porting environment, ASCII-EBCDIC issues, performance, and much more.

The porting page also features a variety of porting tips and lists porting resources that will help you in your port.

z/OS UNIX courses

For a current list of courses that you can take, go to IBM Education home page (http://www.ibm.com/services/learning/).

z/OS UNIX home page

Visit the z/OS UNIX home page at z/OS UNIX home page (http://www.ibm.com/systems/z/os/zos/features/unix/).

Some of the tools available from the website are ported tools, and some are unsupported tools designed for z/OS UNIX. The code works in our environment at the time we make it available, but is not officially supported. Each tool has a readme file that describes the tool and lists any restrictions.

The simplest way to reach these tools is through the z/OS UNIX home page. From the home page, click **Tools and Toys**.

The code is also available from **ftp://ftp.software.ibm.com/s390/zos/unix/** through anonymous FTP.

Because the tools are not officially supported, APARs cannot be accepted.

Discussion list

Customers and IBM participants also discuss z/OS UNIX on the **mvs-oe discussion list**. This list is not operated or sponsored by IBM.

To subscribe to the mvs-oe discussion, send a note to:

listserv@vm.marist.edu

Include the following line in the body of the note, substituting your given name and family name as indicated:

```
subscribe mvs-oe given_name family_name
```

After you have been subscribed, you will receive further instructions on how to use the mailing list.

How to send your comments to IBM

We appreciate your input on this publication. Feel free to comment on the clarity, accuracy, and completeness of the information or provide any other feedback that you have.

Use one of the following methods to send your comments:

1. Send an email to mhvrcfs@us.ibm.com.
2. Send an email from the "Contact us" web page for z/OS (http://www.ibm.com/systems/z/os/zos/webqs.html).
3. Mail the comments to the following address:
   IBM Corporation
   Attention: MHVRCFS Reader Comments
   Department H6MA, Building 707
   2455 South Road
   Poughkeepsie, NY 12601-5400
   US
4. Fax the comments to us, as follows:
   From the United States and Canada: 1+845+432-9405
   From all other countries: Your international access code +1+845+432-9405

Include the following information:

- Your name and address.
- Your email address.
- Your telephone or fax number.
- The publication title and order number:
  z/OS V2R1.0 UNIX System Services Command Reference
  SA23-2280-01
- The topic and page number that is related to your comment.
- The text of your comment.

When you send comments to IBM, you grant IBM a nonexclusive right to use or distribute the comments in any way appropriate without incurring any obligation to you.

IBM or any other organizations use the personal information that you supply to contact you only about the issues that you submit.

If you have a technical problem

Do not use the feedback methods that are listed for sending comments. Instead, take one of the following actions:

- Contact your IBM service representative.
- Call IBM technical support.
- Visit the IBM Support Portal at z/OS support page (http://www.ibm.com/systems/z/support/).

Summary of changes

This information includes terminology, maintenance, and editorial changes. Technical changes or additions to the text and illustrations for the current edition are indicated by a vertical line to the left of the change.

Summary of changes for z/OS Version 2 Release 1 (V2R1) as updated February, 2015

The following changes are made for z/OS Version 2 Release 1 (V2R1) as updated February, 2015.

New

- The dbx debugger now supports machine-level debugging of vector-enabled programs. A new variable, **$novregs**, was added to the set subcommand of **dbx**. See "set subcommand for dbx: Define a value for a dbx variable" on page 240. Information about vector registers was added to "Usage notes for the registers subcommand of dbx" on page 238.

  The usage note for the registers subcommand of **dbx** was also updated with information about displaying and assigning vector registers. See "Usage notes for the registers subcommand of dbx" on page 238.
- With APAR OA46568, a usage note was added to the **ls** command about issuing the **ls** command against a large directory structure. See "Usage notes for the ls command" on page 411.
- With APAR OA46394, to comply with UNIX specifications, a certain arithmetic substitution was changed. See "Arithmetic substitution" on page 618.

Changed

- For the **cd** command, too many arguments could also result in exit value 2. See "cd — Change the working directory" on page 125.

z/OS Version 2 Release 1 summary of changes

See the following publications for all enhancements to z/OS Version 2 Release 1 (V2R1):

- *z/OS Migration*
- *z/OS Planning for Installation*
- *z/OS Summary of Message and Interface Changes*
- *z/OS Introduction and Release Guide*

Chapter 1. Introduction to shell commands and DBCS

This section is an introduction to the shell commands and the double-byte character set (DBCS).

Reading the command descriptions

Related information

Each shell command appears in alphabetic order. The description for each command is divided into several topics, which are explained in the following paragraphs. Some of these topics apply only to a few command descriptions. Also, some command descriptions include special topics that are not explained here.

Format

The *Format* topic provides a quick summary of the command's format, or syntax. The syntax was chosen to conform to general UNIX usage. For example, here is the format of the **ls** command:

ls [**–AabCcdFfgiLlmnopqRrstuWx1**] [*pathname* **...**]

The format takes the form of a command line as you might type it into the system; it shows what you can type in and the order in which you should do it. The parts enclosed in square brackets are optional; you can omit them if you choose. Parts outside the square brackets must be present for the command to be correct.

The format begins with the name of the command itself. Command names always appear in bold font.

After the command name comes a list of options, if there are any. A typical z/OS shell command option consists of a dash (**–**) followed by a single character, typically an uppercase or lowercase letter. For example, you might have **–A** or **–a**.

Note: The case of letters is important; for example, in the format of **ls**, **–a** and **–A** are different options, with different effects.

If you are going to specify several options for the same command, you can put all the option characters after the same dash. Or you can put each option after its own dash. Or you can rearrange the order of options. For example, the following formats are all equivalent:

```
ls -Aa
ls -a -A
ls -aA
```

The format line shows options like **-a** in bold font. In the description of **ls**, all options are shown in one long string after the single dash. But another common option form is:

-x *value*

where **–x** is a dash followed by a character, and *value* provides extra information for using that option. For example, here is the format for the **sort** command, which takes unsorted input and sorts it:

```
sort [–cmu]
[–o outfile]
[–t char]
[–yn]
[–zn]
[–bdfiMnr]

[-k startpos[,endpos]] ...
[file ...]

sort [–cmu]
[–o outfile]
[–tchar]
[–yn]
[–zn]
[–bdfiMnr]

[+startposition[–endposition]] ...
[file ...]
```

You can see that there are two possibilities here; you would need to choose which of the two versions of **sort** met your requirements. In either possibility, however, we have the option:

–o *outfile*

This option tells the **sort** command where to save its sorted output. The form of the option is **–o**, followed by a space, followed by *outfile*. In a command format, anything appearing in *italic serif* font is a *placeholder* for information that you are expected to supply. Sometimes after the format, the kind of information expected in place of the placeholder is explained. In our **sort** example, *outfile* stands for the name of a file where you want **sort** to store its output. For example, if you wanted to store the output in the file **sorted.dat**, you would specify:

```
sort -o sorted.dat
```

(followed by the rest of the command).

The format for **sort** also contains an option of the form:

–t*char*

This is similar to the option form we were just discussing, except that there is no space between the **–t** and *char*. *char* in italics is a placeholder; in this case, it stands for any single character. If you want to use the **–t** option for **sort**, you just type **–t** followed immediately by another character, as in:

```
sort -t:
```

In this case, we use a colon (**:**) in the position of the placeholder *char*.

The end of the **sort** format is:

[*file* ...]

This means a list of one or more file names; the ellipsis (....) stands for repetitions of whatever immediately precedes it. Since there are square brackets around the previous list, you can omit the list if you like.

The format of **ls** ended in:

[*pathname* ...]

As you might guess, this means that an **ls** command can end with an optional list of one or more path names. What's the difference between this and our **sort** example? A path name (specified with *pathname*) can be the name of either a file or a directory; a file name (specified with *file*) is always the name of a file.

The order of items on the command line is important. When you type a command line, you should specify its parts in the order they appear in the command format. The exceptions to this are options marked with a dash (**–**); they do not have to be given in the exact order shown in the format. However, all the **–** options must appear in the correct *area* of the command line. For example, you can specify:

```
ls -l -t myfiles
ls -t -l myfiles
```

but you will not get correct results if you specify:

```
ls myfiles -l -t          ***incorrect***
```

or:

```
ls -l myfiles -t          ***incorrect***
```

and so on. If you enter the last example, for instance, **ls** interprets **–t** as the path name of a file or directory, and the command will try to list the characteristics of that item.

As a special notation, most z/OS shell commands let you specify two dashes (**—**) to separate the options from the nonoption arguments; **—** means that there are no more options. Thus, if you really have a directory named **–t**, you could specify:

```
ls — –t
```

to list the contents of that directory.

Description

The *Description* topic describes what the command does. For a particularly complex command, this topic may be divided into a large number of subtopics, each dealing with a particular aspect of the command.

The Description topic often mentions the *standard input* (**stdin**) and the *standard output* (**stdout**). The standard input is typically the workstation keyboard; the standard output is typically the display screen. The process of *redirection* can change this. Redirection is explained in *z/OS UNIX System Services User's Guide*.

The shell differentiates between hexadecimal, octal, and decimal format as follows:

- Any number that starts with 0x is in hexadecimal format.
- Any number that starts with 0 is in octal format.
- Any number that does not start with 0x or 0 is in decimal format.

Options

The *Options* topic describes each of the options used by the command.

Examples

The *Examples* topic is present in many command descriptions, giving examples of how the z/OS shell can be used.

Before you try to run any of the provided examples, you need to know that the z/OS shell uses the EBCDIC code page 01047 (Latin-1). Characters entered on a workstation keyboard and passed to the shell by z/OS do not have the same hexadecimal encoding as the code page used by the shell. You may need to customize your keyboard so that those characters have the encoding that the shell uses. See *z/OS UNIX System Services User's Guide* for more information about code page conversion.

Environment variables

The *Environment Variables* topic lists the environment variables that affect the command, if any, and describes the purposes that those variables serve. For example, the **ls** command description lists two environment variables (COLUMNS and TZ). It also explains that COLUMNS is the terminal width and that TZ contains information about the local time zone.

Localization

All shell commands are affected by the following special localization variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

The *Localization* topic describes how the locale-related environment variables affect the behavior of the command. These environment variables allow you to access *locale* information, including alternate character sets; alternate numeric, monetary, and date and time formats; and foreign language translations of common messages. Locales make it easier for users around the world to use the shell and utilities.

z/OS UNIX supports the IBM-supplied locales listed in Table 1. User-generated locales using IBM code page 1047 are also supported.

Table 1. Locales supplied by z/OS UNIX

Country or region	Language	Locale name
Bulgaria	Bulgarian	Bg_BG.IBM-1025
Czech Republic	Czech	Cs_CZ.IBM-870
Denmark	Danish	Da_DK.IBM-277
Denmark	Danish	Da_DK.IBM-1047
Switzerland	German	De_CH.IBM-500
Switzerland	German	De_CH.IBM-1047
Germany	German	De_DE.IBM-273
Germany	German	De_DE.IBM-1047
Greece	Ellinika	El_GR.IBM-875
United Kingdom	English	En_GB.IBM-285
United Kingdom	English	En_GB.IBM-1047
Japan	English	En_JP.IBM-1027
United States	English	En_US.IBM-037
United States	English	En_US.IBM-1047
Spain	Spanish	Es_ES.IBM-284
Spain	Spanish	Es_ES.IBM-1047
Finland	Finnish	Fi_FI.IBM-278
Finland	Finnish	Fi_FI.IBM-1047
Belgium	French	Fr_BE.IBM-500
Belgium	French	Fr_BE.IBM-1047
Canada	French	Fr_CA.IBM-037

Table 1. Locales supplied by z/OS UNIX (continued)

Country or region	Language	Locale name
Canada	French	Fr_CA.IBM-1047
Switzerland	French	Fr_CH.IBM-500
Switzerland	French	Fr_CH.IBM-1047
France	French	Fr_FR.IBM-297
France	French	Fr_FR.IBM-1047
Croatia	Croatian	Hr_HR.IBM-870
Hungary	Hungarian	Hu_HU.IBM-870
Iceland	Icelandic	Is_IS.IBM-871
Iceland	Icelandic	Is_IS.IBM-1047
Italy	Italian	It_IT.IBM-280
Italy	Italian	It_IT.IBM-1047
Israel	Hebrew	Iw_IL.IBM-424
Japan	Japanese	Ja_JP.IBM-939
Japan	Japanese	Ja_JP.IBM-1027
Korea	Korean	Ko_KR.IBM-933
Belgium	Dutch	Nl_BE.IBM-500
Belgium	Dutch	Nl_BE.IBM-1047
Netherlands	Dutch	Nl_NL.IBM-037
Netherlands	Dutch	Nl_NL.IBM-1047
Norway	Norwegian	No_NO.IBM-277
Norway	Norwegian	No_NO.IBM-1047
Poland	Polish	Pl_PL.IBM-870
Brazil	Brazilian	Pt_BR.IBM-037
Brazil	Brazilian	Pt_BR.IBM-1047
Portugal	Portugese	Pt_PT.IBM-037
Portugal	Portugese	Pt_PT.IBM-1047
Romania	Romanian	Ro_RO.IBM-870
Russia	Russian	Ru_RU.IBM-1025
Serbia	Serbian(Latin)	Sh_SP.IBM-870
Slovakia	Slovak	Sk_SK.IBM-870
Slovenia	Slovenian	Sl_SI.IBM-870
Serbia	Serbian(Cyrillic)	Sr_SP.IBM-1025
Sweden	Swedish	Sv_SE.IBM-278
Sweden	Swedish	Sv_SE.IBM-1047
Turkey	Turkish	Tr_TR.IBM-1026
People's Republic of China	Simplified Chinese	Zh_CN.IBM-935
Taiwan	Traditional Chinese	Zh_TW.IBM-937

For more information about locales, see Appendix F, “Localization,” on page 997.

Files

The *Files* topic lists any supplementary files (files not specified on the command line) that the command refers to. Such files typically provide information the command needs; the command accesses these files during its operation. If the files cannot be found, the command issues a message to this effect.

Files documented in this topic may be temporary files, output files, databases, configuration files, and so on.

The z/OS XL C/C++ run-time library supports a file naming convention of // (the file name can begin with exactly two slashes). However, z/OS UNIX System Services *does not* support this convention. Do not use this convention (//) unless it

is specifically indicated (as in the description for the **c89** command). z/OS UNIX System Services does support the POSIXfile naming convention, where the file name can be selected from the set of character values excluding the slash and the null character.

Usage notes

The usage notes section gives additional notes for those using the shell. Its purpose is similar to that of the *Caution* topic (see "Caution"). That is, it provides important information that the reader should not overlook. However, it typically deals with issues that are more benign than what the Caution topic deals with.

Exit values

The *Exit Values* topic presents the error messages that the shell may display, along with a description of what caused the message and a possible action you can take to avoid getting that message. Occasionally, this topic refers you to another command description for more information about an error message.

This topic also contains information about the exit status returned by the command. You can test this status to determine the result of the operation that the command was asked to perform.

Limits

The *Limits* topic lists any limits on the operation of the shell. Some limits are implicit rather than explicit and may be lower than the explicitly stated limit.

Portability

The *Portability* topic includes two types of information:

- Availability of a version of the command on existing UNIX systems (System V, BSD)
- Compatibility with industry standards—for example, the POSIX.2 Draft Standard or the X/Open Portability Guide, Issue 4 (XPG4**).

Caution

The *Caution* topic contains important advice for users. In z/OS shell documentation, the *Caution* topic is often aimed at those who are familiar with UNIX systems. Since the z/OS shell primarily conforms to the emerging POSIX standards, its behavior may not precisely match the corresponding UNIX commands. The *Caution* topic may point out discrepancies in behavior that may catch experienced POSIX or UNIX users by surprise.

Related information

The *Related Information* topic refers to other command descriptions that may contain information relevant to the command description you have just read. For example, consider the **head** command; by default, **head** displays the first 10 lines of each file given on the command line. Its *Related Information* topic refers you to **tail**, the command that displays the last 10 lines of a file.

Using the double-byte character set (DBCS)

z/OS UNIX supports the double-byte character set (DBCS). It also supports a DBCS locale. The name of the IBM-supplied DBCS locale is **Ja_JP**. This locale uses the IBM-939 coded-character set, which is a double-byte character set.

This topic discusses the following:
- Requirements for using DBCS
- When you must use SBCS characters and not DBCS characters
- When you can use DBCS characters
- Byte sequences that are not permitted in DBCS strings
- Displaying DBCS characters
- Switching locales
- Problems with DBCS file names containing DBCS characters

Requirements for using DBCS

If you plan to use DBCS interactively, you must work at a terminal that supports DBCS, such as a PS/55, and follow the procedures for the terminal emulator being used. It is not necessary, however, to be at a terminal that supports DBCS if you just want to use files that contain DBCS data.

To use DBCS, you need to do the following:

1. Specify special logmodes to access TSO/E and VTAM® support for DBCS. Typically, the system programmer has already set these up and provided you with instructions.
2. Issue the TSO/E PROFILE PLANGUAGE(JPN) command, if required, to receive TSO/E messages in the Japanese language.
3. On the OMVS command, use the null character conversion table (the default) for character conversion. You do not need to specify the CONVERT operand on the OCOPY, OGETX, OPUT, and OPUTX commands.
4. Access the shell using the OMVS command with the DBCS operand (which is the default setting).

   You can also access the shell by using the rlogin program. The default conversion is from ISO8859-1 to IBM-1047; users can change their conversion to use different code pages by using the **chcp** command.
5. Define single-byte escape characters for typing escape sequences.
6. Enable the shell and utilities for the DBCS locale, including having all shell and utility messages in Japanese, by entering the these commands:

   ```
   export LC_ALL=Ja_JP
   exec sh
   ```

   To receive shell and utility messages in Japanese, but *not* put your terminal in DBCS mode, enter the this command:

   ```
   export  LC_MESSAGES=Ja_JP
   ```

When you must use SBCS and not DBCS characters

You must use the single-byte character set (SBCS) when specifying the following:
- User names.
- System, device, group, and terminal names.
- User names, passwords, and password phrases
- Shell command-line options.
- Shell commands and their operands.

- Environment variables (DBCS characters are not exportable).
- Delimiters such as space, slash (/), braces { }, tab, parentheses, dot (.), and any other shell special characters.
- Encoding for newline or null cannot be embedded in a DBCS character's code. There are other rules that define valid DBCS data:
  - The DBCS blank is 0x4040.
  - The first byte of the code defining the DBCS character must be in the range 0x41 to 0xFE.
  - The second byte must be in the range 0x41 to 0xFE.

  All others are not valid. This effectively covers the newline and null escape sequences, because they cannot be part of a valid DBCS character.

  For more information about invalid DBCS characters, see "Byte sequences that are not permitted in DBCS strings."
- Although file names with DBCS characters are tolerated, you should not create file names with DBCS characters. Doing so makes the file nonportable across locales, and problems may occur if file names are subsequently used in a single-byte locale. Instead, use the portable character set specified by POSIX and single-byte file names.

  IBM will not support any customer problems with DBCS file names.

  For more information about DBCS file names, see "Problems with file names containing DBCS characters" on page 9.

When you can use DBCS characters

When in the DBCS locale, you can use DBCS to specify the following:

- **sh** command-line arguments, although arguments expressed as numeric values must use SBCS characters.
- Text in data files. Files containing DBCS text are processed correctly by the shell and the utilities (such as **ed** and **grep**) if the DBCS locale is active. These files can be either DBCS text or mixed text (combinations of SBCS and DBCS). Both types of file can exist in the file system along with files that contain only single-byte text.

Byte sequences that are not permitted in DBCS strings

If you create invalid DBCS text, you may see an "illegal byte sequence" message when processing that text. The shell or command issues this error message, and the command stops processing in most cases.

Valid DBCS strings must start with "shift out" (SO [0x0E]) and end with "shift in" (SI [0x0F]). The first byte of the code defining the DBCS character must be in the range 0x41 to 0xFE. The second byte must be in the range 0x41 to 0xFE. The exception is that DBCS blank is 0x4040. All others codes are invalid.

Normal terminal operations do not produce incorrect DBCS strings. To prevent incorrect DBCS characters and strings:

- Do not use commands that operate on the data as byte strings instead of character strings. For example, **head** is a utility that could truncate a DBCS string or character in an inappropriate place, thus creating an incorrect DBCS string. Using pipes between utilities can also result in incorrect DBCS strings unless you pay attention to how each command handles the data.
- Do not edit text in nontext mode such as having the TSO/E editor in HEX ON mode.

If the shell command is operating on a character string and not on a byte string, and the shell is in a locale that supports DBCS, and if the utility encounters an invalid DBCS string, such as the ones described in this topic—you get an "illegal byte sequence" message and the utility may fail.

Note: newline (\n [0x15]) causes the shift state of any subsequent character sequence to start in the initial state (shifted into the SBCS mode). This may apply when a command is processing a DBCS string and encounters newline before a "shift in".
For information about rules for creating DBCS data, refer to *DBCS Design Guide—System/370 Software*, GG18-9095.

Displaying DBCS characters

In a double-byte environment, column positions are always based on the width of narrow characters. Normally, characters are "thin"; they take up only one column position when displayed. In contrast, some DBCS characters are "thick"; they take up two column positions when displayed.

The number of actual characters that are displayed by the command in the column area depends on the thickness of the characters. This applies to such commands as **ls**, **fold**, and **pr**, which display DBCS characters in column positions.

Switching locales

By default, the shell starts in the POSIX locale and cannot handle DBCS text until the locale is changed, typically with the shell command export LC_ALL=Ja_JP. This **export** command affects the current shell environment with the following exception: if you change the locale to DBCS, the shell's LC_CTYPE locale category remains in the locale until it is replaced by means of the **exec** command (**exec /bin/sh**).

Even if you change the locale to DBCS by using **export** LC_ALL=Ja_JP, the shell's LC_CTYPE variable remains in the previous locale (initially POSIX) until the shell is exec'd again with **exec sh**.

Always follow the **export** LC_ALL=*your locale* with **exec sh** to be sure the shell and utilities are running in the desired locale. This is true even if you place the **export** LC_ALL=*your_locale* in your login profile.

Problems with file names containing DBCS characters

The file system treats all file names as if they contained SBCS characters. However, when you use the shell in the DBCS locale, file name and path name comparison is performed in wide mode. That is, all the characters in the name are converted to wide characters before comparison. By doing this, the shift codes are removed from the comparison and, therefore, a match can be found with the file names.

For example, if you have such DBCS file names as:

```
db/so dbfile1 si
db/so dbfile2 si
```

where `so` and `si` are the shift codes that shift out to DBCS and back to SBCS, then when in the DBCS locale (Ja_JP),

```
ls db/so file si *
```

lists both files.

When in the POSIX locale, DBCS strings are treated as byte strings. Comparison is performed byte by byte. For example:

```
ls db/so file si *
```

shows the comparison string ending with an "e si". The files in the directory would have to end with an "e si"″ in order to find a match. Neither of the file names in the example would be found.

Chapter 2. Shell command descriptions

Following are the descriptions of all the commands for the z/OS shell. The descriptions are listed in alphabetic order. For instructions on how to read the command descriptions, see "Reading the command descriptions" on page 1.

The z/OS shell is based on the KornShell that originated on a UNIX system. As implemented for z/OS UNIX System Services, this shell conforms to POSIX standard 1003.2-1992.

Restriction: z/OS UNIX shell commands can only read a large format sequential data set that has no more than 65,535 tracks of data on any single volume.

This information assumes that your z/OS system includes Resource Access Control Facility (RACF). Instead of RACF, your system could have an equivalent security product.

alias — Display or create a command alias

Format

alias [**–tx**] [*name*[=*value*] ...]
alias –r

For the tcsh shell:

alias [*name* [*wordlist*]]

Description

When the first word of a shell command line is not a shell keyword, **alias** causes the shell to check for the word in the list of currently defined *aliases*. If it finds a match, the shell replaces the alias with its associated string value. The result is a new command line that might begin with a shell function name, a built-in command, an external command, or another alias.

When the shell performs alias substitution, it checks to see if *value* ends with a blank. If so, the shell also checks the next word of the command line for aliases. The shell then checks the new command line for aliases and expands them, following these same rules. This process continues until there are no aliases left on the command line, or recursion occurs in the expansion of aliases.

Calling **alias** without parameters displays all the currently defined aliases and their associated values. Values appear with appropriate quoting so that they are suitable for reinput to the shell.

Calling **alias** with parameters of the form *name=value* creates an alias for each *name* with the string *value*.

If you are defining an alias where *value* contains a backslash character, you must precede it with another backslash. The shell interprets the backslash as the escape character when it performs the expansion. If you use double quotation marks to enclose *value*, you must precede each of the two back slashes with an additional

backslash, because the shell escapes characters—that is, the shell does not interpret the character as it normally does—both when assigning the alias and again when expanding it.

To avoid using four back slashes to represent a single backslash, use single quotation marks rather than double quotation marks to enclose *value*, because the shell does not escape characters enclosed in single quotation marks during assignment. As a result, the shell escapes characters in single quotation marks only when expanding the alias.

Calling **alias** with *name* without any value assignment displays the function name (*name*) and its associated string value (*value*) with appropriate quoting.

DBCS recommendation: Use single-byte characters when specifying an alias name, because the POSIX standard states that alias names must contain only characters in the POSIX portable character set.

In the tcsh shell:

- Without arguments, **alias** in the tcsh shell prints all aliases.
- With *name*, **alias** prints the alias for name. With *name* and *wordlist*, **alias** assigns *wordlist* as the alias of *name*. *wordlist* is command and filename substituted. *name* cannot be *alias* or *unalias*.

See also the information about **unalias** in the tcsh shell in "unalias — Remove alias definitions" on page 787.

Options

–r Removes all tracked aliases.

–t Makes each *name* on the command line a tracked alias. Each tracked alias resolves to its full path name; the shell thus avoids searching the PATH directories whenever you run the command. The shell assigns the full path name of a tracked alias to the alias the first time you invoke it; the shell reassigns a path name the first time you use the alias after changing the PATH variable.

When you enter the command:

```
set –h
```

each subsequent command you use in the shell automatically becomes a tracked alias. Running **alias** with the **–t** option, but without any specified names, displays all currently defined tracked aliases with appropriate quoting.

–x Marks each alias *name* on the command line for export. If you specify **–x** without any names on the command line, **alias** displays all exported aliases. Only exported aliases are passed to a shell that runs a shell script.

Several aliases are built into the shell. Some of them are:

```
alias autoload="typeset –fu"
alias functions="typeset –f"
alias hash="alias –t"
alias history="fc –l"
alias integer="typeset –i"
```

```
alias nohup="nohup "
alias r="fc –s"
alias stop="kill –STOP"
alias suspend="stop \$\$"
```

You can change or remove any of these aliases. These changes remain in effect for the current shell and any shell scripts or child shells invoked implicitly from the command. These aliases are reset to their default built-in values each time a new shell is invoked from the command line.

Examples

1. The command:

   ```
   alias ls="ls –C"
   ```

   defines **ls** as an alias. From this point on, when you issue an **ls** command, it produces multicolumn output by default.

2. For the tcsh shell, to alias the **!!** history command, use **\!-1** instead of **\!\!**. For example:

   ```
   alias mf 'more \!-1$'
   ```

   creates an alias for looking at the file named by the final argument of the previously entered command. Example output would be the following:

   ```
   alias mf 'more \!-1$'
   echo "We love tcsh." > file1
   mf


   We love tcsh.
   "file1" (EOF)
   ```

   where **mf** pulls the last argument of the previous command (**file1**), and then displays that file using the **more** command.

Localization

alias uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Usage notes

1. **alias** is a built-in shell command.
2. Because exported aliases are only available in the current shell environment and to the child processes of this environment, they are not available to any new shell environments that are started (via the **exec sh** command, for example). To make an alias available to all shell environments, define it as a nonexported alias in the ENV file, which is executed whenever a new shell is run.

Exit values

0 Successful completion

1 Failure because an alias could not be set
2 Failure because of an incorrect command-line option

If you define **alias** to determine the values of a set of names, the exit value is the number of those names that are not currently defined as aliases.

Portability

POSIX.2 User Portability Extension, UNIX KornShell.

The **–t** and **–x** options are extensions to the POSIXstandard.

Related information

fc, **hash**, **nohup**, **set**, **sh**, **typeset**, **unalias**, **tcsh**

amblist — Display formatted information from object and executable files for diagnostic purposes

Format

amblist *file...*

Description

The **amblist** utility provides a UNIX interface to the AMBLIST program. With AMBLIST, you can obtain information about object modules and executable modules, and diagnose problems with them. Output is written to stdout and errors to stderr.

amblist reads control statements from standard input (stdin). One or more control statements that identify the processing to be performed must be specified. Each control statement line must begin with one or more blanks. Keywords are case-sensitive and must be uppercase. Each control statement line can be up to 80 bytes long, but only the first 70 bytes can contain control information. Control statement lines longer than 70 bytes might be ignored or might cause an error to be reported.

Options

file The file argument can be either a path name or a data set name. You cannot specify both a path name and a data set name at the same time. If you do, **amblist** ends with an error message and a nonzero return code.

- If a path name is specified, it can be either a UNIX file or a UNIX directory. You can use only one path name at a time. If a UNIX directory is used for the path name, MEMBER must be specified on the **amblist** control statement to specify the file name.
- If a data set name is specified, or more data sets can be listed to indicate a concatenation of data sets to be searched. If a member name cannot be specified on the data set name (such as for LISTLOAD), it can either be specified on a control statement or omitted completely. If the member name is omitted, then all members are processed.

Examples

1. Control statement from a pipe, output redirected to a file:
   ```
   echo " LISTLOAD" | amblist a.out > a.amblist
   ```
2. Control statement read interactively, output sent to terminal:
   ```
   amblist hello.o
   ```
   The user must then type " LISTOBJ" (leading blank, no quotation marks), then press CTRL-D to end the **amblist** processing.
3. Control statement from a file, with output sent to terminal:
   ```
   amblist hello.o < hello.ambctl
   ```
   where the file **hello.ambctl** contains a single line " LISTOBJ" (leading blank, no quotation marks).
4. Control statement from pipe, process an object data set, output redirected to a file: contains the single line " LISTOBJ" (leading blank, no quotation marks).
   ```
   echo " LISTOBJ" | amblist "//binder.obj(hello)" > hello.amblist
   ```

For examples of output created when running **amblist**, see *z/OS MVS Diagnosis: Tools and Service Aids*.

Localization

amblist uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion.

1 No operands were specified, or -? was used as an option

2 An incorrect option was specified.

3 The AMBLIST program ended with a nonzero return code. The return code is in message AMBU2003. Some output might have been written to stdout.

4 UNIX path names and MVS™ data set names cannot be mixed.

9 A file could not be opened. The error number is in message AMBU2010.

10 Dynamic allocation failure. Message AMBU2010 indicates the return code, error code, and the information code from dynamic allocation (SVC 99). Additional messages that describe the error might have been written to stderr.

Usage notes

1. You cannot use the DNN= control statement keyword except when specifying the default value of SYSLIB because **amblist** does not provide a facility for the use of any other data definition name.
2. You must specify at least one library when invoking **amblist**. Do not use LISTLPA because it is obsolete.

Related information

z/OS MVS Diagnosis: Tools and Service Aids contains detailed reference information about the AMBLIST program. *z/OS MVS Program Management: User's Guide and Reference* also has information about AMBLIST.

---

ar — Create or maintain library archives

Format

ar –d[–Ilv] *archive member...*
ar –m[–abIilsv] *[posname] archive member ...*
ar –p[–Ilsv] *archive member...*
ar –q[–clsv] **[–F** *format]* *archive member ...*
ar –r[abcIilsuv] **[–F** *format]* *[posname]* *archive member ...*
ar –t[Ilsv] *archive[member...]*
ar –u[–abcIiklsv] **[–F** *format]* **[***posname***]** *archive member ...*
ar –x[–CIlsTv] *archive [member...] ...*

Description

ar maintains archive libraries. The archive library is a collection of files, typically object files. Using **ar**, you can create a new library, add members to an existing library, delete members from a library, extract members from a library, and print a table of contents for a library.

A library member is an arbitrary file. Typically, these files are object files or side files, suitable for use by a linkage editor.

If any members of a library are object files, **ar** creates and maintains an external symbol index for link-editing.

Member names in an archive are only the final component of any path name. When creating a new library member (*member*) as given on the command line, **ar** uses the full path name given. When storing the member name in the library, or comparing a member name, **ar** uses only the final component.

Options

The format shows the main functions of **ar**, which are defined as follows:

–d Deletes each named *member* from the archive and regenerates the symbol table.

–m Moves the named archive member in the archive. The new position is specified by **–a**, **–b**, **i**, or *posname*. If a location is not specified, the member is moved to the end of the archive.

–p Displays each *member* specified to the standard output (**stdout**). If you did not specify any members, **ar** displays all members.

–q Quickly appends the specified *file* to the archive. With this option, **ar** does not check to see if *file* is already a member of the archive.

–r Replaces or adds *file* to *archive*. If *archive* does not exist, **ar** creates it and prints a message. When **ar** replaces an existing member, the archive order is not changed. If *file* is not replacing a member, it is added to the end of the archive unless **–a**, **–b**, or **–i** is used. This option regenerates the symbol table.

–t Displays a table of contents that lists members, or every member if *member* is not specified. **ar** prints a message for each member it does not find. By default, **ar** prints the member name for all selected members. With the verbose (**–v**) option, **ar** prints more information for all selected members.

–x Extracts each specified *member* from the archive and copies it to a file. If *member* is specified as a full path name, it is copied to that path name. If no *member* is specified, all members are extracted. The archive remains unchanged.

The following options change the behavior of the main functions:

–a Places *file* in the archive after the member specified by *posname*. If no member is named, *file* is added to the end of the archive.

–b Places *file* in the archive before the member specified by *posname*. If no member is named, *file* is placed at the beginning of the archive.

–C Prevents **ar** from overwriting existing files with extracted files. This option is used only with extraction (**–x**).

–c Suppresses the message normally printed when **ar** creates a new archive file. You can use this only in conjunction with the **–r** and **–q** options.

–F *format*
Specifies the archive format to be used by a new archive. You can use this option only when creating a new archive with the **–r** and **–q** options.

–I Ignores the case of letters when searching the archive for specified member names. Normally, the case is significant.

–i Inserts *file* into the archive before the member specified by *posname*. If *posname* isn't specified, **ar** inserts *file* at the beginning of the archive. This option is the same as **–b**.

–l This option is ignored. It requests that temporary files generated by **ar** be put in the directory rather than in the default temporary file directory. It is provided for compatibility with earlier versions of **ar**

–s Regenerates the external symbol table regardless of whether the command modifies the archive.

–T When used with **–x**, allows extraction of members with names longer than the file system supports. Normally this is an error, and **ar** does not extract the file. Most file systems truncate the file name to the appropriate length.

–u Replaces the archive member only if the *member* file's modification time is more recent than the archive member time. **–u** implies **–r**, so it is not necessary to specify **–r** also.

–v Gives verbose output. With **–d**, **–q**, **–r**, and **–x**, this option prints the command letter and the member name affected before performing each operation. With **–t**, **ar** prints more information about archive members using a format similar to **ls –l**. With **–p**, **ar** writes the name of the member to **stdout**, before displaying the contents of the file.

Operands

archive Specifies the path name of the archive file.

member
Specifies the path name of the file that is to be acted upon (placed, deleted, searched for, and so on) in the archive library.

Examples

1. To add a member **fioacc.o** to the archive file **/u/turner/bin/cliserpgm.a**, specify:
   ```
   ar –rc /u/turner/bin/cliserpgm.a fioacc.o
   ```
2. To display the members of the archive file **/u/turner/bin/cliserpgm.a**, specify:
   ```
   ar –tv /u/turner/bin/cliserpgm.a
   ```
3. To delete the member **repgen.o** from the archive file **/u/turner/bin/cliserpgm.a** and regenerate the external symbol table for the archive, specify:
   ```
   ar –ds /u/turner/bin/cliserpgm.a repgen.o
   ```

Environment variables

ar uses the following environment variable:

TMPDIR
The path name of the directory that is used for temporary files. If it is not set, z/OS UNIX uses **/tmp**.

Localization

ar uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Files

ar creates temporary files in the *archive* file's directory and in the directory named by the **TMPDIR** environment variable. These files are intermediate versions of the archive file being created or updated. Consequently, they require approximately the same file size as the archive file being manipulated.

Usage notes

ar can be used to store multiple versions of the same object file within one archive library. This is useful if you are providing an archive library which may be used to resolve references from code compiled with various compiler options. These options cause differences in the object files which must be matched with the archive library member attributes. Attributes for **ar** are: AMODE, XPLINK, and IPA.

ar will store the attribute information for every entry in the symbol table. The linkage editor will use the attribute information to resolve external references with the appropriate archive library member. Because archive library member names are only the final component of the pathname, these member names must be unique for the different object file versions.

Side files (normally those created when link-editing a DLL) can be made members of an archive file. When the linkage editor processes such an archive file, it will normally read in all such side-files so that archives can be used for resolving

symbol references in DLLs. For more information about resolving external references, see *z/OS MVS Program Management: User's Guide and Reference*.

You will want to establish a naming convention for the object files, and change your build procedures to generate the correct names. For example, if your archive contains 3 versions of myfuncs.o, you could generate names

```
myfuncs.o   AMODE(31), non-XPLINK
myfuncsX.o  AMODE(31), XPLINK
myfuncs64.o  AMODE(64) (AMODE(64) always forces XPLINK)
```

Your make file might generate commands such as these:

```
c89 -c myfuncs.c
c89 -Wc,xplink -o myfuncsX.o -c myfuncs.c
c89 -Wc,LP64 -o myfuncs64.o -c myfuncs.c
ar  -ruv libmyfuncs.a myfuncs.o myfuncsX.o myfuncs64.o
```

To display the attributes of the symbols within an object file or an archive library of object files, use "nm — Display symbol table of object, library, or executable files" on page 502.

Exit values

0 Successful completion

1 Failure due to any of the following reasons:
- Inability to create the extracted file
- An error writing to the extracted file
- The requested module not found on appending
- An error opening the module on appending
- An incorrect module on appending
- Inability to access the module on appending
- A module not found on table or extraction

2 Incorrect command-line arguments or options

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

For compatibility with earlier versions, you can omit the dash (**–**) preceding the options if the options appear only as the first argument after the command name.

The following options are XPG extensions to the POSIX standard: **–a**, **–b**, **–C**, **–i**, **–l**, **–m**, **–q**, **–s**, and **–T**.

The **–F** and the **–I** options are extensions to the POSIX and XPG standards.

Related information

c89, **make**, **nm**

as — Use the HLASM assembler to produce object files

Format

as
[**--***option*[, *option*] ...] ...
[**-a**[**egimrsx**][=*file*]] ...

[**-g**]
[**--[no]gadata**[=*file*]]
[**--[no]gdwarf4**[=*file*]]
[**-m***option*]
[**-I** *name*]
[**-o** *objectfile*]
[**-d** *textfile*]
[**-v**]
[**--[no]help**]
[**--[no]verbose**]
file

Description

The **as** command processes assembler source files and invokes the HLASM assembler to produce object files.

Options

-- Accepts all options that are accepted by HLASM. Multiple options can be specified by separating them with a comma. This style of option specification is designed to provide smooth migration for users accustomed to specifying options in JCL. For example:

```
--"FLAG(ALIGN),RENT"
```

-a[egimrsx][=*file***]**
Instructs the assembler to produce a listing.

- **-ae** Instructs the assembler to produce the External Symbol Dictionary section of the assembler listing. This is equivalent to specifying: --ESD.
- **-ag** Instructs the assembler to produce the General Purpose Register Cross Reference section of the assembler listing. This is equivalent to specifying: --RXREF.
- **-ai** Instructs the assembler to copy all product information to the list data set. This is equivalent to specifying: --INFO.
- **-am** Instructs the assembler to produce the Macro and Copy Code Source Summary section of the assembler listing. This is equivalent to specifying: --MXREF.
- **-ar** Instructs the assembler to produce the Relocation Dictionary (RLD) section of the assembler listing. This is equivalent to specifying: --RLD.
- **-as** Instructs the assembler to produce the Ordinary Symbol and Literal Cross Reference section of the assembler listing. It also instructs the assembler to produce the un-referenced symbols defined in the CSECTs section of the assembler listing. This is equivalent to specifying: --XREF(SHORT,UNREFS).
- **-ax** Instructs the assembler to produce the DSECT Cross Reference section of the assembler listing. This is equivalent to specifying: --DXREF.
- **=***file* Specifies the file name of the listing output. If you do not specify a file name, the output goes to `stdout`.

You may combine these options; for example, use **-ams** for an assembly listing with expanded macro and symbol output. The **=file** option, if used, must be specified last.

-g Instructs the assembler to collect debug information. By default, the debug information is produced in DWARF Version 4 format (or **--gdwarf4**).

--[no]gadata[=*file***]**
Instructs the assembler to collect associated data and write it to the associated data file. You can optionally specify the name of the output debug file. The specified name cannot be a PDS or z/OS UNIX file system directory name. If you do not specify a file name, the default name is created as follows:

- If you are compiling a data set, the **as** command uses the source file name to form the name of the output data set. The high-level qualifier is replaced with the user ID under which the **as** command is running, and .ADATA is appended as the low-level qualifier. For example, if `TS12345` is compiling `TSMYID.MYSOURCE(src)` with this option, the produced debug file name will be `TS12345.MYSOURCE.ADATA(src)`.
- If you are compiling a z/OS UNIX file, the **as** command stores the debug information in a file that has the name of the source file with an .ad extension. For example, if you are compiling `src.a` with this option, the compiler will create a debug file named `src.ad`.

--[no]gdwarf4[=*file***]**
Instructs the assembler to generate debug information conforming to the DWARF Version 4 format. Debugging tools (for example, dbx) can take advantage of this debug information. You can optionally specify the name of the output debug file. The file name of the output debug file must be a PDS member, a sequential data set or z/OS UNIX file; it cannot be a PDS directory or z/OS UNIX System Services file system directory name. If you do not specify a file name, the default name is created as follows:

- If you are compiling a data set, the **as** command uses the source file name to form the name of the output data set. The high-level qualifier is replaced with the userid under which the **as** command is running, and .DBG is appended as the low-level qualifier. For example, if `TS12345` is compiling `TSMYID.MYSOURCE(src)` with the **-g** option, the produced debug file name will be `TS12345.MYSOURCE.DBG(src)`. If `TS12345` is compiling `TSMYID.SEQSRC` with the **-g** option, the produced debug file name will be `TS12345.SEQSRC.DBG`.
- If you are compiling a z/OS UNIX file, the **as** command stores the debug information in a file that has the name of the source file with a .dbg extension. For example, if you are compiling `src.a` with the **-g** option, the produced debug file name will be `src.dbg`.

-m*option*
HLASM keyword options are specified using the following syntax:

```
-m<option>[=<parm>[=<value>][:<parm>[=<value>]]...]
```

where <option> is an option name, <parm> is a suboption name, and <value> is the suboption value.

Keyword options with no parameters represent switches that may be either on or off. The keyword by itself turns the switch on, and the keyword preceded by the letters NO turns the switch off. For example, **-mLIST** tells the HLASM assembler to produce a listing and **-mNOLIST** tells the HLASM

assembler not to produce a listing. If an option that represents a switch is set more than once, the HLASM assembler uses the last setting.

Keyword option and parameter names may appear in mixed case letters in the invocation command.

-I *name*

Instructs HLASM to look for assembler macro invocation in the specified location. The *name* can be either a PDS name or z/OS UNIX file system directory name. If a PDS data set is specified, it must be fully qualified. The specified locations are then prepended to a default set of macro libraries. The **as** command assumes a default set of macro libraries that is compatible with the defaults for the C/C++ compilers. The default data sets used are: -I CEE.SCEEMAC, -I SYS1.MACLIB, and -I SYS1.MODGEN. The default data sets can be changed via the environment variable _AS_MACLIB, for example:

```
export _AS_MACLIB="FIRST.PDS:SECOND.PDS"
```

-o *objectfile*

Specifies the name of the object file. If the name specified is a PDS or z/OS UNIX System Services directory name, a default file name is created in the PDS or z/OS UNIX directory specified as follows:

- If the source file is a sequential data set, the second last part of the data set name will be used. If the data set name only contains one part after the high-level qualifier, then the last part will be used.
- If the source file is a PDS member, the member name will be used.
- If the source file is a z/OS UNIX file, the suffix will be removed if applicable.
- If the object file is going into a PDS, the first eight characters of the name will be used. If there is a dot, anything after the first dot will be removed.
- If the object file is going into a z/OS UNIX directory, .o will be appended to the name.

For example:

```
Source file: //'abc.hello.source'
Ouput file in PDS: HELLO
Output file in UNIX directory: hello.o

Source file: //'ABC.HELLO'
Ouput file in PDS: HELLO
Output file in UNIX directory: HELLO.o

Source file: //SOURCE(hello)
Ouput file in PDS: HELLO
Output file in UNIX directory: hello.o

Source file: /abc/hello.s
Ouput file in PDS: HELLO
Output file in UNIX directory: hello.o

Source file: /abc/hellothere.s
Ouput file in PDS: HELLOTHE
Output file in UNIX directory: hellothere.o
```

-d *textfile*

Specifies the name of the object file output in text mode. If the name specified is a PDS or z/OS UNIX System Services directory name, a default file name is created in the PDS or z/OS UNIX directory with the same rule as **-o**.

-v Writes the version of the **as** command to stderr.

--[no]help
Help menu. Displays the syntax of the **as** command.

--[no]verbose
Specifies verbose mode, which writes additional information messages to stdout.

file may be:

- An MVS data set (for example, //somename)
- An absolute z/OS UNIX file (for example, /somename)
- A relative z/OS UNIX file (for example, ./somename or somename)

The output of the **as** command is an object file. If you do not specify a file name via the **-o** option, the default name is created as follows:

- If you are compiling a data set, the **as** command uses the source file name to form the name of the output data set. The high-level qualifier is replaced with the user ID under which the **as** command is running, and .OBJ is appended as the low-level qualifier. For example, if TS12345 is compiling TSMYID.MYSOURCE(src), the compiler will create an object file named TS12345.MYSOURCE.OBJ(src).
- If you are compiling a z/OS UNIX file, the **as** command names the object file with the name of the source file with an .o extension. For example, if you are compiling src.a, the object file name will be src.o.

Notes:

1. The **as** command does not accept standard input as a file.
2. The **as** command invokes the HLASM assembler to produce the object file. The HLASM assembler is invoked with the default options ASA and TERM. The ASA option instructs HLASM to use American National Standard printer control characters in records written to the listing file, thus making the listing file more readable in the z/OS UNIX System Services environment. The TERM option instructs HLASM to write error messages to stderr. These defaults can be changed by using the **-m** option or **--** option.
3. HLASM messages and **as** error messages are directed to stderr. Verbose option output is directed to stdout.
4. When invoking **as** from the shell, any option arguments or operands specified that contain characters with special meaning to the shell must be escaped. For example, source files specified as PDS member names contain parentheses; if they are specified as fully qualified names, they contain single quotation marks. To escape these special characters, either enclose the option argument or operand in double quotation marks, or precede each character with a backslash.

asa — Interpret ASA/FORTRAN carriage control

Format

asa [*file ...*]

Description

Historically, printouts created by programs use the first character of each line to control the spacing between that line and the previous one. For example, if the first

character is a space, the rest of that line immediately follows the previous line; if it is a 1, that line should begin on a new page, and so on.

asa reads input in this format and writes it out in a normal text format, using newlines, formfeeds, and carriage returns to achieve the same effects as the carriage control characters.

If you specify files on the command line, **asa** reads input from these files; otherwise, it reads the standard input (**stdin**). **asa** writes output to the standard output (**stdout**).

It does not copy newline characters in the input to the output. Instead, it uses the first character of each line to determine how to print the rest of the line. **asa** interprets the first character as follows:

Space Outputs the rest of the line without change.

0 Outputs a newline character before printing *line*.

1 Outputs a formfeed (start a new page) sequence before printing *line*.

+ Outputs a carriage return sequence so that *line* is output over the previous *line*. If **+** starts the first line, it's treated as a space.

Localization

asa uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Write error on stdout
- Inability to open the input file

2 Unknown command-line option

Portability

POSIX.2, X/Open Portability Guide, UNIX System V.

---

at — Run a command at a specified time

Format

at [**–m**] [**–f** *file*] [**–q** *queue*] **–t** *time*
at [**–m**] [**–f** *file*] [**–q** *queue*] *timespec*
at –r [**–q** *queue*] *at_job ...*
at –l [**–q** *queue*] [*at_job ...*]

Description

at lets you set up a series of commands to be run later. It reads the commands from the standard input (stdin) or from a file specified with the **–f** option. When the commands run, they have the same environment variables, working directory, file creation mask, and so on that are set up when you run the **at** command; however, **at** does not typically preserve open file descriptors, traps, or priority inherited from the working environment.

Typically, you redirect the standard output (stdout) from these commands to files so you can read the files after the system runs the commands. **at** mails the standard output (stdout) and standard error output (stderr) to you if you do not redirect them.

The **at** command displays an *at-job* identifier when you submit commands, along with the time that the system is to run the commands.

at, **batch**, and **crontab** submit jobs to **cron**; the data in these jobs may contain double-byte characters. When the jobs are run, the data in the jobs are interpreted in the locale that **cron** is using. Since it is strongly recommended that **cron** be started in the POSIX locale, double-byte characters in the job may not be interpreted correctly. You can get around this by calling **setlocale()** in the job itself.

Options

–f *file* Reads commands from *file* rather than from standard input (stdin).

–l Reports on standard output (stdout) all jobs you have scheduled and when the system is to run them if you do not specify *at_job*. Specifying *at_job* reports information about those jobs only.

–m Sends you mail after your job has finished running. If you did not redirect the stdout and stderr, **at** also mails these to you. If stdout or stderr is non-null, **at** mails this output to you even if you do not specify **–m**.

–q *queue*
Specifies the queue your **at** job is to be recorded in or removed from. *queue* can be any single-byte character except a space, a tab, a null character, or a number sign (#). By default, **at** stores all its jobs in a queue called `a`, and **batch** stores all its jobs in a queue called `b`. If used with this option, **–l** only reports information about **at** jobs in *queue*.

–r *at_job*
Removes previously scheduled **at** jobs. The *at_job* arguments must be the identifiers assigned to the jobs when you set them up with **at**.

–t *time* Specifies the time for the system to run the job. You specify *time* in the same format as the time argument for **touch**.

When you do not use the **–t** option, you can use a *timespec* argument to specify the time. A *timespec* argument consists of three parts: a time, a date, and an increment (in that order). You must always specify the time, but you can omit the date, the increment, or both. Following are possible time formats:

Format Meaning

hhmm *hh* hours, *mm* minutes, 24-hour clock

hh:mm *hh* hours, *mm* minutes, 24-hour clock

h:mm *h* hours, *mm* minutes, 24-hour clock

h:m *h* hours, *m* minutes, 24-hour clock

hh:mm zone
zone is time zone

*hh:mm***am**
Morning, 12-hour clock

*hh:mm***am** *zone*
Morning, 12-hour clock in given time zone

*hh:mm***pm**
Afternoon, 12-hour clock

*hh:mm***pm** *zone*
Afternoon, 12-hour clock in given time zone

noon Noon

midnight
Midnight

next The current time, next day that meets date and increment

now The current time today

All minute specifications are optional. For example, to specify an **at** job to run at 1:00 p.m., you can enter

```
at 1pm
```

Currently, the z/OS shell only supports the time zones GMT, CUT, UTC, and ZULU, all of which stand for Coordinated Universal Time (often called Greenwich Mean Time). If you do not specify a zone, **at** interprets times with respect to the TZ environment variable.

Appendix I, "Format of the TZ environment variable," on page 1021 explains how to set the local time zone with the TZ environment variable.

Possible date formats are shown in the following list:

Format Meaning
month day
month is the full name, or the three-letter abbreviation (as in `January` or `Jan`)
month day, year
day and *year* given as appropriate numbers
weekday
weekday is the full name or the three-letter abbreviation (as in `Monday` or `Mon`)
today The current day
tomorrow
Next day

The increment is added to the time and date you specify with the preceding parts of *timespec*. It has the format `+` *`n units`* where *n* is a number and *units* is one of the following:

```
minute     minutes    hour     hours
day        days       week     weeks
month      months     year     years
```

Here are some sample time specifications:

```
0655
1855
18:55
6:55pm
6:55 pm Jan 10
now + 3 hours
noon tomorrow
midnight Friday
```

Environment variables

at uses the following environment variables:

SHELL
Contains the name of the shell used to invoke the **at** job.

TZ Specifies the default time zone for all times given on the command line. If you include a time zone as part of *time* or *timespec*, it overrides the value of **TZ**. Appendix I, "Format of the TZ environment variable," on page 1021 explains how to set the local time zone with the TZ environment variable.

Usage notes

at jobs that contain a line consisting of just the string `"!!!ATEOF!!!"` fail with unexpected results.

Localization

at uses the following localization variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**
- **NLSPATH**

The keywords *midnight*, *noon*, *today*, and *tomorrow* are valid only in the POSIX locale.

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

>0 Returned if the command fails for any reason

If an error occurs, **at** does not schedule, remove, or list the job.

Portability

POSIX.2 User Portability Extension, UNIX systems.

Related information

batch, **bg**, **cron**, **crontab**, **touch**, **tcsh**

autoload — Indicate function name not defined

Format

autoload *name ...*

Description

autoload is an alias for **typeset –fu**. Like **typeset –fu**, **autoload** indicates that the functions named in the command line are not yet defined.

See "typeset — Assign attributes and values to variables" on page 781 and Command execution for more information.

Related information

typeset, **functions**, **sh**

automount — Configure the automount facility

Format

automount [**–aeqs**] [*master_file_name*]
automount –f *filesystem_name*

Description

automount is used to configure the automount facility. The automount facility can automatically mount file systems at the time they are accessed, and also unmount them later. You can use a single automount policy to manage both HFS and zFS file systems. For information about setting up the automount facility, see *z/OS UNIX System Services Planning*.

automount requires superuser authority.

Run **automount** from the `/etc/rc` script with no arguments. This action processes the installation's default **automount** configuration file. When run with no arguments, **automount** reads the `/etc/auto.master` file to determine all directories that are to be configured for the automount and the file names that contain their configuration specifications.

Note: The `/etc/auto.master` file contains the directory or directories that the automount facility will monitor. It also contains an associated MapName file that contains the mount parameters. The name of the map file can be specified as an MVS data set name. The data set name must be specified as a fully qualified name and can be uppercase or lowercase. Single quotation marks are not needed.

If the automount policy is loaded, you will get a return code of 0. A nonzero return code indicates that the policy was not loaded.

The automount file system (*AMD/) is mounted with an automove attribute of either AUTOMOVE or UNMOUNT. The automove attribute is set to UNMOUNT only when its parent file system has its automove attribute set to UNMOUNT. When the automove attribute is set to UNMOUNT, the owning system of the automount file system is identical to the owning system of the parent.

If you run **automount** with the [*master filename*] argument, that file name is used instead of `/etc/auto.master`.

Tip: zFS is the preferred file system and continued use of HFS is discouraged. New file systems should be created as zFS file systems.

Options

–a Indicates that the policy being loaded is to be appended to the existing policy rather than replace the existing policy. For example:

```
/usr/sbin/automount -a
```

–a is mutually exclusive with **–q**.

–e Displays recent error information from automount attempting to create a new zFS or HFS file system. Typically, one allocation error value and reason code is displayed for the last allocation error, if there was one. If a zFS file system could not be created, you will see message text or error and reason codes (or both) for each automount-managed directory where the zFS file system was to be created.

–f Displays the information of the job that last accessed the specified file system. The file system name must be specified and it is treated as case-insensitive. All automount managed file systems that match is reported. The information includes file system name, mount point, state, timer, UID, PID, and job name. The state has two values: duration and delay. The timer is the minutes left for the specified file system to be in this state.

–q Displays the current automount policy. **–q** is mutually exclusive with **–a**.

–s Checks the syntax of the configuration file. No automount is performed.

Examples

1. The following example shows how automatic unmount can be avoided for a directory:

   ```
   name       wjs
   duration   nolimit
   ```

   Keywords that are not specified on a specific entry are inherited from the generic entry, if present. If the generic entry is not present, or if keys are not specified, the defaults are used. If the file system key cannot be resolved, the entry is considered invalid. The filesystem attribute for a specific entry must already exist, and will never be created using the inherited allocany values.
2. The following example is a `/etc/auto.master` file that is used to specify `/u` as automount-managed and the specifications for that directory in `/etc/u.map`:

   ```
   /u       /etc/u.map
   ```

Files

automount uses these files:

/etc/auto.master

Specifies a list of directories to be configured, along with their MapName files.

Each line in this file contains two path names that are separated by at least one space: the directory name to be managed and the path name of the MapName file. Both of these path names must be absolute.

The path name of the managed directory is used as a file system name prefixed with *AMD/. This restricts the length of the path name of a managed directory to 40 characters. If path names need to be longer, you can use symbolic links to resolve all or part of the path name.

Blank lines and lines beginning with the characters /* are considered comments and are ignored. Line comments are not tolerated

Tip: While MVS system symbols can be used in master files such as &ZOSREL, only use static system symbols in order to avoid unexpected results. The symbols are resolved when the automount policy is loaded. If the symbol is dynamically changed after the policy is loaded, the policy must be reloaded in order to have the symbol resolved again. To display the symbol substitution, use the **automount -q** option.

MapName

The MapName file contains the mapping between a subdirectory of a directory managed by **automount** and the mount parameters.

The file is organized as a set of specifications. Each specification contains one or more lines. Each line is of the form *keyword argument*. Each specification must begin with the keyword *name*.

Blank lines and lines that begin with the characters * are considered comments and are ignored. Line comments are not tolerated.

A generic entry can be specified as the first specification by using the name of *. The generic specification provides defaults for subsequent specific specifications. When the automount facility tries to resolve a lookup request, it attempts to find a specific entry. If a specific entry does not exist for the name that is being looked up, it attempts to use the generic entry.

The following is an example of a generic entry:

```
name           *
type           HFS
filesystem     OMVS.HFS.USER.<uc_name>
mode           rdwr
duration       30
delay          10
parm           SYNC(60)
tag            text,819
```

These special symbols provide name substitution:

- <asis_name> used to represent the name exactly, as is.
- <uc_name> used to represent the name in uppercase characters.
- <sysname> or &SYSNAME. used to substitute the system name.

Use &SYSNAME. because <sysname> is only temporarily supported for compatibility.

You can use these symbols when specifying a file system name or file system parameter that has a specific form with the name inserted as a qualifier.

Following is a list of supported keywords. You can enter keywords using mixed case letters. Some arguments require mixed case. The allocany, allocuser, and lowercase keywords are valid on any specification, but are meaningful only on the generic entry.

Note: The filesystem attribute for a specific entry must already exist, and will never be created using the inherited allocany values.

allocany *allocation-spec*

Specifies the allocation parameters when using **automount** to allocate HFS or zFS file systems, keeping in mind that zFS is the preferred file system. Specifying the allocany keyword causes an allocation if the data set does not exist for any name looked up in the automount-managed directory.

The automount facility creates a new zFS file system as an HFS-compatible file system if the file system that was specified in the automount policy does not already exist. Space for zFS file systems is always assumed to be in units of cylinders regardless of other specifications. All other allocation keywords that can be used for HFS can be specified but will be ignored. However, the syntax must be correct. These restrictions are in place so that migration to zFS or back to HFS will require minimal changes to the automount policy. See usage note 5 on page 35.

allocation–spec

A string that specifies allocation keywords. The keywords in Table 2 can be specified in the string.

Table 2. Allocation-spec keywords for allocany and allocuser

Keyword	zFS	HFS	Explanation
cyl | tracks | block	Applied	Applied	Specifies primary and optional secondary space allocations.
vol	Applied	Applied	Specifies the unit of space in cylinders, tracks, or blocks.
maxvol	Ignored	Applied	Specifies the serial numbers for eligible direct access volumes where the data set is to reside.
unit	Ignored	Applied	Specifies the unit name, device type, or unit address.
storclas	Applied	Applied	Specifies the storage class for the data set.
mgmtclas	Applied	Applied	Specifies the management class for the data set.
dataclas	Applied	Applied	Specifies the data class for the data set.
pathperm	Applied	Not supported	Specifies permission to the root directory. **Requirement:** In order to use the pathperm keyword, all systems in a shared file system configuration must be at least the z/OS V2R1 level.
euid	Applied	Applied	The new data set owner is set to the effective UID and GID.

allocuser *allocation–spec*

Specifies the allocation parameters when using automount to allocate HFS or zFS file systems, keeping in mind that zFS is the preferred file system. Allocation occurs only if the name being looked up matches the user ID of the current user.

The automount facility creates a new zFS file system as an HFS-compatible file system if the file system that was specified in the automount policy does not already exist. Space for zFS file systems is always assumed to be in units of cylinders regardless of other specifications. All other allocation keywords that can be used for HFS can be specified but will be ignored. However, the syntax must be correct. These restrictions are in place so that migration to zFS or back to HFS will require minimal changes to the automount policy. See usage note 5 on page 35.

allocation–spec

A string that specifies allocation keywords. The keywords in Table 2 can be specified in the string.

charcase [lower|upper|asis]
Indicates the case for names that can match the * specification. This keyword is valid on any specification but is only meaningful on the generic entry. This keyword is mutually exclusive with the lowercase keyword.

lower Only names that are composed of lowercase characters can match the * specification. Numbers and special characters can also be used. When this keyword is specified, uppercase characters are not allowed. This is equivalent to `lowercase yes`.

upper Only names that are composed of uppercase characters can match the * specification. Numbers and special characters can also be used. When this keyword is specified, lowercase characters are not allowed.

asis Any name can match the * specification. This keyword is the default and is equivalent to `lowercase no`.

delay The minimum amount of time in minutes to leave the file system mounted after the duration expires and the file system is no longer in use. The default is `10`.

Tip: In a shared file system environment, specify a delay time of at least 10.

duration
The minimum amount of time in minutes to leave the file system mounted. The default is *nolimit*.

filesystem
The name of the file system to mount. This argument is case-sensitive. For the HFS file system, this argument must be specified in uppercase.

Restriction: Symbol symbolics that are used by the file system name template cannot be more than 44 characters long. Symbolics that are used for the automount (`<sysname>`, `<asis_name>`, `<us_name>`) are resolved within automount as part of checking the length of the file system name template.

lowercase [Yes|No]
Indicates the case for names that can match the * specification. This keyword is valid on any specification, but is only meaningful on the generic entry. It is also mutually exclusive with the charcase keyword.

Yes Only names that are composed of lowercase characters can match the * specification (numbers and special characters can also be used). When this is specified, uppercase characters are not allowed. **Yes** is equivalent to `charcase lower`.

No Any names can match the * specification. This is the default and is equivalent to `charcase asis`.

mode The mount mode for the file system (rdwr or read). The default is rdwr.

name The name of the directory to be mounted. This key is required and

must be the first key that is specified for the entry. If the first entry specifies *name* *, it is treated as the generic entry for the automount-managed directory.

parm The file system-specific parameter. This argument is case-sensitive. For example, the following parameters can be specified for an HFS file system:

```
parm   SYNC(t),NOWRITEPROTECT
```

security [Yes | No]
Specifies security checking which should be done for files in the file system. You can specify these values:

Yes Normal security checking will be done. This is the default.

No Specifies that security checks will not be enforced for files in this file system. Any user can access or change any file or directory in any way.

Security auditing will still be performed if the installation is auditing successes.

The SETUID, SETGID, APF, and Program Control mode bits can be turned on in files from this file system, but are not honored while it is mounted with NOSECURITY. When a file system is mounted with the NOSECURITY option enabled, any new files or directories that are created are assigned an owner of UID 0, no matter what UID issued the request.

Tip: The installation should normally take the default (`Yes`).

For more information about mounting with no security and on the MOUNT statement in BPXPRMxx, see *z/OS UNIX System Services Planning*. Security keywords on the TSO MOUNT command are also discussed in "mount — Logically mount a file system" on page 481.

setuid [Yes | No]
Specifies whether the setuid and setgid mode bits are to be respected for executables run from this file system. You can specify these values:

Yes The setuid and setgid modes are respected. This is the default.

No The setuid and setgid modes are ignored.

tag (text | notext,*ccsid*)
Specifies whether file tags for untagged files in the mounted file system are implicitly set. Either `text` or `notext`, and *ccid* (coded character set identifier) must be specified when tag is specified:

text Specifies that each untagged file is implicitly marked as containing pure text data that can be converted.

notext Specifies that none of the untagged files in the file system are automatically converted during file reading and writing.

ccsid Identifies the coded character set identifier to be implicitly set for the untagged file. *ccsid* is specified as a decimal

value from 0 to 65535. However, when text is specified, the value must be between 0 and 65535. Other than this, the value is not checked as being valid and the corresponding code page is not checked as being installed.

For more information about file tagging, see *z/OS UNIX System Services Planning*. More information about the TAG parameter can be found in "mount — Logically mount a file system" on page 481.

type The type of the file system (such as HFS, zFS, and NFS). The default is HFS.

Usage notes

1. When a new file system of the type HFS is created and allocated to a new user, the owner UID and GID are based on that user. The setting of the permission bits is 700. By default, **automount** uses the UID and GID of the user ID that owns the process. If the euid keyword is specified for allocany or allocuser, the thread-level UID and GID are used instead.
2. When a new file system of the type zFS is created and allocated to a new user, the owner UID and GID are based on that user. The permission is set to the value of `pathperm` (the default is 750). If permission is not specified, or if the value is 000, the default is used. To display the `pathperm` value, whether or not it is specified for allocany and allocuser, use the **automount -q** option. By default, automount uses the UID and GID of the user ID owning the process. If the euid keyword is specified for allocany or allocuser, the thread-level UID and GID are used instead.
3. The syntax of the automount master file is extended to optionally include the name of the filter utility. Each line contains:
   - The path name of the directory that is to be managed.
   - The path name of the map file.
   - An optional path name of the conversion utility.

   If a conversion utility is specified, automount will run that utility and provide the specified map file as the standard input for the utility. It will process the standard output from the utility as the automount map file and list it on its standard output. Errors detected by the automount facility are flagged the same as before, but line numbers will refer to the line as output from the conversion utility rather than the original map file that the utility processes.
4. **automount** recognizes the type specification in the automount map files of HFS and zFS as potentially interchangeable file system types. At the time **automount** applies the specification for the mount, it will determine if the file system is the name of either an zFS or HFS file system and alters the type as appropriate. If the data set does not exist and if allocany or allocuser is specified, a new file system is allocated as the file system type as specified in type. Allocation is only done if allocany or allocuser is specified. If it is preferred to have new file systems allocated as zFS file systems, the automount policy should be changed to specify type zFS.

   This allows automount-managed file systems to be changed from HFS to zFS without changing the file system name and without changing the automount policy. If the file system name must be changed, it will be necessary to add a specific entry in the automount policy for this file system or manage it on another managed directory.

5. When the allocation-spec keyword TRACKS or BLOCK is specified in either the allocany or allocuser option for zFS file systems, the specified SPACE( ) units are converted to approximate CYL equivalent units before the zFS file system is allocated.

   The following formulas are used to do the conversion into CYL units:

   ```
   1 TRACKS Unit = 1/15 CYL Unit
   1 BLOCK Unit = 1/180 CYL Unit
   ```

   The conversion used does not consider the device type.
6. The /// placeholder is supported when used with the allocany or allocuser keywords in automount policy files to create new file systems.
7. The steps for preparing RACF in *z/OS UNIX System Services Planning* include a suggestion to make the kernel address space trusted. If you did not make the local address space trusted, you must give the kernel access to the local data sets as described in Step 3 on page 34.

Related information

chmount, **mount**, **unmount**

---

awk — Process programs written in the awk language

Format

awk [**–F** *ere*] [**–v** *var*=*value* ...] [*program*] [*var*=*value* ...] [*file* ...]

awk [**–F** *ere*] [**–f** *prog*] [**–v** *var*=*value* ...] [*var*=*value* ...] [*file* ...]

Description

awk is a file-processing language that is well suited to data manipulation and retrieval of information from text files. If you are unfamiliar with the language, you might find it helpful to read the **awk** information in *z/OS UNIX System Services User's Guide* first.

An **awk** program consists of any number of user-defined functions and rules of the form:

```
pattern {action}
```

There are two ways to specify the **awk** program:

- Directly on the command line. In this case, *program* is a single command-line argument, typically enclosed in single quotation marks (') to prevent the shell from attempting to expand it.
- By using the **–f** *prog* option.

You can specify *program* directly on the command line only if you do not use any **–f** *prog* arguments.

For a summary of the UNIX03 changes to this command, see Appendix N, "Shell commands changed for UNIX03," on page 1039.

Options

awk recognizes the following options:

–F *ere* Is an extended regular expression to use as the field separator.

–f *prog* Runs the **awk** program contained in the file *prog*. When more than one **–f** option appears on the command line, the resulting program is a concatenation of all programs you specify.

–v *var=value*
Assigns *value* to *var* before running the program.

Files that you specify on the command line with the *file* argument provide the input data for **awk** to manipulate. If you specify no files or you specify a dash (–) as a file, **awk** reads data from standard input (stdin).

You can initialize variables on the command line using:

```
var=value
```

You can intersperse such initializations with the names of input files on the command line. **awk** processes initializations and input files in the order they appear on the command line. For example, the command:

```
awk -f progfile a=1 f1 f2 a=2 f3
```

sets *a* to 1 before reading input from *f1* and sets *a* to 2 before reading input from *f3*.

Variable initializations that appear before the first *file* on the command line are performed immediately after the BEGIN action. Initializations appearing after the last *file* are performed immediately before the **END** action. For more information about BEGIN and END, see "Patterns" on page 45.

Use the **–v** option to assign a value to a variable before the **awk** program begins execution (that is, before the BEGIN action). For example, in:

```
awk -v v1=10 -f prog datafile
```

awk assigns the variable *v1* its value before the BEGIN action of the program (but after default assignments made to such built-in variables as **FS** and **OFMT**; these built-in variables have special meaning to **awk**, as described later).

awk divides input into *records*. By default, newline characters separate records; however, you can specify a different record separator if you want.

One at a time, and in order, **awk** compares each input record with the pattern of every rule in the program. When a pattern matches, **awk** performs the action part of the rule on that input record. Patterns and actions often refer to separate *fields* within a record. By default, white space (usually blanks, newlines, or horizontal tab characters) separates fields; however, you can specify a different field separator string using the **–F** *ere* option).

You can omit the *pattern* or *action* part of an **awk** rule (but not both). If you omit *pattern*, **awk** performs the *action* on every input record (that is, every record matches). If you omit *action*, **awk**'s default action is equivalent to: **{print}**.

awk considers everything after a # in a program line to be a comment. For example:

```
# This is a comment
```

To continue program lines on the next line, add a backslash (\) to the end of the line. Statement lines ending with a comma (**,**), double or-bars (||), or double ampersands (&&) continue automatically on the next line.

Variables and expressions

There are three types of variables in **awk**: *identifiers*, *fields*, and *array elements*.

An identifier is a sequence of letters, digits, and underscores beginning with a letter or an underscore. These characters must be from the POSIX portable character set. (Data can come from other character sets.)

For a description of fields, see "Input" on page 40.

Arrays are associative collections of values called the *elements* of the array. Constructs of the form:
identifier[*subscript*]

where *subscript* has the form *expr* or *expr,expr,...,* refer to array elements. Each such *expr* can have any string value. For multiple *expr* subscripts, **awk** concatenates the string values of all *expr* arguments with a separate character **SUBSEP** between each. The initial value of **SUBSEP** is set to `\042` (code page 01047 field separator).

We sometimes refer to fields and identifiers as *scalar variables* to distinguish them from arrays.

You do not declare **awk** variables, and you do not need to initialize them. The value of an uninitialized variable is the empty string in a string context and the number `0` in a numeric context.

Expressions consist of constants, variables, functions, regular expressions, and *subscript-in-array* conditions combined with operators. (Subscript-in-array conditions are described in Subxcript in array.) Each variable and expression has a string value and a corresponding numeric value; **awk** uses the value appropriate to the context.

When converting a numeric value to its corresponding string value, **awk** performs the equivalent of a call to the **sprintf()** function where the one and only *expr* argument is the numeric value and the *fmt* argument is either `%d` (if the numeric value is an integer) or the value of the variable **CONVFMT** (if the numeric value is not an integer). The default value of **CONVFMT** is `%.6g`. If you use a string in a numeric context, and **awk** cannot interpret the contents of the string as a number, it treats the value of the string as zero.

Numeric constants are sequences of decimal digits.

String constants are quoted, as in `"a literal string"`. Literal strings can contain the following escape sequences:

Escape Character	Sequence
`\a`	Audible bell
`\b`	Backspace
`\f`	Form feed
`\n`	Newline
`\r`	Carriage return
`\t`	Horizontal tab
`\v`	Vertical tab

Escape Character	Sequence
ooo	Octal value *ooo*
\x*dd*	Hexadecimal value *dd*
\/	Slash
\"	Quote
c	Any other character *c*

awk supports full regular expressions. (See Appendix C, "Regular expressions (regexp)," on page 971 for more information.) When **awk** reads a program, it compiles characters enclosed in slash characters (/) as regular expressions. In addition, when literal strings and variables appear on the right side of a ~ or!~ operator, or as certain arguments to built-in matching and substitution functions, **awk** interprets them as dynamic regular expressions.

Note: When you use literal strings as regular expressions, you need extra backslashes to escape regular expression metacharacters, because the backslash is also the literal string escape character. For example, the regular expression:

```
/e\.g\./
```

should be written as:

```
"e\\.g\\."
```

Subscript in array

awk defines the *subscript-in-array* condition as:

```
index in array
```

where *index* looks like *expr* or *(expr,...,expr)*. This condition evaluates to 1 if the string value of *index* is a subscript of *array*, and to 0 otherwise. This is a way to determine if an array element exists. When the element does not exist, the subscript-in-array condition does not create it.

Symbol table

You can access the symbol table through the built-in array **SYMTAB.** **SYMTAB[***expr***]** is equivalent to the variable named by the evaluation of *expr*.

For example, **SYMTAB[***"var"***]** is a synonym for the variable *var*.

Environment

An **awk** program can determine its initial environment by examining the **ENVIRON** array. If the environment consists of entries of the form *name=value,* then **ENVIRON**[*name*] has string value "*value*". For example, the following program is equivalent to the default output of **env**:

```
BEGIN {        for (i in ENVIRON)
                printf("%s=%s\n", i, ENVIRON[i])
        exit
    }
```

Operators

awk follows the usual precedence order of arithmetic operations, unless overridden with parentheses; a table giving the order of operations appears later in this topic.

The unary operators are +, -, ++, and - -, where you can use the ++ and - - operators as either postfix or prefix operators, as in C. The binary arithmetic operators are +, -, *, /, %, and ^.

The conditional operator

```
expr ? expr1 : expr2
```

evaluates to *expr1* if the value of *expr* is nonzero, and to *expr2* otherwise.

If two expressions are not separated by an operator, **awk** concatenates their string values.

The tilde operator ~ yields **1** (true) if the regular expression on the right side matches the string on the left side. The operator !~ yields 1 when the right side has no match on the left. To illustrate:

```
$2 ~ /[0-9]/
```

selects any line where the second field contains at least one digit. **awk** interprets any string or variable on the right side of ~ or !~ as a dynamic regular expression.

The relational operators are <, <=, >, >=, ==, and !=. When both operands in a comparison are numeric, or if one is numeric and the other is not initialized, **awk** compares their values numerically; otherwise, it compares them as strings. An operator is considered to be numeric if it consists of any of the following:

- An integer or floating-point number
- A field, FILENAME, ARGV array element, or ENVIRON array element that looks like a number
- A variable created by a command-line assignment that looks like a number
- Input from a getline() function that looks like a number
- An array element created by the split() function that looks like a number
- A variable assignment from another number variable that looks like a number

The Boolean operators are || (or), && (and), and ! (not). **awk** uses *short-circuit evaluation* when evaluating expressions. With an && expression, if the first operator is false, the entire expression is false and it is not necessary to evaluate the second operator. With an || expression, a similar situation exists if the first operator is true.

You can assign values to a variable with:

```
var = expr
```

If *op* is a binary arithmetic operator, *var op= expr* is equivalent to *var = var op expr*, except that *var* is evaluated only once.

See Table 3 on page 40 for the precedence rules of the operators.

Table 3. The order of operations for awk

Operators	Order of operations
(A)	Grouping
$*i* V[a]	Field, array element
V++ V-- ++V --V	Increment, decrement
A^B	Exponentiation
+A -A !A	Unary plus, unary minus, logical NOT
A*B A/B A%B	Multiplication, division, remainder
A+B A-B	Addition, subtraction
A B	String concatenation
A<B A>B A<=B A>=B A!=B A==B	Comparisons
AB (with the ~ character above the A) A!~B ~	Regular expression matching
A in V	Array membership
A && B	Logical AND
A || B	Logical OR
A ? B : C	Conditional expression
V=B V+=B V-=B V*=B V/=B V%=B V^=B	Assignment

Note:

1. A, B, C are any expression.
2. i is any expression yielding an integer.
3. V is any variable.

Command-line arguments

awk sets the built-in variable ARGC to the number of command-line arguments. The built-in array ARGV has elements subscripted with digits from zero to ARGC-1, giving command-line arguments in the order they appeared on the command line.

The ARGC count and the ARGV vector do not include command-line options (beginning with -) or the program file (following **–f**). They do include the name of the command itself, initialization statements of the form *var=value*, and the names of input data files.

awk actually creates ARGC and ARGV before doing anything else. It then "walks through" ARGV, processing the arguments. If an element of ARGV is an empty string, **awk** skips it. If it contains an equals sign (=), **awk** interprets it as a variable assignment. If it is a minus sign (-), **awk** immediately reads input from stdin until it encounters the end of the file. Otherwise, **awk** treats the argument as a file name and reads input from that file until it reaches the end of the file. **awk** runs the program by "walking through" ARGV in this way; thus, if the program changes ARGV, **awk** can read different files and make different assignments.

Input

awk divides input into records. A *record separator character* separates each record from the next. The value of the built-in variable RS gives the current record

separator character; by default, it begins as the newline (\n). If you assign a different character to RS, **awk** uses that as the record separator character from that point on.

awk divides records into fields. A *field separator string*, given by the value of the built-in variable FS, separates each field from the next. You can set a specific separator string by assigning a value to FS, or by specifying the **–F** *ere* option on the command line. You can assign a regular expression to FS. For example:

```
FS = "[,:$]"
```

says that commas, colons, or dollar signs can separate fields. As a special case, assigning FS a string that contains only a blank character sets the field separator to white space. In this case, **awk** considers any sequence of contiguous space or tab characters a single field separator. This is the default for FS. However, if you assign FS a string containing any other character, that character designates the start of a new field. For example, if we set FS=\t (the tab character),

```
texta \t textb \t  \t  \t textc
```

contains five fields, two of which contain only blanks. With the default setting, this record only contains three fields, since **awk** considers the sequence of multiple blanks and tabs a single separator.

The following list of built-in variables provides various pieces of information about input:

NF Number of fields in the current record

NR Number of records read so far

FILENAME
Name of file that contains the current record

FNR Number of records that was read from current file

Field specifiers have the form $*n*, where *n* runs from 1 through **NF**. Such a field specifier refers to the *n*th field of the current input record. **$0** (zero) refers to the entire current input record.

The **getline** function can read a value for a variable or **$0** from the current input, from a file, or from a pipe. The result of **getline** is an integer indicating whether the read operation was successful. A value of 1 indicates success; 0 indicates that the end of the file was encountered; and -1 indicates that an error occurred. Possible forms for **getline** are:

getline
Reads next input record into $0 and splits the record into fields. **NF, NR,** and **FNR** are set appropriately.

getline *var*
Reads the next input record into the variable *var*. **awk** does not split the record into fields (which means that the current *$n* values do not change), but sets **NR** and **FNR** appropriately.

getline *<expr*
Interprets the string value of *expr* to be a file name. **awk** reads the next record from that file into **$0**, splits it into fields, and sets **NF** appropriately. If the file is not open, **awk** opens it. The file remains open until you close it with a **close** function.

getline *var* **<***expr*
Interprets the string value of *expr* to be a file name, and reads the next record from that file into the variable *var*, but does not split it into fields.

expr **|** **getline**
Interprets the string value of *expr* as a command line to be run. **awk** pipes output from this command into **getline**, and reads it into *$0*, splits it into fields, and sets **NF** appropriately. See "System function" on page 44 for additional details.

expr **|** **getline** *var*
Runs the string value of *expr* as a command and pipes the output of the command into **getline**. The result is similar to **getline** *var* **<***expr*.

You can have only a limited number of files and pipes open at one time. You can close files and pipes during execution using the **close**(*expr*) function. The *expr* argument must be one that came before **|** or after **<** in **getline**, or after **>** or **>>** in **print** or **printf**.

If the function successfully closes the pipe, it returns zero. By closing files and pipes that you no longer need, you can use any number of files and pipes in the course of running an **awk** program.

Built-in arithmetic functions

atan2(*expr1***,** *expr2***)**
Returns the arctangent of *expr1*/*expr2* in the range of -π through π.

exp(*expr***), log(***expr***), sqrt(***expr***)**
Returns the exponential, natural logarithm, and square root of the numeric value of *expr*. If you omit (*expr*), these functions use *$0* instead.

int(*expr***)**
Returns the integer part of the numeric value of *expr*. If you omit (*expr*), the function returns the integer part of *$0*.

rand() Returns a random floating-point number in the range `0` through `1`.

sin(*expr***), cos(***expr***)**
Returns the sine and cosine of the numeric value of *expr* (interpreted as an angle in radians).

srand(*expr***)**
Sets the seed of the **rand** function to the integer value of *expr*. If you omit (*expr*), **awk** uses the time of day as a default seed.

Built-in string functions

len **= length (***expr***)**
Returns the number of characters in the string value of *expr*. If you omit (*expr*), the function uses *$0* instead. The parentheses around *expr* are optional.

n **= split(***string***,** *array***,** *regexp***)**
Splits the *string* into fields. *regexp* is a regular expression giving the field separator string for the purposes of this operation. This function assigns the separate fields, in order, to the elements of *array*; subscripts for `array` begin at `1`. **awk** discards all other elements of *array*. **split** returns the number of fields into which it divided *string* (which is also the maximum subscript for *array*).

regexp divides the record in the same way that the **FS** field separator string does. If you omit *regexp* in the call to **split**, it uses the current value of **FS**.

str **= substr(***string***,** *offset***,** *len***)**
Returns the substring of *string* that begins in position *offset* and is at most *len* characters long. The first character of the string has an *offset* of 1. If you omit *len*, or if *len* specifies more characters than are left in the string, **substr** returns the rest of *string*.

pos **= index(***string***,** *str***)**
Returns the position of the first occurrence of *str* in *string*. The count is in characters. If **index** does not find *str* in *string*, it returns `0`.

pos **= match(***string***,** *regexp***)**
Searches *string* for the first substring matching the regular expression *regexp*, and returns an integer giving the position of this substring counting from 1. If it finds no such substring, **match** returns zero. This function also sets the built-in variable RSTART to *pos* and the built-in variable RLENGTH to the length of the matched string. If it does not find a match, **match** sets RESTART to `0`, and RLENGTH to -1. You can enclose *regexp* in slashes or specify it as a string.

n **= sub(***regexp***,** *repl***,** *string***)**
Searches *string* for the first substring matching the regular expression *regexp*, and replaces the substring with the string *repl*. **awk** replaces any ampersand (&) in *repl* with the substring of *string* which matches *regexp*. An ampersand preceded with a backslash ('\') is interpreted as the literal ampersand character. An occurrence of two consecutive backslashes is interpreted as just a single literal backslash character. Any other occurrence of a backslash (for example, preceding any other character) is treated as a literal backslash character. If *repl* is a string literal, the handling of the ampersand character occurs after any lexical processing, including any lexical backslash escape sequence. If you omit *string*, **sub** uses the current record instead. **sub** returns the number of substrings replaced (which is 1 if it found a match, and `0` otherwise).

n **= gsub(***regexp***,** *repl***,** *string***)**
Works the same way as **sub**, except that **gsub** replaces all matching substrings (global substitution). The return value is the number of substitutions performed.

str **= sprintf(***fmt***,** *expr***,** *expr...***)**
Formats the expression list *expr, expr, ...* using specifications from the string *fmt*, and then returns the formatted string. The *fmt* string consists of conversion specifications that convert and add the next *expr* to the string, and ordinary characters that **sprintf** simply adds to the string. These conversion specifications are similar to those used by the ANSI C standard.

Conversion specifications have the form

`%[-][0][x][.y]c`

where

- Left-justifies the field; default is right justification.

0 (Leading zero) prints numbers with leading zero.

x Is the minimum field width.

y Is the precision.

c Is the conversion character.

In a string, the precision is the maximum number of characters to be printed from the string; in a number, the precision is the number of digits to be printed to the right of the decimal point in a floating-point value. If *x* or *y* is * (asterisk), the minimum field width or precision is the value of the next *expr* in the call to **sprintf**.

The conversion character *c* is one of following:

d Decimal integer

i Decimal integer

o Unsigned octal integer

x,X Unsigned hexadecimal integer

u Unsigned decimal integer

f,F Floating point

e,E Floating point (scientific notation)

g,G The shorter of **e** and **f** (suppresses nonsignificant zeros)

c Single character of an integer value; first character of string

s String

The lowercase **x** specifies alphabetic hexadecimal digits in lowercase, whereas the uppercase **X** specifies alphabetic hexadecimal digits in uppercase. The other uppercase-lowercase pairs work similarly.

n **= ord(***expr***)**
Returns the integer value of first character in the string value of *expr*. This is useful in conjunction with *%c* in **sprintf**.

str **= tolower(***expr***)**
Converts all letters in the string value of *expr* into lowercase, and returns the result. If you omit *expr*, **tolower** uses *$0* instead. This function uses the value of the locale or the LC_CTYPE environment variable.

str **= toupper(***expr***)**
Converts all letters in the string value of *expr* into uppercase, and returns the result. If you omit *expr*, **toupper** uses *$0* instead. This function uses the value of the locale or the LC_CTYPE environment variable.

System function

status **= system(***expr***)**
Runs the string value of *expr* as a command. For example, **system***("tail " $1)* calls the **tail** command, using the string value of *$1* as the file that **tail** examines. The standard command interpreter runs the command, as discussed in the "Portability" on page 6 section, and the exit status returned depends on that command interpreter.

User-defined functions

You can define your own functions using the form:

```
function name(parameter-list) {
        statements
}
```

A function definition can appear in the place of a *pattern* {*action*} rule. The *parameter-list* argument contains any number of normal (scalar) and array variables separated by commas. When you call a function, **awk** passes scalar arguments by value, and array arguments by reference. The names specified in *parameter-list* are local to the function; all other names used in the function are global. You can define local variables by adding them to the end of the parameter list as long as no call to the function uses these extra parameters.

A function returns to its caller either when it runs the final statement in the function, or when it reaches an explicit **return** statement. The return value, if any, is specified in the **return** statement (see "Actions").

Patterns

A *pattern* is a regular expression, a special pattern, a pattern range, or any arithmetic expression.

BEGIN is a special pattern used to label actions that **awk** performs before reading any input records. **END** is a special pattern used to label actions that **awk** performs after reading all input records.

You can give a pattern range as:

```
pattern1,pattern2
```

This matches all lines from one that matches *pattern1* to one that matches *pattern2*, inclusive.

If you omit a pattern, or if the numeric value of the pattern is nonzero (true), **awk** runs the resulting action for the line.

Actions

An *action* is a series of statements ended by semicolons, newlines, or closing braces. A *condition* is any expression; **awk** considers a nonzero value true, and a zero value false. A *statement* is one of the following or any series of statements enclosed in braces:

```
# expression statement, e.g. assignment
expression

# if statement
if (condition)
        statement
[else
        statement]

# while loop
while (condition)
        statement

# do-while loop
do
        statement
while (condition)

# for loop
for (expression1; condition; expression2)
        statement
```

The **for** statement is equivalent to:

```
expression1
while (condition) {
        statement
        expression2
}
```

The **for** statement can also have the form:

```
for (i in array)
        statement
```

awk runs the statement (specified with the *statement* argument) once for each element in *array*; on each repetition, the variable *i* contains the name of a subscript of *array*, running through all the subscripts in an *arbitrary* order. If *array* is multidimensional (has multiple subscripts), *i* is expressed as a single string with the **SUBSEP** character separating the subscripts.

- The statement **break** exits a **for** or a **while** loop immediately. **continue** stops the current iteration of a **for** or **while** loop and begins the next iteration (if there is one).
- **next** ends any processing for the current input record and immediately starts processing the next input record. Processing for the next record begins with the first appropriate rule. If a **next** statement appears or is invoked in a **BEGIN** or **END** action, **awk** will cause all further **BEGIN** or **END** action processing to be abandoned.
- **exit**[(*expr*)] immediately goes to the **END** action if it exists; if there is no **END** action, or if **awk** is already running the **END** action, the **awk** program ends. **awk** sets the exit status of the program to the numeric value of *expr*. If you omit (*expr*), the exit status is `0`. **return** [*expr*] returns from the execution of a function.

If you specify an *expr*, the function returns the value of the expression as its result; otherwise, the function result is undefined. **delete** *array*[*i*] deletes element *i* from the given *array*. **print** *expr*, *expr*, ... is described in "Output." **printf** *fmt*, *expr*, *expr*, ... is also described in "Output."

Output

The **print** statement prints its arguments with only simple formatting. If it has no arguments, it prints the entire current input record. **awk** adds the output record separator **ORS** to the end of the output that each **print** statement produces; when commas separate arguments in the **print** statement, the output field separator **OFS** separates the corresponding output values. **ORS** and **OFS** are built-in variables, whose values you can change by assigning them strings. The default output record separator is a newline, and the default output field separator is a space.

The variable **OFMT** gives the format of floating-point numbers output by **print**. By default, the value is `%.6g`; you can change this by assigning **OFMT** a different string value. **OFMT** applies only to floating-point numbers (ones with fractional parts).

The **printf** statement formats its arguments using the *fmt* argument. Formatting is the same as for the built-in function **sprintf**. Unlike **print**, **printf** does not add output separators automatically. This gives the program more precise control of the output.

The **print** and **printf** statements write to **stdout**. You can redirect output to a file or pipe.

If you add *>expr* to a **print** or **printf** statement, **awk** treats the string value of *expr* as a file name, and writes output to that file. Similarly, if you add *>>expr*, **awk** sends output to the current contents of the file. The distinction between > and >> is important only for the first **print** to the file *expr.* Subsequent outputs to an already open file append to what is there already.

You cannot use such ambiguous statements as:

```
print a > b c
```

Use parentheses to resolve the ambiguity.

If you add *|expr* to a **print** or **printf** statement, **awk** treats the string value of *expr* as an executable command and runs it with the output from the statement piped as input into the command.

As mentioned earlier, you can have only a limited number of files and pipes open at any time. To avoid going over the limit, use the **close** function to close files and pipes when you no longer need them.

print and **printf** are also available as functions with the same calling sequence, but no redirection.

Examples

1. The following example:

   ```
   awk '{print NR ":" $0}' input1
   ```

   outputs the contents of the file `input1` with line numbers prepended to each line.
2. The following is an example using *var=value* on the command line:

   ```
   awk '{print NR SEP $0}' SEP=":" input1
   ```

   awk can also read the program script from a file as in the command line:

   ```
   awk –f addline.awk input1
   ```

   which produces the same output when the file `addline.awk` contains:

   ```
   {print NR ":" $0}
   ```
3. The following program appends all input lines starting with `January` to the file `jan` (which may or may not exist already), and all lines starting with `February` or `March` to the file `febmar`:

   ```
   /^January/ {print >> "jan"}
   /^February|^March/ {print >> "febmar"}
   ```
4. This program prints the total and average for the last column of each input line:

   ```
           {s += $NF}
   END     {print "sum is", s, "average is", s/NR}
   ```
5. The next program interchanges the first and second fields of input lines:

   ```
   {        tmp = $1
           $1 = $2
           $2 = tmp
           print
   }
   ```
6. The following inserts line numbers so that output lines are left-aligned:

   ```
   {printf "%–6d: %s\n", NR, $0}
   ```

7. The following prints input records in reverse order (assuming sufficient memory):

```
{
        a[NR] = $0 # index using record number
}
END {
        for (i = NR; i>0; --i)
                print a[i]
}
```

8. The following program determines the number of lines starting with the same first field:

```
{
        ++a[$1] # array indexed using the first field
}
END {   # note output will be in undefined order
        for (i in a)
                print a[i], "lines start with", i
}
```

   You can use the following program to determine the number of lines in each input file:

```
{
        ++a[FILENAME]
}
END {
        for (file in a)
                if (a[file] == 1)
                        print file, "has 1 line"
                else
                        print file, "has", a[file], "lines"
}
```

9. The following program illustrates how you can use a two-dimensional array in **awk**. Assume the first field of each input record contains a product number, the second field contains a month number, and the third field contains a quantity (bought, sold, or whatever). The program generates a table of products versus month.

```
BEGIN   {NUMPROD = 5}
{
        array[$1,$2] += $3
}
END     {
        print "\t Jan\t Feb\tMarch\tApril\t May\t" \
            "June\tJuly\t Aug\tSept\t Oct\t Nov\t Dec"
        for (prod = 1; prod <= NUMPROD; prod++) {
                printf "%-7s", "prod#" prod
                for (month = 1; month <= 12; month++){
                        printf "\t%5d", array[prod,month]
                }
                printf "\n"
        }
}
```

10. As the following program reads in each line of input, it reports whether the line matches a predetermined value:

```
function randint() {
        return (int((rand()+1)*10))
}
BEGIN   {
        prize[randint(),randint()] = "$100";
        prize[randint(),randint()] = "$10";
        prize[1,1] = "the booby prize"
        }
```

```
{
        if (($1,$2) in prize)
                printf "You have won %s!\n", prize[$1,$2]
}
```

11. The following example prints lines, the first and last fields of which are the same, reversing the order of the fields:

```
$1==$NF {
        for (i = NF; i > 0; --i)
                printf "%s", $i (i>1 ? OFS : ORS)
}
```

12. The following program prints the input files from the command line. The **infiles** function first empties the passed array, and then fills the array. The extra parameter *i* of **infiles** is a local variable.

```
function infiles(f,i) {
        for (i in f)
               delete f[i]
        for (i = 1; i < ARGC; i++)
                if (index(ARGV[i],"=") == 0)
                        f[i] = ARGV[i]
}
BEGIN   {
        infiles(a)
        for (i in a)
                print a[i]
        exit
     }
```

13. Here is the standard recursive factorial function:

```
function fact(num) {
        if (num <= 1)
                return 1
        else
                return num * fact(num - 1)
}
{ print $0 " factorial is " fact($0) }
```

14. The following program illustrates the use of **getline** with a pipe. Here, **getline** sets the current record from the output of the **wc** command. The program prints the number of words in each input file.

```
function words(file,   string) {
        string = "wc " fn
        string | getline
        close(string)
        return ($2)
}
BEGIN   {
        for (i=1; i<ARGC; i++) {
                fn = ARGV[i]
                printf "There are %d words in %s.",
                    words(fn), fn
        }
}
```

Environment variables

awk uses the following environment variables:

PATH Contains a list of directories that **awk** searches when looking for commands run by **system**(*expr*), or input and output pipes.

_UNIX03
For more information about the effect of _UNIX03 on the **awk** command, see Appendix N, “Shell commands changed for UNIX03,” on page 1039.

Any other environment variable can be accessed by the **awk** program itself.

Localization

awk uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_NUMERIC**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion
- If the **awk** program contains no actions and no patterns, but is otherwise a valid **awk** program, standard input and any file operands are not read and **awk** exits with an exit status of zero.

1 Any of the following errors:
- Parser internal stack overflow
- Syntax error
- Function redefined
- Internal execution tree error
- Insufficient memory for string storage
- Unbalanced parenthesis or brace
- Missing script file
- Missing field separator
- Missing variable assignment
- Unknown option
- Incorrect character in input
- Newline in regular expression
- Newline in string
- EOF in regular expression
- EOF in string
- Cannot open script file
- Inadmissible use of reserved keyword
- Attempt to redefine built-in function
- Cannot open input file
- Error on **print**
- Error on **printf**
- Getline in END action was not redirected
- Too many open I/O streams
- Error on I/O stream
- Insufficient arguments to **printf** or **sprintf()**
- Array cannot be used as a scalar
- Variable cannot be used as a function
- Too many fields
- Record too long
- Division (/ or %) by zero
- Syntax error
- Cannot assign to a function
- Value required in assignment

- Return outside of a function
- Can delete only array element or array
- Scalar cannot be used as array
- SYMTAB must have exactly one index
- Impossible function call
- Function call nesting level exceeded
- Wrong number of arguments to function
- Regular expression error
- Second parameter to “split” must be an array
- **sprintf** string longer than allowed number of characters
- No open file name
- Function requires an array
- Is not a function
- Failed to match
- Incorrect collation element
- Trailing \ in pattern
- Newline found before end of pattern
- More than 9 \(\) pairs
- Number in [0–9] incorrect
- [ ] imbalance or syntax error
- ( ) or \(\) imbalance
- { } or \{ \} imbalance
- Incorrect endpoint in range
- Out of memory
- Incorrect repetition
- Incorrect character class type
- Internal error
- Unknown *regex* error

When an **awk** program ends because of a call to **exit()**, the exit status is the value passed to **exit()**.

Limits

Most constructions in this implementation of **awk** are dynamic, limited only by memory restrictions of the system.

The maximum record size is guaranteed to be at least LINE_MAX as returned by **getconf**. The maximum field size is guaranteed to be LINE_MAX, also.

The parser stack depth is limited to 150 levels. Attempting to process extremely complicated programs may result in an overflow of this stack, causing an error.

Input must be text files.

Portability

POSIX.2, X/Open Portability Guide UNIX systems.

The **ord** function is an extension to traditional implementations of **awk**. The **toupper** and **tolower** functions and the ENVIRON array are in POSIX and the UNIX System V Release 4 version of **awk**. This version is a superset of New awk, as described in *The AWK Programming Language* by Aho, Weinberger, and Kernighan.

The standard command interpreter that the system function uses and that **awk** uses to run pipelines for **getline**, **print**, and **printf** is system-dependent. On z/OS UNIX, this interpreter is always `/bin/sh`.

Related information

ed, **egrep**, **sed**, **vi**

For more information about **regexp**, see Appendix C, "Regular expressions (regexp)," on page 971.

basename — Return the nondirectory components of a path name

Format

basename *name* [*suffix*]

Description

basename strips off the leading part of a path name, leaving only the final component of the name, which is assumed to be the file name. To accomplish this, **basename** first checks to see if *name* consists of nothing but slash (/) characters. If so, **basename** replaces *name* with a single slash and the process is complete. If not, **basename** removes trailing slashes. If slashes still remain, **basename** strips off all leading characters up to and including the final slash. Finally, if you specify *suffix* and the remaining portion of *name* contains a suffix that matches *suffix*, **basename** removes that suffix.

Examples

The command:

```
basename src/dos/printf.c
```

produces:

```
printf.c
```

Localization

basename uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Unknown command-line option
- Incorrect number of arguments

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

dirname

batch — Run commands when the system is not busy

Format

batch

Description

batch lets you run commands in batch mode. It reads the commands from the standard input (**stdin**). The system records the commands and runs them at a time when the system load is relatively low (that is, when the system is not busy).

The **batch** command is equivalent to

```
at –q b –m now
```

For more details, see **at**.

at, **batch**, and **crontab** submit jobs to **cron**; the data in those jobs may contain double-byte characters. When the jobs are run, the data in the jobs are interpreted in the locale that **cron** is using. Since it is strongly recommended that **cron** be started in the POSIX locale, double-byte characters in the job may not be interpreted correctly. You may be able to get around this by calling **setlocale()** in the job itself.

Environment variables

batch uses the following environment variable:

SHELL
Contains the name of the shell command interpreter used to invoke the **batch** job.

Localization

batch uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

>0 Returned if the command fails for any reason

If an error occurs, **batch** does not schedule the job.

Portability

POSIX.2 User Portability Extension

Related information

at, **bg**, **crontab**

bc — Use the arbitrary-precision arithmetic calculation language

Format

bc [**–i**] [**–l**] [*file*]

Description

bc is a programming language that can perform arithmetic calculations to arbitrary precision. You can use it interactively, by entering instructions from the terminal. It can also run programs taken from files.

The *file* arguments you specify on the command line should be text files containing **bc** instructions. **bc** runs the instructions from those files, in the order that they appear on the command line, and then runs instructions from the standard input (stdin). **bc** ends when it runs a **quit** instruction or reaches the end of the file on **stdin**.

bc is a simple but complete programming language with a syntax reminiscent of the C programming language. This version of **bc** is a superset of the standard language available on most systems. It has a number of additional features intended to make the language more flexible and useful. Features unique to this implementation are noted.

Input consists of a series of instructions that assign values to variables or make calculations. It is also possible to define subprograms called *functions*, which perform a sequence of instructions to calculate a single value.

bc displays the result of any line that calculates a value, but does not assign it to a variable. For example, the instruction:

```
2+2
```

displays:

```
4
```

By default, **bc** displays the result of any evaluated instruction followed by a newline. **bc** also saves the last value displayed in a special variable **.** (dot), so that you can use it in subsequent calculations.

For a summary of the UNIX03 changes to this command, see Appendix N, “Shell commands changed for UNIX03,” on page 1039.

Options

bc supports the following options.

–i Puts **bc** into interactive mode with a displayed prompt. In this mode, **bc** displays a prompt, which is **:** (waiting for input). In addition, it handles errors differently. Typically, when **bc** encounters an error while processing a file, the interpreter displays the error message and exits. In interactive mode, the interpreter displays the message and returns to the prompt mode to allow debugging.

–l Loads a library of standard mathematical functions before processing any other input. This library also sets the *scale* to 20. For a description of the functions in the **–l** library, see Built-in functions.

Numbers

Numbers consist of an optional minus (-) sign or an optional plus (+) sign followed by a sequence of zero or more digits, followed by an optional decimal point (.), followed by a sequence of zero or more digits. Valid digits are 0 through 9, and the hexadecimal digits A through F. The uppercase letters represent the values from 10 through 15. There must be at least one digit, either before or after the decimal point. If not, **bc** interprets the decimal point as the special variable **.**.

A number can be arbitrarily long and can contain spaces. Here are some valid numbers with an input base of 10:

```
0    0.   .0   -3.14159   +09.    -12    1 000 000
```

Here are some valid numbers with an input base of 16 (*ibase*=16):

```
0    FF    FF.3    -10.444   A1
```

See Bases for more information.

Restriction: You cannot break up numbers with commas; you can write 1000000 or 1 000 000, but 1,000,000 results in an error message.

Identifiers

Identifiers can include sequences containing any number of letters, digits, or the underscore (_) character but must start with a lowercase letter. Spaces are not allowed in identifiers.

In the POSIX locale, valid identifiers can include sequences containing any number of letters, digits, or the underscore (_) character but must start with a lowercase letter, as defined by the current locale.

For other locales, the character map for that locale determines which characters are valid in an identifier. If you want identifiers to be portable between locales, use characters from the POSIX character set. The use of identifiers longer than one character is an extension of this implementation. Identifiers are used as names for variables, functions, or arrays:

- A *variable* holds a single numeric value. You can declare variables that are local to a function using the **auto** statement. (See Functions.) All other variables are global and you can use them inside any function or outside all functions. You do not need to declare global variables. **bc** creates variables as it requires them, with an initial value of zero. (Remember that there is also the special variable **.** [dot], which contains the result of the last calculation.)
- A *function* is a sequence of instructions that calculates a single value. A list of zero or more values enclosed in parentheses always follow a function name, as in **my_func(3.14159)**. (See Functions.)

- An *array* is a list of values. Values in the list are called *elements* of the array. These elements are numbered, beginning at zero. We call such a number a *subscript*, or *index*, of the array. Subscripts always appear in square brackets after the array. For example, **a[0]** refers to element zero in the array **a**. The first element of the array always has the subscript `0`. If a subscript value is a floating-point number, the fractional part is discarded to make the subscript into an integer. For example, the following expressions all refer to the same element:

  ```
  a[3]   a[3.2]   a[3.999]
  ```

  The maximum number of elements in a **bc** array is in the range from `0` to {*BC_DIM_MAX*}-1 inclusive. Unlike with many languages, you do not need to declare the size of an array. Elements are created dynamically as required, with an initial value of zero.

Since parentheses always follow function names and square brackets always follow array names, **bc** can distinguish between all three types of names—variable names, function names, and array names. Therefore, you can have variables, functions, and arrays with the same name. For example, *foo* may be a variable whereas **foo()** is a function and **foo[ ]** is an array.

Built-in variables

bc has a number of built-in variables that are used to control various aspects of the interpreter. These are described in the following topics.

Scale

The *scale value* is the number of digits to be retained after the decimal point in arithmetic operations. For example, if the scale is 3, each calculation retains at least three digits after the decimal point. This means that:

```
5 / 3
```

has the value:

```
1.666
```

If **–l** is specified, the scale is set to 20; otherwise, the default scale is zero.

The variable *scale* holds the current scale value. To change scales, assign a new value to *scale*, as in:

```
scale = 5
```

Since *scale* is just a regular **bc** variable, it can be used in the full range of **bc** expressions.

The number of decimal places in the result of a calculation is affected not only by the scale, but also by the number of decimal places in the operands of the calculation. Arithmetic operations discusses this.

There is also a function **scale**, which can determine the scale of any expression. For example, **scale(1.1234)** returns the result 4, which is the scale of the number 1.1234. The result of the **scale** function is always an integer (that is, it has the scale of `0`).

The maximum value for **scale** is given by the configuration variable {BC_SCALE_MAX} and the minimum value is `0`.

Bases

bc lets you specify numbers in different bases—for example, octal (base 8) or hexadecimal (base 16). You can input numbers in one base and output them in a different base, simplifying the job of converting from one base to another. **bc** does this using the built-in variables *ibase* and *obase*.

ibase is the base for input numbers. It has an initial value of 10 (normal decimal numbers). To use a different base for inputting numbers, assign an integer to *ibase*, as in:

```
ibase = 8
```

This means that all future input numbers are to be in base 8 (octal). The largest valid input base is 16, and the smallest valid input base is 2. There is no mechanism provided to represent digits larger than 15, so bases larger than 16 are essentially useless. When the base is greater than 10, use the uppercase letters as digits. For example, base 16 uses the digits `0` through `9`, and `A` through `F`. The digits are allowed in any number, regardless of the setting of *ibase* but are largely meaningless if the base is smaller than the digit. The one case where this is useful is in resetting the input base to 10. The constant `A` always has the value 10 no matter what *ibase* is set to, so to reset the input base to 10, type:

```
ibase = A
```

obase is the base in which numbers are output. It has an initial value of 10 (normal decimal numbers). To change output bases, assign an appropriate integer to *obase*.

If the output base is 16 or less, **bc** displays numbers with normal digits and hexadecimal digits (if needed). The output base can also be greater than 16, in which case each *digit* is printed as a decimal value and digits are separated by a single space. For example, if *obase* is 1000, the decimal number 123 456 789 is printed as:

```
123 456 789
```

Here, the digits are decimal values from `0` through `999`. As a result, all output values are broken up into one or more *chunks* with three digits per chunk. Using output bases that are large powers of 10, you can arrange your output in columns; for example, many users find that 100 000 makes a good output base, because numbers are grouped into chunks of five digits each.

Long numbers are output with a maximum of 70 characters per line. If a number is longer than this, **bc** puts a backslash (\) at the end of the line indicating that the number is continued on the next line. The backslash (\) and `newline` characters are counted as part of the 70 character length.

Internal calculations are performed in decimal, regardless of the input and output bases. Therefore the number of places after the decimal point are dictated by the scale when numbers are expressed in decimal form.

The maximum value for **obase** is given by the configuration variable {BC_BASE_MAX}.

Arithmetic operations

bc provides a large number of arithmetic operations. Following standard arithmetic conventions, some operations are calculated before others. For example,

multiplications take place before additions unless you use parentheses to group operations. Operations that take place first are said to have a higher *precedence* than operations that take place later.

Operations also have an *associativity*. The associativity dictates the order of evaluation when you have a sequence of operations with equal precedence. Some operations are evaluated left to right, whereas others are evaluated right to left. The following list shows the operators of **bc** from highest precedence to lowest.

bc operator
: **Associativity**

( )
: Left to right

Unary ++ --
: Not applicable

Unary - !
: Not applicable

^
: Right to left

*** / %**
: Left to right

+ -
: Left to right

= ^= *= /= %= +=
: Right to left

== <= >= != < >
: None

&&
: Left to right

||
: Left to right

bc's order of precedence is not the same as C's. In C, the assignment operators have the lowest precedence.

The following list describes what each operation does. In the descriptions, `A` and `B` can be numbers, variables, array elements, or other expressions. `V` must be either a variable or an array element.

(A)
: Indicates that this expression—`A`—should be evaluated before any other operations are performed on it.

-A
: Is the negation of the expression.

!A
: Is the logical complement of the expression. If `A` evaluates to zero, `!A` evaluates to `1`. If `A` is not zero, `!A` evaluates to zero. This operator is unique to this version of **bc**.

++V
: Adds `1` to the value of `V`. The result of the expression is the new value of `V`.

- -V
: Subtracts `1` from the value of `V`. The result of the expression is the new value of `V`.

V++
: Adds `1` to the value of `V`, but the result of the expression is the old value of `V`.

V- -
: Subtracts `1` from the value of `V`, but the result of the expression is the old value of `V`.

A ^ B
: Calculates `A` to the power `B`. `B` must be an integer. The scale of the result of `A^B` is:

```
min(scale(A) * abs(B), max(scale, scale(A)))
```

where **min** calculates the minimum of a set of numbers and **max** calculates the maximum.

A * B Calculates A multiplied by B. The scale of the result is:

```
min(scale(A) + scale(B), max(scale, scale(A), scale(B)))
```

A / B Calculates A divided by B. The scale of the result is the value of *scale*.

A % B Calculates the remainder from the division of A by B. This is calculated in two steps. First, **bc** calculates A/B to the current scale. It then obtains the remainder through the formula:

```
A - (A / B) * B
```

calculated to the scale:

```
max(scale + scale(B), scale(A))
```

A + B Adds A plus B. The scale of the result is the maximum of the two scales of the operands.

A-B Calculates A minus B. The scale of the result is the maximum of the two scales of the operands.

Therefore, you can write such operations as `a=1+(b=2)`. In this operation, the value of the assignment in parentheses is 2 because that is the value assigned to b. Therefore, the value 3 is assigned to a. The possible assignment operators are:

V = B Assigns the value of B to V.

V ^= B
Is equivalent to V=V^B.

V *= B
Is equivalent to V=V*B.

V /= B Is equivalent to V=V/B.

V %= B
Is equivalent to V=V%B.

V += B
Is equivalent to V=V+B.

V -= B Is equivalent to V=V-B.

The next group of operators are all *assignment* operators. They assign values to objects. An assignment operation has a value, which is the value that is being assigned.

The following expressions are called *relations*, and their values can be either true (1) or false (0). This version of **bc** lets you use the relational operators in any expression, not just in the conditional parts of **if**, **while**, or **for** statements. These operators work exactly like their equivalents in the C language. The result of a relation is 0 if the relation is false and 1 if the relation is true.

A == B
Is true if and only if A equals B.

A <= B
Is true if and only if A is less than or equal to B.

A >= B
Is true if and only if A is greater than or equal to B.

A != B Is true if and only if A is not equal to B.

A < B Is true if and only if A is less than B.

A > B Is true if and only if A is greater than B.

A && B
Is true if and only if A is true (nonzero) and B is true. If A is not true, the expression B is never evaluated.

A || B
Is true if A is true or B is true. If A is true, the expression B is never evaluated.

Comments and white space

A *comment* has the form:

```
/* Any string */
```

Comments can extend over more than one line of text. When **bc** sees /* at the start of a comment, it discards everything up to the next */. The only effect a comment has is to indicate the end of a token. As an extension, this version of **bc** also provides an additional comment convention using the # character. All text from the # to the end of the line is treated as a single blank, as in:

```
2+2 # this is a comment
```

bc is free format. You can freely insert blanks or horizontal tab characters to improve the readability of the code. Instructions are assumed to end at the end of the line. If you have an instruction that is so long you need to continue it on a new line, put a backslash (\) as the very last character of the first line and continue on the second, as in:

```
a = 2\
 + 3
```

The \ indicates that the instruction continues on the next line, so this is equivalent to:

```
a = 2 + 3
```

Instructions

A **bc** instruction can be an expression that performs a calculation, an assignment, a function definition, or a statement. If an instruction is not an assignment, **bc** displays the result of the instruction when it has completed the calculation. For example, if you enter:

```
3.14 * 23
```

bc displays the result of the calculation. However, with:

```
a = 3.14 * 23
```

bc does not display anything, because the expression is an assignment. If you do want to display the value of an assignment expression, simply place the expression in parentheses.

The following list shows the instruction forms recognized by **bc**:

expression
Calculates the value of the *expression*.

"string"
Is a string constant. When **bc** sees a statement of this form, it displays the contents of the string. For example:

```
"Hello world!"
```

tells **bc** to display `Hello world!` A newline character is *not* output after the string. This makes it possible to do things like:

```
foo = 15
"The value of foo is "; foo
```

With these instructions, **bc** displays

```
The value of foo is 15
```

statement **;** *statement ...*
Is a sequence of statements on the same line. In **bc**, a semicolon (**;**) and a newline are equivalent. They both indicate the end of a statement. **bc** runs these statements in order from left to right.

{*statement***}**
Is a brace-bracketed statement. Brace brackets are used to group sequences of statements together, as in:

```
{
  statement
  statement
     ...
}
```

Brace brackets can group a series of statements that are split over several lines. Braces are typically used with control statements like **if** and **while**.

break Can be used only inside a **while** or **for** loop. `break` ends the loop.

for (*initexp* **;** *relation* **;** *endexp***)** *statement*
Is equivalent to:

```
initexp
while (relation) {
    statement
    endexp
}
```

where *initexp* and *endexp* are expressions and *relation* is a relation. For example:

```
a = 0
for (i = 1; i <= 10; ++i) a += i
```

is equivalent to the **while** example given earlier. **Rule:** All three items inside the parentheses must be specified. Unlike C, **bc** does not let you omit any of these expressions.

if (*relation***)***statement*
Tests whether the given *relation* is true. If so, **bc** runs the *statement*; otherwise, **bc** skips over the *statement* and goes to the next instruction. For example:

```
if ((a%2) == 0) "a is even"
```

displays `a is even` if `a` has an even value.

if (*relation***)** *statement1* **else***statement2*

Is similar to the simple **if** statement. It runs *statement1* if *relation* is true and otherwise runs *statement2*. It may be used as follows:

```
if ((a%2) == 0) "a is even" else "a is odd"
```

There is no statement separator between "a is even" and the **else** keyword. This differs from the C language

Here is another example:

```
if (a<10) {
        "a "
        "is "; "less than 10 "
        a
} else {
        "a is"
        " greater than 10 "
        a
}
```

Rule: The braces must be on the same line as the **if** and the **else** keywords. This is because a new line or a semicolon right after (*relation*) indicates that the body of the statement is null. One common source of errors in **bc** programs is typing the statement body portion of an **if** statement on a separate line. If **–i** is used, the interpreter displays a warning when **if** statements with null bodies are encountered.

while (*relation***)***statement*

Repeatedly runs the given *statement* while *relation* is true. For example:

```
i = 1
a = 0
while (i <= 10) {    a += i
    ++i
}
```

adds the integers from 1 through 10 and stores the result in `a`.

If *relation* is not true when **bc** encounters the **while** loop, **bc** does not run *statement* at all.

print *expression* **,** *expression ...*

Displays the results of the argument expressions. Normally, **bc** displays the value of each expression or string it encounters. This makes it difficult to format your output in programs. For this reason, the z/OS shell version of **bc** has a **print** statement to give you more control over how things are displayed. **print** lets you display several numbers on the same line with strings. This statement displays all its arguments on a single line. A single space is displayed between adjacent numbers (but not between numbers and strings). A **print** statement with no arguments displays a newline. If the last argument is null, subsequent output continues on the same line. Here are some examples of how to use **print**:

```
/* basic print statement */
print "The square of ", 2, "is ", 2*2
The square of 2 is 4

/* inserts a space between adjacent numbers */
print 1,2,3
1 2 3

/* note - no spaces */
print 1,"",2,"",3
123
```

```
/* just print a blank line */
print
/* two statements with output on same line */
print 1,2,3, ; print 4, 5, 6
1 2 3 4 5 6
```

quit Ends **bc**. In other implementations of **bc**, the interpreter exits as soon as it reads this token. This version of **bc** treats **quit** as a real statement, so you can use it in loops, functions, and so on.

sh ... Lets you send a line to the system command interpreter for execution, as in:

```
sh more <foo
```

This command passes everything from the first nonblank character until the end of the line to the command interpreter for execution.

void *expression*
Throws away, or "voids," the result of the evaluation of *expression* instead of displaying it. This instruction is useful when using `++` and `--` operators, or when you want to use a function but don't want to use the return value for anything. For example:

```
void foo++
```

increments `foo` but does not display the result. The **void** statement is unique to this version of **bc**.

Several other types of statements are relevant only in function definitions. These are described in the next topic.

Functions

A function is a *subprogram* to calculate a result based on *argument* values. For example, the following function converts a temperature given in Fahrenheit into the equivalent temperature in Celsius:

```
define f_to_c(f) {
    return ((f-32) * 5 / 9)
}
```

This defines a function named **f_to_c()** that takes a single argument called `f`. The *body* of the function is enclosed in brace brackets. The opening brace must be on the same line as the **define** keyword. The function body consists of a sequence of statements to calculate the *result* of the function. An expression of the form:

return (*expression*)

returns the value of *expression* as the result of the function. The parentheses around the expression are optional.

To activate the subprogram you use a *function call*. This has the form:

name(*expression*,*expression*,...)

where **name** is the name of the function, and the *expression*s are argument values for the function. You can use function call anywhere you might use any other expression. The value of the function call is the value that the function returns. For example, with the function **f_to_c()**, described earlier, **f_to_c(41)** has the value 5 (since 41 Fahrenheit is equivalent to 5 Celsius).

The general form of a function definition is:

```
define name(parameter,parameter,...) {
    auto local, local, ...
    statement
    statement
         ...
}
```

Each *parameter* on the first line can be a variable name or an array name. Array names are indicated by putting square brackets after them. For example, if **cmpvec** is a function that compares two vectors, the function definition might start with:

```
define cmpvec(a[],b[]) {
```

Parameters do not conflict with arrays or variables of the same name. For example, you can have a parameter named `a` inside a function, and a variable named `a` outside, and the two are considered entirely separate entities. Assigning a value to the variable does not change the parameter and vice versa. All parameters are *passed by value*. This means that a copy is made of the argument value and is assigned to the formal parameter. This also applies to arrays. If you pass an array to a function, a copy is made of the whole array, so any changes made to the array parameter do not affect the original array.

A function may not need any arguments. In this case, the **define** line does not have any parameters inside the parentheses, as in:

```
define f() {
```

The **auto** statement declares a sequence of local variables. When a variable or array name appears in an **auto** statement, the current values of those items are saved and the items are initialized to zero. For the duration of the function, the items have their new values. When the function ends, the old values of the items are restored.

However, **bc** uses dynamic scoping rules, unlike C which uses lexical scoping rules. "Usage notes" on page 68 for more information.

For example:

```
define addarr(a[],l) {
    auto i, s
    for (i=0; i < l; ++i) s += a[i]
    return (s)
}
```

is a function that adds the elements in an array. The argument `l` stands for the number of elements in the array. The function uses two local names: a variable named *i* and a variable named *s*. These variables are "local" to the function **addarr** and are unrelated to objects of the same name outside the function (or in other functions). Objects that are named in an **auto** statement are called *autos*. Autos are initialized to `0` each time the function is called. Thus, the sum *s* is set to zero each time this function is called. You can also have local arrays, which are specified by placing square brackets after the array name in the **auto** statement.

```
define func_with_local_array() {
        auto local_array[];
        for(i=0; i<100; i++) local_array[i] = i*2
}
```

This example defines a local array called **local_array**. Local arrays start out with no elements in them.

If a function refers to an object that is not a parameter and not declared **auto**, the object is assumed to be *external*. External objects may be referred to by other functions or by statements that are outside of functions. For example:

```
define sum_c(a[ ],b[ ],l) {
    auto i
    for (i=0; i < l; ++i) c[i] = a[i] + b[i]
}
```

refers to an external array named **c**, which is the element-by-element sum of two other arrays. If **c** did not exist prior to calling **sum_c**, it is created dynamically. After the program has called **sum_c**, statements in the program or in functions can refer to array **c**.

Functions typically require a `return` statement. This has the form:

```
return (expression)
```

The argument *expression* is evaluated and used as the result of the function. The expression must have a single numeric value; it cannot be an array.

A **return** statement ends a function, even if there are more statements left in the function. For example:

```
define abs(i) {
    if (i < 0) return (-i)
    return (i)
}
```

is a function that returns the absolute value of its argument. If *i* is less than zero, the function takes the first **return**; otherwise, it takes the second.

A function can also end by running the last statement in the function. If so, the result of the function is zero. The function **sum_c** is an example of a function that does not have a **return** statement. The function does not need a **return** statement, because its work is to calculate the external array **c**, not to calculate a single value. Finally, if you want to return from a function, but not return a value you can use **return()** or simply **return**. If there are no parameters to the **return** statement, a default value of zero is returned.

Built-in functions

bc has a number of built-in functions that perform various operations. These functions are similar to user-defined functions. You do not have to define them yourself, however; they are already set up for you. These functions are:

length(*expression***)**
: Calculates the total number of decimal digits in *expression*. This includes digits both before and after the decimal point. The result of **length()** is an integer. For example, **length(123.456)** returns 6.

scale(*expression***)**
: Returns the scale of *expression*. For example, **scale(123.456)** returns 3. The result of **scale()** is always an integer. Subtracting the scale of a number from the length of a number lets you determine the number of digits before the decimal point.

sqrt(*expression***)**
: Calculates the square root of the value of *expression*. The result is truncated in the least significant decimal place (not rounded). The scale of the result is the scale of *expression*, or the value of **scale()**, whichever is larger.

You can use the following functions if **–l** is specified on the command line. If it is not, the function names are not recognized. There are two names for each function: a full name, and a single character name for compatibility with POSIX.2POSIX.2. The full names are the same as the equivalent functions in the standard C math library.

arctan(*expression***) or a(***expression***)**
Calculates the arctangent of *expression*, returning an angle in radians. This function can also be called as **atan**(*expression*).

bessel(*integer***,***expression***) or j(***integer***,***expression***)**
Calculates the Bessel function of *expression*, with order *integer*. This function can also be called as **jn**(*integer*,*expression*).

cos(*expression***) or c(***expression***)**
Calculates the cosine of *expression*, where *expression* is an angle in radians.

exp(*expression***) or e(***expression***)**
Calculates the exponential of *expression* (that is, the value **e** to the power of *expression*).

ln(*expression***) or l(***expression***)**
Calculates the natural logarithm of *expression*. This function can also be called as **log**(*expression*).

sin(*expression***) or s(***expression***)**
Calculates the sine of *expression*, where *expression* is an angle in radians.

The *scale* value of the result returned by these functions is the value of the *scale* variable at the time the function is invoked. The value of the *scale* variable after these functions have completed their execution will be the same value it had upon invocation.

Examples

1. Here is a simple function to calculate the sales tax on a purchase. The amount of the purchase is given by *purchase*, and the amount of the sales tax (in per cent) is given by *tax*.

   ```
   define sales_tax(purchase,tax) {
       auto old_scale
       scale = 2
       tax = purchase*(tax/100)
       scale = old_scale
       return (tax)
   }
   ```

   For example:

   ```
   sales_tax(23.99,6)
   ```

   calculates 6% tax on a purchase of $23.99. The function temporarily sets the scale value to 2 so that the monetary figures have two figures after the decimal point. Remember that **bc** truncates calculations instead of rounding, so some accuracy may be lost. It is better to use one more digit than needed and perform the rounding at the end. The **round2** function, shown later in this topic, rounds a number to two decimal places.

2. Division resets the scale of a number to the value of *scale*. You can use this to extract the integer portion of a number, as follows:

   ```
   define integer_part(x) {
           # a local to save the value of scale
           auto old_scale
           # save the old scale, and set scale to 0
           old_scale = scale; scale=0
   ```

```
        # divide by 1 to truncate the number
        x /= 1
        # restore the old scale
        scale=old_scale
        return (x)
}
```

3. Here is a function you can define to return the fractional part of a number:

```
define fractional_part(x) {return (x - integer_part(x))}
```

4. The following function lets you set the scale of number to a given number of decimal places:

```
define set_scale(x, s)
     { auto os
        os = scale
        scale = s
        x /= 1
        scale = os
        return (x)  }
```

   You can now use **set_scale()** in a function that rounds a number to two decimal places:

```
define round2(num) {
        auto temp;
        if(scale(num) < 2) return (set_scale(num, 2))
        temp = (num - set_scale(num, 2)) * 1000
        if(temp > 5) num += 0.01
        return (set_scale(num,2))
}
```

   This is a very useful function if you want to work with monetary values. For example, you can now rewrite **sales_tax()** to use **round2()**:

```
define sales_tax(purchase,tax) {
    auto old_scale
    scale = 2
    tax = round2(purchase*(tax/100))
    scale = old_scale
    return (tax)
}
```

5. Here is a function that recursively calculates the factorial of its argument:

```
define fact (x) {
        if(x < 1) return 1
        return (x*fact(x-1))
}
```

   You can also write the factorial function iteratively:

```
define fact (x) {
        auto result
        result = 1
        while(x>1) result *= x--
        return (result)
}
```

   With either version, **fact(6)** returns 720.

6. Here is another recursive function, that calculates the *n*th element of the Fibonacci sequence:

```
define fib(n) {        if(n < 3) {                return (1)
        } else {
                return (fib(n-1)+fib(n-2))
        }
}
```

Usage notes

1. Unlike the C language, which uses lexical scoping rules, **bc** uses dynamic scoping, which is most easily explained with an example:

```
a=10
define f1() {
        auto a;
        a = 13;
        return (f2())
}
define f2() {
        return (a)
}
f1()
13
f2()
10
```

   If **f1()** is called, **bc** prints the number 13, instead of the number 10. This is because **f1()** hides away the old (global) value of `a` and then sets it to 13. When **f2()** refers to `a`, it sees the variable dynamically created by **f1()** and so prints 13. When **f1()** returns, it restores the old value of `a`. When **f2()** is called directly, instead of through **f1()**, it sees the global value for `a` and prints 10. The corresponding C code prints 10 in both cases.

2. Numbers are stored as strings in the program and converted into numbers each time they are used. This is important because the value of a "constant" number may change depending on the setting of the *ibase* variable. For example, suppose that the following instructions are given to **bc**:

```
define ten() {
        return (10)
}
ten()
10
ibase=16
ten()
16
```

   In this example, when the base is set to 10, **ten()** returns the decimal value 10. However, when the input base is changed to 16, the function returns the decimal value 16. This can be a source of confusing errors in **bc** programs.

3. The library of functions loaded using the **–l** option is stored in the file **/usr/lib/lib.b** under your root directory. This is a simple text file that you can examine and change to add new functions as desired.

4. In a noninteractive invocation, **bc** exits on any invalid input and the rest of the input are skipped.

Files

bc uses the following file:

/usr/lib/lib.b
: File containing the library of functions loaded with **–l**

Localization

bc uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**

- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following errors:
- Break statement found outside loop
- Parser stack overflow
- Syntax error
- End of file in comment
- End of file in string
- Numerical constant is too long
- String is too long
- Empty evaluation stack
- Cannot pass scalar to array
- Cannot pass array to scalar
- Incorrect array index
- Built-in variable cannot be used as a parameter or auto variable
- *name* is not a function
- Incorrect value for built-in variable
- Shell command failed to run
- Division by `0`
- Incorrect value for exponentiation operator
- Attempt to take square root of negative number
- Out of memory

2 Unknown command-line option

Limits

The parser stack depth is limited to 150 levels. Attempting to process extremely complicated programs may result in an overflow of this stack, causing an error.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The following are extensions to the POSIX standard:
- The **–i** option
- The &&and || operators
- The **if ... else ...** statement
- Identifiers of more than one character or containing characters outside the POSIX character set
- The **print** statement
- The **sh** statement
- The optional parentheses in the **return** statement

In a double-byte environment, remember that only numbers and operators from the POSIX character set can be used. Identifiers can use characters from the current locale; if you want scripts to be portable, use only characters from the POSIX character set.

bg — Move a job to the background

Format

bg [*job...*]

tcsh shell: **bg** [*%job ...*]

Description

bg runs one or more jobs in the background. The job IDs given on the command line identify these jobs, which should all be ones that are currently stopped. If you do not specify any job IDs, **bg** uses the most recently stopped job. It works only if job control is enabled; see the **–m** option of **set** for more information. Job control is enabled by default in the z/OS shell.

In the tcsh shell:

- **bg** puts the specified jobs (or, without arguments, the current job) into the background, continuing each if it is stopped. *job* can be a number, a string, ", %, + or - .
- **%job &** is a synonym of the **bg** command.

Localization

bg uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Usage notes

bg is a built-in shell command.

Exit values

0 Successful completion
>0 Failure because a *job* argument is incorrect or there is no current job

If an error occurs, **bg** exits and does not place the job in the background.

Portability

POSIX.2 User Portability Extension, UNIX systems.

Related information

at, **batch**, **fg**, **jobs**, **set**, **tcsh**

bpxmtext — Display reason code text

Format

bpxmtext [-d] *reason_code* | *error_number*

Description

bpxmtext displays the description and action text for a reason code returned from z/OS UNIX System Services, TCP/IP, zFS, TFS, and the C/C++ Runtime Library. It also returns information about error numbers. It can be run from the z/OS UNIX shell and the TSO environment. You can also enter that command through System REXX as an MVS system command.

This command is intended as an aid for problem determination. Reason codes such as those returned by HFS or NFS are not supported by this command. When an *error_number* is specified, the description for that error number is displayed.

reason_code is specified as 7-8 hexadecimal characters.

error_number is specified as 1-4 hexadecimal characters.

Options

-d *reason_code* or *error_number* is provided as a decimal number.

Usage notes

1. If no text is available for the reason code, a blank line is displayed.
2. An argument that is not 1–8 hexadecimal digits in length results in a usage message. The message is not translated.

Examples

1. The command:

   ```
   bpxmtext 058800B0
   ```

   produces data displayed in the following format:

```
BPXFSUMT 08/18/98
JRUserNotPrivileged:  The requester of the service is not privileged

Action:  The service requested required a privileged user.  Check the
documentation for the service to understand what privilege is required.
```

2. To find information for reason code 058800B0, issue:

   ```
   F AXR,BPXMTEXT 058800B0
   ```

Exit values

0 Successful completion
2 Failure due to an argument that is not 1-8 hexadecimal digits

bpxtrace — Activate or deactivate traces for processes

Format

- **bpxtrace –a** [**-B** *debug*] [**-p** *pid*] [**-u** *userid*]
- **bpxtrace –c**

[**–f** *format* | full | short | counts]
[**–o** *outputpath*] [**–T** *tempdir*] [**–v** *volser*]
[**–B** *debug*] [**–h** *columns*] [**–x**]
[*command*]

- **bpxtrace –e** [**-p** *pid*] [**-u** *userid*]
  [**–f** *format* | full | short | counts]
  [**–o** *outputpath*] [**–T** *tempdir*] [**–v** *volser*]
  [**-B** *debug*] [**–h** *columns*] [**–x**]
- **bpxtrace –i** [**-p** *pid*] [**-u** *userid*]
  [**–f** *format* | full | short | counts]
  [**–o** *outputpath*] [**–T** *tempdir*] [**–v** *volser*]
  [**-B** *debug*] [**–h** *columns*] [**–x**]
- **bpxtrace –s** [**-B** *debug*] [**-p** *pid*] [**-u** *userid*]
- **bpxtrace –S**
  [**–o** *outputpath*] [**–T** *tempdir*]
  [**–B** *debug*] [**–v** *volser*]
- **bpxtrace –t** <*seconds*> [**-p** *pid*] [**-u** *userid*]
  [**–f** *format* | full | short | counts]
  [**–o** *outputpath*] [**–T** *tempdir*] [**–v** *volser*]
  [**-B** *debug*] [**–h** *columns*] [**–x**]

Description

bpxtrace activates and deactivates tracing for one or more processes. It can be run from the z/OS UNIX shell or the TSO environment. The captured syscall trace output is dependent on the system-wide setting for SYSOMVS CTRACE options and the amount of z/OS UNIX activity on the system when the **bpxtrace** command is issued.

Guideline: When using SYSOMVS CTRACE, always specify the minimal setting. Otherwise, when you run **bpxtrace** to capture syscall data, the amount of the output might be reduced.

Restriction: A single user can run **bpxtrace** only once at any given time. Running multiple occurrences might result in allocation errors, dump failures, inconsistent process tracing, or other unexpected behaviors.

The **bpxtrace** command might allocate the following temporary data sets:
- *userid*.BPXGDCORE.DUMPDS
- *userid*.BPXGDCORE.LOG
- *userid*.BPXGDCORE.BPXEXEC
- *userid*.BPXGDCORE.DDIR

The *userid* prefix is the MVS user name of the user running the command and is not affected by the current TSO prefix setting. The caller must have authority to create these data sets or the **bpxtrace** command will fail.

The data set names must be eligible for allocation on the specified or default volumes, or the **bpxtrace** command will fail. For example, any ACS routines that determine the SMS classes and storage groups for these data sets and objects might need to be modified to allow allocation on these volumes.

Options

While all options and parameters are accepted for each function, some might be ignored for a particular function. See the function descriptions in “Format” on page 71 for options that are applicable to that particular function.

-a Stops tracing without producing trace output.

-B *debug*
Used when diagnosing problems running **bpxtrace**.

Restriction: This option is intended for use by service personnel only.

The debug level is specified as one of the following numbers:

1 Verbose mode

2 Verbose mode and traps REXX signals

3 Verbose mode, traps REXX signals, and retains the temporary files and data sets

4 Verbose mode, traps REXX signals, retains the temporary files and data sets, and does not disable tracing for the **bpxtrace** command itself

-c *command*
Traces the shell command or script that is specified by the *command* string invoked by the **/bin/sh -c** command.

-e Ends the tracing of user processes and produces trace output.

–f format | full | short | counts

Specifies how the trace records (syscall entry and syscall exit records) should be displayed. The values **full**, **short**, and **counts** show the trace records as formatted by the IPCS CTRACE command with the corresponding IPCS format request for COMP(SYSOMVS).

- **format** processes the trace records and displays one line per trace record formatted with relevant information from the trace record. The format value is also filtered based on the user ID or process ID value that was specified. The following screen shows an example of output from **bpxtrace -f format**:

```
PID ASID TCB    Local time      System call    Additional trace data
  7 0025 8FF1D8 09:43:04.070651 Call open      pgm=/bin/bpxtrace parms: 0000000D /bin/bpxwrtso 00800002
                                               00000000 00000000 00000000 00000000
  7 0025 8FF1D8 09:43:04.070668 Exit open      rv=00000007 pgm=/bin/bpxtrace
  7 0025 8FF1D8 09:43:04.070675 Call read      pgm=/bin/bpxtrace parms: 00000007 25D00000 00000000 00001000
                                               00000000 00000000 00000000
  7 0025 8FF1D8 09:43:04.091468 Exit read      rv=00001000 pgm=/bin/bpxtrace</xmp></entry>
```

The first word of the "System Call" column identifies whether the trace entry corresponds to a syscall entry (CALL) or syscall exit (EXIT). The second word identifies the syscall. For "CALL" type entries, parameters shown in the "Additional Trace Data" column must be matched with the input and output parameters for the specified syscall. Note that the output parameters might contain residual data upon entry to a syscall. The pgm=field displays information about the process being traced only if it remains active after **bpxtrace** has ended. For "EXIT" type entries, the return value (RV) returned from the syscall is displayed in the "Additional Trace Data" column. Both the input parameter mapping and

the return value meaning can be found in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.

- **full** corresponds to the **full** format option of the IPCS CTRACE command when specified with the KERNINFO option.

  Restriction: This option is intended for use by service personnel only.

  ```
  CTRACE COMP(SYSOMVS) FULL OPTIONS((KERNINFO))
  ```

The following screen shows an example of output from **bpxtrace -f full**:

```
 FCN...open            SYSCALL...BPX1OPN  PID...00000007  MODULE...BPXJCPC
SY1       SYSCALL   0F080001  09:43:04.070651  STANDARD SYSCALL ENTRY TRACE
    ASID..0025      USERID....MEGA      STACK@....26D9D0A8
    TCB...008FF1D8  EUID......00000000  PID.......00000007
   +0000  00000026  00000000  D1C3E2C5  8C000004  | ........JCSE.... |
   +0010  8000000C  00000000  8288B768  FFFFFFFF  | ........bh...... |
   +0020  00000002  26D9E8B4  00000000  7F6DCBBC  | .....RY....."_.. |
   +0030  C0000007  0000000D  61828995  618297A7  | {......./bin/bpx |
   +0040  A699A3A2  96000000  00800002  00000000  | wrtso........... |
   +0050  00000000  00000000  0BBD0000  00000000  | ................ |
   +0060  00000000  00000000  00000000  00000000  | ................ |
   +0070  00000000  00000000  00000000  00000000  | ................ |
   +0080  00000000  00000000  00000000            | ............     |
FCN...open            SYSCALL...BPX1OPN  PID...00000007  MODULE...BPXJCPC
SY1       SYSCALL   0F080002  09:43:04.070668  STANDARD SYSCALL EXIT TRACE
    ASID..0025      USERID....MEGA      STACK@....26D9D0A8
    TCB...008FF1D8  EUID......00000000  PID.......00000007
   +0000  00000026  00000000  D1C3E2C5  8C008000  | ........JCSE.... |
   +0010  8000000A  00000000  00000007  00000002  | ................ |
   +0020  00000001                                | ....             |
  FCN...read             SYSCALL...BPX1RED  PID...00000007  MODULE...BPXJCPC
 SY1       SYSCALL   0F080001  09:43:04.070675  STANDARD SYSCALL ENTRY TRACE
     ASID..0025      USERID....MEGA      STACK@....26D9D0A8
     TCB...008FF1D8  EUID......00000000  PID.......00000007
    +0000  0000002B  00000000  D1C3E2C5  8C000004  | ........JCSE.... |
    +0010  8000000C  00000000  82885438  00000000  | ........bh...... |
    +0020  00000000  618297A7  00000000  7F6DCBBC  | ..../bpx...."_.. |
    +0030  40000007  00000007  25D00000  00000000  |  ........}...... |
    +0040  00001000  00000007  00000000  0BBD0000  | ................ |
  FCN...read             SYSCALL...BPX1RED  PID...00000007  MODULE...BPXJCPC
 SY1       SYSCALL   0F080002  09:43:04.091468  STANDARD SYSCALL EXIT TRACE
     ASID..0025      USERID....MEGA      STACK@....26D9D0A8
     TCB...008FF1D8  EUID......00000000  PID.......00000007
    +0000  0000002B  00000000  D1C3E2C5  8C008000  | ........JCSE.... |
    +0010  8000000A  00000000  00001000  26D9D0BA  | ............R}. |
    +0020  00000000                                | ....             |
```

- **short** corresponds to the IPCS CTRACE command **short** format option:

  ```
  CTRACE COMP(SYSOMVS) SHORT
  ```

  For an example of the SYSOMVS trace record when the **short** format option is specified, see *z/OS MVS Diagnosis: Tools and Service Aids*.

- **counts** corresponds to the IPCS CTRACE command SYSOMVS **sccounts** option

  ```
  CTRACE COMP(SYSOMVS) OPTIONS((SCCOUNTS))
  ```

  For an example of the SYSOMVS trace record when the **sccounts** format option is specified, see *z/OS MVS Diagnosis: Tools and Service Aids*.

The default is **–f format**.

–h *columns*

Selects the columns for trace output when **–f format** is used. *columns* is specified as a string of characters where each character represents a column.

p PID column

a ASID column

t TCB column
l Local time column
s System call column
d Additional trace data

The characters can be specified in any order but the column order in the output is not affected. An incorrect specification for the columns causes the default to be used. The default is **-h patlsd**.

-i Produces trace output, leaving trace enabled.

–o *outputpath*
Specifies the path name of the z/OS UNIX file to contain the trace output. The default is to write the trace records to the standard output stream, which might cause a significant amount of trace output. When running in a shell environment, stdout can be redirected to a file; otherwise you can use the **-o** option to avoid having the output written to your session.

If the specified file exists, the contents are replaced. If redirection is used, the results depend on the redirection operator.

–p *pid,...*
Specifies the process ID of the process to have trace started, stopped, or formatted. When formatting a trace, the default formatting shows only the records for the processes that are identified by the list of specified PIDs. To have a list of multiple processes traced, specify multiple `-p pids` instances on the command. By default, tracing is started for all processes for the user.

-s Starts tracing user processes.

-S Produces trace output for unusual or unexpected conditions reported by the System Authorization Facility (SAF). To avoid flooding its trace with SAF results, z/OS UNIX traces only those conditions where the callable service documentation and return values do not provide enough information to determine the cause of the problem.

Users with an effective UID of 0 will see the trace records for all UIDs while non-effective UID 0 users will see only those trace records with a matching UID. The first 40 (decimal) bytes of these trace records are mapped by the ThliSecErrCT section of the BPXYTHLI macro, which is documented in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*. The portion of the records beyond the first 40 bytes are for use by IBM service.

The trace facilities utilized by the **-S** option do not require the prior activation of tracing for the system or for a given process. The trace facilities that are used for the **-S** option are always active and do not need to be activated or deactivated.

The following z/OS UNIX services create trace records for unusual or unexpected conditions reported by SAF:
- BPX1PWD (__passwd)
- BPX1SUI (setuid)
- BPX1SEU (seteuid)
- BPX1SRU (setreuid)
- BPX1TLS (pthread_security)
- BPX1GGN (getgrnam)
- BPX1GGR (getgroups)
- BPX1SEC (__login)

-t *seconds*
Traces for a specified period and then produces output. At the end of the time period, the traced processes will no longer have tracing on.

-T *tempdir*
Specifies the path name of the directory to be used for temporary files. By default, if **bpxtrace** is running in a shell environment, it uses the TMPDIR environment variable if available. Otherwise, **/tmp** is used.

–u *userid*
Specifies the user ID that is used in processing the trace. If the user ID is not the same as that of the invoking user, **bpxtrace** attempts to switch to UID(0) before determining which processes are to be traced. If the invoking user does not have permission to switch to UID(0), the **bpxtrace** command will fail. If both **-p** and **-u** are specified, **-u** is ignored.

–v *volser*
Specifies the volume to use for allocating temporary data sets. If **-v** is not specified, `unit(sysallda)` is used.

-x Specifies that the output contains only exit trace lines. **-f** *format* must also be specified.

Examples

1. To trace the calls made by the **df** utility and capture the output in a file:

```
bpxtrace -c -o trace.output df
```

Usage notes

If the user's effective UID is changed after BPXTRACE tracing started, CTRACE records might be missing from the BPXTRACE output. Due to limitations in DUMP processing, only CTRACE records matching the user's EUID at the time of the dump are captured and made available for display.

Exit values

0 Successful completion

1 The trace was successful but a listing was not generated

3 Command-line syntax error

4 Data set or file allocation error

5 The seteuid failed

8 z/OS UNIX callable service BPXGMCDE (MVS IPCS dump open/close service) open failure. This error indicates that the dump data set could not be opened. Try the command again. If the error persists, contact IBM Service.

9 z/OS UNIX callable service BPXGMPTR (Ptrace IPCS dump access service) command failure. This error indicates that a resource constraint was encountered while attempting to process the dump. Try the command again. If the error persists, contact IBM Service.

12 Review the error log to determine the problem.

break — Exit from a loop in a shell script

Format

break [*number*]

tcsh shell: **break**

Description

break exits from a **for**, **select**, **while**, or **until** loop in a shell script. If *number* is given, **break** exits from the given number of enclosing loops. The default value of *number* is 1.

break is a special built-in shell command.

In the tcsh shell, **break** causes execution to resume after the end of the nearest enclosing **foreach** or **while**. The remaining commands on the current line are executed. Multilevel breaks are thus possible by writing them all on one line.

Localization

break uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

break always exits with an exit status of `0`.

Portability

POSIX.2, X/Open Portability Guide.

Related information

continue, **sh**, **tcsh**

c++ — Compile C and C++ source code, link-edit and create an executable file

See **c89/xlc** or **man xlc**.

Note: When working in the shell, to view man page information about **c++**, type: `man c89` or `man xlc`.

c89 — Compiler invocation using host environment variables

Format

c89 | **cc** | **c++** | **cxx** [**–+CcEFfgOpqrsVv0123**]
[**-D** *name*[=*value*]]... [**-U** *name*]...
[**-e** *function*] [**-u** *function*]...
[**-W** *phase*,*option*[,*option*]...]...
[**-o** *outfile*]
[**-I** *directory*]... [**-L** *directory*]...
[*file.C*]... [*file.i*]... [*file.c*]... [*file.s*]...
[*file.o*]... [*file.x*]... [*file.p*]... [*file.I*]... [*file.a*]... [**-l** *libname*]...

Notes:

1. The **c99** command is only supported by the xlc utility. See "xlc — Compiler invocation using a customizable configuration file" on page 870 for more information.
2. In this information, **-l** signifies **-**l (a lowercase L) and not an uppercase I.

Description

The **c89** and **cc** commands compile, assemble, and link-edit C programs; the **cxx** or **c++** command does the same for C++ programs.

- The **c89** command should be used when compiling C programs that are written according to *Standard C*.
- The **cc** command should be used when compiling C programs that are written according to *Common Usage C*.
- The **cxx** or **c++** command must be used when compiling C++ programs. Prior to z/OS V1R2, the C++ compiler supported the *Draft Proposal International Standard for Information Systems — Programming Language C++ (X3J16)*. As of z/OS V1R7, the C++ compiler supports the *Programming languages - C++ (ISO/IEC 14882:2003(E))* standard, as well as the *Programming languages - C++ (ISO/IEC 14882:1998)* standard. The **c++** command can compile both C++ and C programs, and can also be invoked by the name **cxx** (all references to the **c++** command throughout this document apply to both names).

The **c89**, **cc**, and **c++** commands call other programs for each step of the compilation, assemble and link-editing phases. The list below contains the step name and the name of the document that describes the program you use for that step and the document that describes any messages issued by that program, and prefixes to those messages.

Table 4. Reference documentation for programs invoked by c89, cc, and c++ commands

Step Name	Document Describing Options and How to Call Program	Document Containing Messages Issued by Program	Prefix of Messages Issued by Program
ASSEMBLE	*HLASM Programmer's Guide*	*HLASM Programmer's Guide*	ASMA

Table 4. Reference documentation for programs invoked by c89, cc, and c++ commands (continued)

Step Name	Document Describing Options and How to Call Program	Document Containing Messages Issued by Program	Prefix of Messages Issued by Program
COMPILE, IPACOMP, TEMPINC, IPATEMP, IPALINK	*z/OS C/C++ User's Guide* for releases prior to z/OS V1R7 and *z/OS XL C/C++ User's Guide* for z/OS V1R7 and later releases	*z/OS C/C++ Messages* for z/OS V1R5 and z/OS V1R6 releases and *z/OS XL C/C++ Messages* for z/OS V1R7 and later releases	CCN for z/OS V1R2 and later releases
PRELINK	*z/OS Language Environment Programming Guide* and *z/OS XL C/C++ User's Guide*	*z/OS Language Environment Debugging Guide*	EDC
LINKEDIT (Program Management Binder)	*z/OS MVS Program Management: User's Guide and Reference*	*z/OS MVS System Messages, Vol 8 (IEF-IGD)*	IEW

Execution of any Language Environment® program can result in runtime messages. These messages are described in *z/OS Language Environment Runtime Messages* and have an EDC prefix.

In order for the **c89**, **cc**, and **c++** commands to perform C and C++ compiles, the z/OS C/C++ Optional Feature must be installed on the system. The z/OS C/C++ Optional Feature provides a C compiler, a C++ compiler, C++ Class Libraries, and some utilities. See *z/OS Introduction and Release Guide* for further details. Also see *prefix*_CLIB_PREFIX and *prefix*_PLIB_PREFIX in "Environment variables" on page 94 for information about the names of the z/OS XL C/C++ Optional Feature data sets that must be made available to the **c89/cc/c++** command.

Note: The term *prefix* is defined in "Environment variables" on page 94.

First, the **c89**, **cc**, and **c++** commands perform the compilation phase (including preprocessing) by compiling all source file operands (*file.C*, *file.i*, and *file.c*, as appropriate). For the **c++** command, if automatic template generation is being used (which is the default), then z/OS XL C++ source files may be created or updated in the `tempinc` subdirectory of the working directory during the compilation phase (the `tempinc` subdirectory will be created if it does not already exist). Then, the **c89**, **cc**, and **c++** commands perform the assemble phase by assembling all operands of the *file.s* form. The result of each compile step and each assemble step is a *file.o* file. If all compilations and assemblies are successful, or if only *file.o* and/or *file.a* files are specified, the **c89**, **cc**, and **c++** commands proceed to the link-editing phase. For the **c++** command, the link-editing phase begins with an automatic template generation step when applicable. For IPA (Interprocedural Analysis) optimization an additional IPA Link step comes next. The link-edit step is last. See the

environment variable *prefix*_STEPS under “Environment variables” on page 94 for more information about the link-editing phase steps.

In the link-editing phase, the **c89**, **cc**, and **c++** commands combine all *file.o* files from the compilation phase along with any *file.o* files that were specified on the command line. For the **c++** command, this is preceded by compiling all C++ source files in the `tempinc` subdirectory of the working directory (possibly creating and updating additional C++ source files during the automatic template generation step). After compiling all the C++ source files, the resulting object files are combined along with the *file.o* files from the compilation phase and the command line. Any *file.a* files, *file.x* files and **-l** *libname* operands that were specified are also used.

The usual output of the link-editing phase is an executable file. For the **c89**, **cc**, and **c++** commands to produce an executable file, you must specify at least one operand which is of other than **-l** *libname* form. If **-r** is used, the output file is not executable.

For more information about automatic template generation, see *z/OS XL C/C++ User's Guide* and the information on "Using `TEMPINC` or `NOTEMPINC`" in *z/OS XL C/C++ Programming Guide*. Note that the **c++** command only supports using the `tempinc` subdirectory of the working directory for automatic template generation.

For more information on IPA, see “Options.”

Options

–+ Specifies that all source files are to be recognized as C++ source files. All *file.s*, *file.o*, and *file.a* files will continue to be recognized as assembler source, object, and archive files respectively. However, any C *file.c* or *file.i* files will be processed as corresponding C++ *file.C* or *file.i* files, and any other file suffix which would otherwise be unrecognized will be processed as a *file.C* file.

This option effectively overrides the environment variable *prefix*_EXTRA_ARGS. This option is only supported by the **c++** command.

-C Specifies that C and C++ source comments should be retained by the preprocessor. By default, all comments are removed by the preprocessor. This option is ignored except when used with the -E option.

-c Specifies that only compilations and assemblies be done. Link-edit is not done.

-D *name*[=*value*]
Defines a C or C++ macro for use in compilation. If only *name* is provided, a value of 1 is used for the macro it specifies. For information about macros that the **c89/cc/c++** command automatically defines, see Usage Note 5 and Usage Note 13.

Notes:

- The xlc utility has slightly different semantics for processing -D options.
- As of z/OS V1R12, to define a macro name that contains an escape character (that is, the back slash) using an option such as **-D** or **-Wc,DEFINE**, you must specify the option in a way that can preserve the back slash character when the macro reaches the compiler parser. Because an option passes through the UNIX shell and the compiler options processor, both of which are sensitive to back slash characters,

the rules for such characters must be followed to ensure that the compiler parser receives a macro with the back slash character. The UNIX shell and the compiler options parser both interpret and consume back slash characters that are unquoted or quoted by double quotation marks. On the other hand, the UNIX shell does not interpret back slash characters that are quoted by single quotation marks, while the compiler options parser is not sensitive to single quotation marks. For example, for the compiler parser to receive **\u0024** as the macro symbol, the compiler options processor must receive **\\u0024**, so you must specify **-D'\\u0024'** or **-D"\\\u0024"** on the command line. This also applies to the **-Wc,DEFINE** option, which is an alternative method of defining macros (for example, **-Wc,'DEFINE(\\u0024)'** or **-Wc,"DEFINE(\\\ u0024)")**. The same is true for any compiler option which requires the use of a back slash to suppress special meaning of a particular character.

-E Specifies that output of the compiler preprocessor phase be copied to `stdout`. Object files are not created, and no link-editing is performed.

-e *function*

Specifies the name of the function to be used as the entry point of the program. This can be useful when creating a fetchable program, or a non–C or non–C++ main, such as a COBOL program. Non–C++ linkage symbols of up to 1024 characters in length may be specified. You can specify an S-name by preceding the function name with double slash (//). (For more information about S-names, see Usage Note 23.)

Specify a null S-name ("-e //") so that no function name is identified by the **c89/cc/c++** command as the entry point of the program. In that case, the Program Management Binder (link editor) default rules will determine the entry point of the program. For more information about the Program Management Binder and the ENTRY control statement, see *z/OS MVS Program Management: User's Guide and Reference*.

The function `//ceestart` is the default. When the default function entry point is used, a binder ORDER control statement is generated by the **c89/cc/c++** command to cause the CEESTART code section to be ordered to the beginning of the program. Specify the name with a trailing blank to disable this behavior, as in `"//ceestart "`. For more information about the Program Management Binder and the ORDER control statement, see *z/OS MVS Program Management: User's Guide and Reference*.

This option may be required when building products which are intended to be installed using the IBM SMP/E product. When installing ++MOD elements with SMP/E, binder control statements should be provided in the JCLIN created to install the product instead of being embedded in the elements themselves.

-F Ignored by the **cc** command. Provided for compatibility with historical implementations of the **cc** command. Flagged as an error by the **c89** and **c++** commands.

-f Ignored by the **cc** command. Provided for compatibility with historical implementations of the **cc** command. Flagged as an error by the **c89** and **c++** commands.

Historical implementations of C/C++ used this option to enable floating-point support. Floating-point is automatically included in z/OS XL C/C++. However, in z/OS XL C/C++, two types of floating-point support are available:

HEXADECIMAL
Base 16 IBM System z9® hexadecimal format. The IBM System z9 hexadecimal format is referred to as the hexadecimal floating-point format, and is unique to IBM System z9 hardware. This is the default.

IEEE754
Base 2 IEEE-754 binary format. The IEEE-754 binary format is referred to as binary floating-point format. The IEEE-754 binary format is the more common floating point format used on other platforms.

If you are porting an application from another platform, transmitting floating-point numbers between other platforms or workstations, or your application requires the larger exponent range provided by IEEE-754 binary format, then you should consider using IEEE floating-point. The *z/OS XL C/C++ User's Guide* contains more information on the FLOAT compiler option.

Example: An example of compiling with *IEEE*-754 binary floating point format:

```
c89 -o outfile -Wc,'float(ieee)' file.c
```

-g Specifies that a side file that contains symbolic information is emitted and the executable is to be loaded into read/write storage, which is required for source-level debugging with dbx, and other debuggers.

For 32-bit compiles, if the _DEBUG_FORMAT=ISD environment variable is exported, then **-g** specifies that the output file (executable) is to contain symbolic information and is to be loaded into read/write storage, which is required for source-level debugging with dbx, and other debuggers.

When specified for the compilation phase, the compiler produces symbolic information for source-level debugging.

When specified for the link-editing phase, the executable file is marked as being serially reusable and will always be loaded into read/write storage.

dbx requires that all the executables comprising the process be loaded into read/write storage so that it can set break points in these executables. When dbx is attached to a running process, this cannot be guaranteed because the process was already running and some executables were already loaded. There are two techniques that will cause all the executables comprising the process to be loaded into read-write storage:

1. Specify the **-g** option for the link-editing phase of each executable. After this is done, the executable is always loaded into read/write storage.

   Because the executable is marked as being serially reusable, this technique works except in cases where the executable must be marked as being reentrant. For example:

   - If the executable is to be used by multiple processes in the same user space.
   - If the executable is a DLL that is used on more than one thread in a multithreaded program.

   In these cases, use the following technique instead:

2. Do not specify the **-g** option during the link-editing phase so that the executable will be marked as being reentrant. Before invoking the program, export the environment variable _BPX_PTRACE_ATTACH

with a value of YES. After you do this, then executables will be loaded into read/write storage regardless of their reusability attribute.

If you compile an MVS data set source using the **-g** option, you can use dbx to perform source-level debugging for the executable file. You must first issue the **dbx use** subcommand to specify a path of double slash (//), causing dbx to recognize that the symbolic name of the primary source file is an MVS data set. For information on the **dbx** command and its use subcommand, see use subcommand for dbx: Set the list of directories to be searched.

For more information on using dbx, see *z/OS UNIX System Services Programming Tools*.

The z/OS UNIX System Services web page also has more information about dbx. Go to http://www.ibm.com/systems/z/os/zos/features/unix/.

For more information on the _BPX_PTRACE_ATTACH environment variable, see *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.

The GONUMBER option is automatically turned on by the **-g** option, but can also be turned on independently. There is no execution path overhead incurred for turning on this option, only some additional space for the saved line number tables.

For 31-bit compiles and In Storage Debug (ISD) information, the GONUMBER option generates tables that correspond to the input source file line numbers. These tables make it possible for Debug Tools and for error trace back information in CEE dumps to display the source line numbers. Having source line numbers in CEE dumps improves serviceability costs of applications in production. The *z/OS XL C/C++ User's Guide* contains more information on the GONUMBER compiler option.

Example: An example of compiling with the GONUMBER compiler option:

```
c89 -o outfile -Wc,'GONUM' file.c
```

Note: **-g** forces the NOOPTIMIZE compiler option regardless of its position in the command line.

-I *directory*

Note: The I option signifies an uppercase i, not a lowercase L.
-I specifies the directories to be used during compilation in searching for include files (also called header files).

Absolute pathnames specified on #include directives are searched exactly as specified. The directories specified using the -I option or from the usual places are not searched.

If absolute pathnames are not specified on #include directives, then the search order is as follows:

1. Include files enclosed in double quotation marks (") are first searched for in the directory of the file containing the #include directive. Include files enclosed in angle-brackets (< >) skip this initial search.
2. The include files are then searched for in all directories specified by the -I option, in the order specified.

3. Finally, the include files are searched for in the usual places. (See Usage Note 4 for a description of the usual places.)

You can specify an MVS data set name as an include file search directory. Also, MVS data set names can explicitly be specified on `#include` directives. You can indicate both by specifying a leading double slash (//).

Example: To include the include file DEF that is a member of the MVS PDS ABC.HDRS, code your C or C++ source as follows:

```
#include <//'abc.hdrs(def)'>
```

MVS data set include files are handled according to z/OS XL C/C++ compiler conversion rules (See Usage Note 4). When specifying an `#include` directive with a leading double slash (in a format other than `#include<//'`*dsname*`'>` and `#include<//dd:`*ddname*`>`), the specified name is paired only with MVS data set names specified on the -I option. That is, when you explicitly specify an MVS data set name, any z/OS UNIX file system directory names specified on the -I option are ignored.

Note: As of z/OS V1R12, a directory name that contains a comma must be quoted by double quotation marks, and the comma must be escaped by the back slash character. For example, **-Imy,directory** can result in two directories **"my"** and **"directory"**. If the intended name is a single directory name that contains a comma, the option must be specified as **-I"my\,directory"** to suppress the special meaning of the comma as suboption separator.

-L *directory*

Specifies the directories to be used to search for archive libraries specified by the **-l** operand. The directories are searched in the order specified, followed by the usual places. You cannot specify an MVS data set as an archive library directory.

For information on specifying C370LIB libraries, see the description of the **-l** *libname* operand. Also see Usage Note 7 for a description of the usual places.

-0, -O (-1), -2, -3

Specifies the level of compiler optimization (including inlining) to be used. The level -1 (number one) is equivalent to -O (capital letter O). The level -3 gives the highest level of optimization. The default is -0 (level zero), no optimization and no inlining, when not using IPA (Interprocedural Analysis).

When optimization is specified, the default is ANSIALIAS. The ANSIALIAS default specifies whether type-based aliasing is to be used during optimization. That is, the optimizer assumes that pointers can only be used to access objects of the same type. Type-based aliasing improves optimization. Applications that use pointers that point to objects of a different type will need to specify NOANSIALIAS when the optimization compiler option is specified. If your application works when compiled with no optimization and fails when compiled with optimization, then try compiling your application with both optimization and NOANSIALIAS compiler options. The *z/OS XL C/C++ User's Guide* contains more information on ANSIALIAS.

Notes:

1. Options can also be specified as -O1 (using capital letter O), -O2, and -O3. For further information, see Usage Note 12.

2. These options cannot be overridden by specifying optimization options using the **-Wc** syntax. This behavior differs from the behavior of the xlc utility, which allows the use of **-q** and **-Wc** syntax to override the flag optimization options.

Example: An example of a compile with the highest level of optimization and no type-based aliasing:

```
c89 -o outfile -O3 -Wc,NOANSIALIAS file.c
```

When optimization is specified, you may want to obtain a report on the amount of inlining performed and increase or decrease the level of inlining. More inlining will improve application performance and increase application memory usage. The *z/OS XL C/C++ User's Guide* contains more information on the INLINE compiler option.

Example: An example of a compilation with optimization with no report generated, a threshold of 500 abstract code units, and a limit of 2500 abstract code units:

```
c89 -o outfile -O2 -Wc,'inline(auto,noreport,500,2500)' file.c
```

When using IPA, the default is -O (level 1) optimization and inlining. IPA optimization is independent from and can be specified in addition to this optimization level. IPA is further described in this topic.

If compiling with PDF, the same optimization level must be used in the PDF1 and PDF2 steps.

If you compile your program to take advantage of **dbx** source-level debugging and specify **-g** (see the **-g** option description in this topic), you will always get -0 (level zero) optimization regardless of which of these compiler optimization levels you specify.

In addition to using optimization techniques, you may want to control writable strings by using the **#pragma strings(readonly)** directive or the ROSTRING compiler option. As of z/OS Version 1 Release 2, ROSTRING is the default.

For more information on this topic, refer to reentrancy in z/OS XL C/C++ in *z/OS XL C/C++ Programming Guide* or the description of the ROSTRING option in the *z/OS XL C/C++ User's Guide*.

-o *outfile*
Specifies the out put file name of the **c89/cc/c++** command.

If the **-o** option is specified in addition to the **–c** option, and only one source file is specified, then this option specifies the name of the output file associated with the one source file. See *file.o* under "Operands" on page 92 for information on the default name of the output file.

Otherwise the **-o** option specifies the name of the executable file produced during the link-editing phase. The default output file is **a.out**.

-p Ignored by the **cc** command. Provided for compatibility with historical implementations of the **cc** command. Flagged as an error by the **c89** and **c++** commands.

-q Ignored by the **cc** command. Provided for compatibility with historical implementations of the **cc** command. Flagged as an error by the **c89** and **c++** commands.

-r Specifies that the **c89/cc/c++** command is to save relocation information about the object files which are processed. When the output file (as

specified on **–o**) is created, it is not made an executable file. Instead, this output file can later be used as input to the **c89/cc/c++** command. This can be used as an alternative to an archive library.

IPA usage note: When using **-r** and link-editing IPA compiled object files, you must link-edit with IPA (see the description of IPA under the -W option). However, the **-r** option is typically not useful when you create an IPA optimized program. This is because link-editing with IPA requires that all of the program information is available to the link editor. It is not acceptable to have unresolved symbols, especially the program entry point symbol, which is usually `main`. The **-r** option is normally used when you want to combine object files incrementally. Specify object files during the initial link-edit that uses **-r**. Later, specify the output of the initial link-edit, along with the remaining object files in a final link-edit that is done without using **-r**. When you want to combine IPA compiled object files, use the alternative that does not involve the link editor, that is, concatenating the object files into one larger file by using the **cp** or **cat** utilities. You can use this larger file later in a final link-edit when the remainder of the object files are also made available.

-S

Specifies that the output file produced by the compiler is in assembler source code format. The absence of the -S flag indicates that the output file produced is in object code format. The -S flag is supported only with the METAL compiler option. The compiler does not produce an object file when the -S flag is used.

By default, the assembler source file name is based on the C source file name specified on the command line. The suffix is determined based on the appropriate environment variable. However, the assembler source file name can be affected by the use of the -o option.

When you specify the -o option, the assembler source file name is based on the name specified with the option. For example, when you specify `c89 -S -Wc,metal -c -o foo.x hello.c`, the output assembler source file name is `foo.x`.The following specifications have the same result:

```
c89 -S -Wc,metal hello.c
c89 -S -Wc,metal -o hello.s hello.c
c89 -S -Wc,metal -c hello.c
c89 -S -Wc,metal -c -o hello.s hello.c
```

-s Specifies that the compilation phase is to produce a *file.o* file that does *not* include symbolic information, and that the link-editing phase produce an executable that is marked reentrant. This is the default behavior for the **c89/cc/c++** command.

-U *name*
Undefines a C or C++ macro specified with *name*. This option affects only macros defined by the -D option, including those automatically specified by the **c89/cc/c++** command. For information about macros that the **c89/cc/c++** command automatically define, see Usage Note 5 and Usage note 13.

Note: The xlc utility uses different semantics for handling the -U option. See “xlc — Compiler invocation using a customizable configuration file” on page 870 for more information.

-u *function*
Specifies the name of the function to be added to the list of symbols which

are not yet defined. This can be useful if the only input to the **c89/cc/c++** command is archive libraries. Non–C++ linkage symbols of up to 255 characters in length may be specified. You can specify an S-name by preceding the function name with double slash (//). (For more information about S-names, see Usage Note 23.) The function `//ceemain` is the default for non-IPA Link-editing, and the function `main` is the default for IPA Link-editing. However, if this **-u** option is used, or the DLL link editor option is used, then the default function is not added to the list.

-V This verbose option produces and directs output to `stdout` as compiler, assembler, IPA linker, prelinker, and link editor listings. If the -O, -2, or -3 options are specified and cause the **c89/cc/c++** command to use the compiler INLINE option, then the inline report is also produced with the compiler listing. Error output continues to be directed to `stderr`. Because this option causes the **c89/cc/c++** command to change the options passed to the steps producing these listings so that they produce more information, it may also result in additional messages being directed to `stderr`. In the case of the compile step, it may also result in the return code of the compiler changing from 0 to 4.

Note: This option has a different meaning when using the xlc utility. See "xlc — Compiler invocation using a customizable configuration file" on page 870 for more information.

-v This verbose option causes pseudo-JCL to be written to `stdout` before the compiler, assembler, IPA linker, prelinker, and link editor programs are run.

Example: It also causes phaseid information to be emitted in `stderr`:

```
FSUM0000I  Utility(c89)                        Level(UQ99999)
```

It provides information about exactly which compiler, prelinker, and link editor options are being passed, and also which data sets are being used. If you want to obtain this information without actually invoking the underlying programs, specify the **-v** option more than once on the **c89/cc/c++** command string. For more information about the programs which are executed, see Usage Note 14.

-W *phase, option[,option]...*
Specifies options to be passed to the steps associated with the compile, assemble, or link-editing phases of the **c89/cc/c++** command. The valid phase codes are:

0 Specifies the compile phase (used for both non-IPA and IPA compilation).

a Specifies the assemble phase.

c Same as phase code 0.

I Enables IPA (Interprocedural Analysis) optimization.

Unlike other phase codes, the IPA phase code I does not require that any additional options be specified, but it does allow them. In order to pass IPA suboptions, specify those suboptions using the IPA phase code.

Example: To specify that an IPA Compile should save source line number information, without writing a listing file, specify:

```
c89 -c -W I,list file.c
```

Example: To specify that an IPA Link-edit should write the map file to `stdout`, specify:

```
c89 -W I,map file.o
```

l Specifies the link-editing phase.

- To pass options to the prelinker, the first link-editing phase option must be **p** or P. All the following options are then prelink options.

  Example: To write the prelink map to `stdout`, specify:

  ```
  c89 –W l,p,map file.c
  ```

  Note: The prelinker is no longer used in the link-editing phase in most circumstances. If it is not used, any options passed are accepted but ignored. See the environment variable *prefix*_STEPS under Environment variables for more information about the link-editing phase prelink step.

- To pass options to the IPA linker, the first link-editing phase option must be **i** or I. All the following options are then IPA Link options.

  Example: To specify the size of the SPILL area to be used during an IPA Link-edit, you could specify:

  ```
  c89 –W l,I,"spill(256)" file.o
  ```

- To link-edit a DLL (Dynamic Link Library) and produce a side deck, the link-editing phase option DLL must be specified.

  Example: To accomplish this task, you could specify:

  ```
  c89 –o outdll –W l,dll file.o
  ```

Most z/OS XL C/C++ extensions can be enabled by using this option. Those which do not directly pass options through to the underlying steps, or involve files which are extensions to the compile and link-edit model, are described here:

DLL (Dynamic Link Library)

A DLL is a part of a program that is not statically bound to the program. Instead, linkage to symbols (variables and functions) is completed dynamically at execution time. DLLs can improve storage utilization, because the program can be broken into smaller parts, and some parts may not always need to be loaded. DLLs can improve maintainability, because the individual parts can be managed and serviced separately.

In order to create a DLL, some symbols must be identified as being exported for use by other parts of the program. This can be done with the z/OS XL C/C++ **#pragma export** compiler directive, or by using the z/OS XL C/C++ EXPORTALL compiler option. If during the link-editing phase some of the parts have exported symbols, the executable which is created is a DLL. In addition to the DLL, a definition side-deck is created, containing link-editing phase IMPORT control statements which name those symbols which were exported by the DLL. In order for the definition side-deck to be created, the DLL link editor option must be specified. This definition side-deck is subsequently used during the link-editing phase of a program which is to use the DLL. See the *file.x* operand description in the “Operands” on page 92 topic for information on

where the definition side-deck is written. In order for the program to refer to symbols exported by the DLL, it must be compiled with the DLL compiler option.

Example: To compile and link a program into a DLL, you could specify:

```
c89 -o outdll -W c,exportall -W l,dll file.c
```

To subsequently use *file.x* definition side-decks, specify them along with any other *file.o* object files specified for the **c89/cc/c++** link-editing phase.

Example: To accomplish this task, you could specify:

```
c89 –o myappl –W c,dll myappl.c outdll.x
```

In order to run an application which is link-edited with a definition side-deck, the DLL must be made available (the definition side-deck created along with the DLL is not needed at execution time). When the DLL resides in the z/OS UNIX file system, it must be in either the working directory or in a directory named on the LIBPATH environment variable. Otherwise it must be a member of a data set in the search order used for MVS programs.

Note: For non-DLL C++ compiles, a dummy definition side file will be allocated to prevent the binder from issuing a warning message. If you do want the binder to issue a warning message when an exported symbol is encountered, specify the DLL=NO option for the link-editing phase; for example:

```
c++ -o outfile -W l,dll=no file.C
```

IPA (interprocedural analysis)

IPA optimization is independent from and can be used in addition to the **c89/cc/c++** optimization level options (such as –O). IPA optimization can also improve the execution time of your application. IPA is a mechanism for performing optimizations across function boundaries, even across compilation units. It also performs optimizations not otherwise available with the z/OS XL C/C++ compiler.

When phase code I (capital letter I) is specified for the compilation phase, then IPA compilation steps are performed. When phase code I is specified for the link-editing phase, or when the first link-editing phase (code **l**) option is **i** or I, then an additional IPA Link step is performed prior to the prelink and link-edit steps.

With conventional compilation and link-editing, the object code generation takes place during the compilation phase. With IPA compilation and link-editing, the object code generation takes place during the link-editing phase. Therefore, you might need to request listing information about the program (such as with the -V option) during the link-editing phase.

Unlike the other phase codes, phase code I does not require that any additional options be specified. If they are, they should be specified for both the compilation and link-editing phases.

No additional preparation needs to be done in order to use IPA.

Example: To create the executable `myIPApgm` using `c89` with some existing source program `mypgm.c`, you could specify:

```
c89 –W I –o myIPApgm mypgm.c
```

When IPA is used with the **c++** command, and automatic template generation is being used, phase code I will control whether the automatic template generation compiles are done using IPA. If you do not specify phase code I, then regular compiles will be done. Specifying I as the first option of the link-editing phase option (that is, **-W l,I**), will cause the IPA linker to be used, but will not cause the IPA compiler to be used for automatic template generation unless phase code I (that is, -W I) is also specified.

The IPA Profile-Directed Feedback (PDF) option tunes optimizations, where results from sample program execution are used to improve optimization near conditional branches and in frequently executed code sections. The profiling information is placed in the file specified by the PDFNAME(filename) suboption. If PDFNAME(filename) is not specified, the default name of the file containing profile information is PDF.

Note: When using the c89 command to invoke the compiler for IPA Compile and IPA Link processing using a single command line, some compiler options are not passed to both the IPA Compile and IPA Link steps; for example, the LIST compiler option is not passed. If you want to pass it to both steps, you must use `-Wl,I,list` syntax so that it is also passed to the IPA Link step. The xlc utility passes all compiler options to both the IPA Compile and IPA Link step.

LP64 The LP64 option instructs the compiler to generate AMODE 64 code utilizing the z/Architecture® 64-bit instructions.

To compile 64-bit code, specify the z/OS XL C/C++ LP64 compiler option.

Example: The following example shows how to compile and bind using the LP64 option:

```
c89 -o -W c,LP64 -Wl,LP64 file.c
```

XPLINK (Extra Performance Linkage)

z/OS XPLINK provides improved performance for many C/C++ programs. The XPLINK compiler option instructs the z/OS XL C/C++ compiler to generate high performance linkage for subroutine calls. It does so primarily by making subroutine calls as fast and efficient as possible, by reducing linkage overhead, and by passing function call parameters in registers. Furthermore, it reduces the data size by eliminating unused information from function control blocks.

An XPLINK-compiled program is implicitly a DLL-compiled program (the C/C++ DLL compiler option need not be specified along with the XPLINK option). XPLINK improves performance when crossing function boundaries, even across compilation units, since XPLINK uses a more efficient linkage mechanism.

For more information about the z/OS XL C/C++ XPLINK compiler option, refer to *z/OS XL C/C++ User's Guide*. For more information about Extra Performance Linkage, refer to *z/OS Language Environment Programming Guide*.

To use XPLINK, you must both compile and link-edit the program for XPLINK. All C and C++ source files must be compiled XPLINK, as you cannot statically link together XPLINK and non-XPLINK C and C++ object files (with the exception of non-XPLINK "OS" linkage). You can however mix XPLINK and non-XPLINK executables across DLL and fetch() boundaries.

To compile a program as XPLINK, specify the z/OS XL C/C++ XPLINK compiler option. If there are any exported symbols in the executable and you want to produce a definition side-deck, specify the DLL link editor option. When XPLINK is specified in the link-editing step, different link-edit libraries will be used.

Example: Here is an example of compiling and link-editing an XPLINK application in one command:

```
c89 -o outxpl -W c,XPLINK -W l,XPLINK,dll file.c
```

In order to execute an XPLINK program, the SCEERUN2 as well as the SCEERUN data set must be in the MVS program search order (see the *prefix*_PLIB_PREFIX environment variable).

You cannot use -W to override the compiler options that correspond to c89 flag options, with the following exceptions:

- Listing options (corresponding to -V)
- Inlining options (corresponding to -O, -2, and -3)
- Symbolic options (corresponding to **-s** and **-g**); symbolic options can be overridden only when neither **-s** nor **-g** is specified.

Notes:

1. Most compiler, prelinker, and IPA linker options have a positive and negative form. The negative form is the positive with a prepended NO (as in XREF and NOXREF).
2. The compiler **#pragma options** directives as well as any other #pragma directives which are overridden by compiler options, will have no effect in source code compiled by the **c89/cc/c++** command.
3. Link editor options must be specified in the *name=value* format. Both the option *name* and *value* must be spelled out in full. If you do not specify a value, a default value of YES is used, except for the following options, which if specified without a value, have the default values shown here:

   ALIASES
   ALIASES=ALL

   DYNAM
   DYNAM=DLL

   LET LET=8

   LIST LIST=NOIMPORT

   Notes:

   a. The binder default is COMPAT=MIN. For downward compatibility (when -Wc,'target(release)' is used), COMPAT should also be used (for example, -Wl,compat=min, or the specific program object format level supported by the target deployment system, if it is known). For more information, see the Downward Compatibility section of *z/OS XL C/C++ User's Guide*.

b. As of z/OS V1R8, the default for the COMPAT option is no longer emitted. In prior releases, the default was COMPAT=CURRENT.

c. References throughout this document to the link editor are generic references. The **c89/cc/c++** command specifically uses the Program Management binder for this function.

4. The z/OS XL C/C++ compiler is described in *z/OS XL C/C++ User's Guide*. Related information about the z/OS XL C/C++ runtime library, including information about DLL and IPA support, is described in *z/OS XL C/C++ Programming Guide*. Related information about the C and C++ languages, including information about compiler directives, is described in *z/OS XL C/C++ Language Reference*.
5. Since some compiler options are only used by z/OS XL C and some compiler options are only used by z/OS XL C++, you may get warning messages and a compiler return code of 4, if you use this option and compile both C and C++ source programs in the same **c++** command invocation.
6. The prelinker is described in *z/OS XL C/C++ User's Guide*.
7. The *z/OS XL C/C++ User's Guide* also describes z/OS XL C/C++ compiler options.Any messages produced by it (CCN messages) are documented in *z/OS XL C/C++ Messages*.
8. You may see runtime messages (CEE or EDC) in executing your applications. These messages are described in *z/OS Language Environment Debugging Guide*.
9. The link editor (the Program Management binder) is described in *z/OS MVS Program Management: User's Guide and Reference*. The Program Management binder messages are described in *z/OS MVS System Messages, Vol 8 (IEF-IGD)*.

Operands

The **c89/cc/c++** command generally recognizes their file operand types by file suffixes. The suffixes shown here represent the default values used by the **c89/cc/c++** command. See Environment variables for information about changing the suffixes to be used.

Unlike the **c89** and **c++** commands, which report an error if given an operand with an unrecognized suffix, the **cc** command determines that it is either an object file or a library based on the file itself. This behavior is in accordance with the environment variable *prefix*_EXTRA_ARGS.

file.a Specifies the name of an archive file, as produced by the **ar** command, to be used during the link-editing phase. You can specify an MVS data set name, by preceding the file name with double slash (//), in which case the last qualifier of the data set name must be *LIB*. The data set specified must be a C370LIB object library or a load library. See the description of the **-l** *name* operand for more information about using data sets as libraries.

file.C Specifies the name of a C++ source file to be compiled. You can specify an MVS data set name by preceding the file name with double slash (//), in which case the last qualifier of the data set name must be *CXX*. This operand is only supported by the **c++** command.

file.c Specifies the name of a C source file to be compiled. You can specify an MVS data set name by preceding the file name with double slash (//), in which case the last qualifier of the data set name must be *C*. (The conventions formerly used by c89 for specifying data set names are still

supported. See the environment variables *prefix*_OSUFFIX_HOSTRULE and *prefix*_OSUFFIX_HOSTQUAL for more information.)

file.I Specifies the name of a IPA linker output file produced during the **c89/cc/c++** link-editing phase, when the -W option is specified with phase code I. IPA is further described in the Options topic. By default the IPA linker output file is written to a temporary file. To have the IPA linker output file written to a permanent file, see the environment variable *prefix*_TMPS under Environment variables.

When an IPA linker output file is produced by the **c89/cc/c++** command, the default name is based upon the output file name. See the **-o** option description in the Options topic, for information on the name of the output file.

If the output file is named *a.out*, then the IPA linker output file is named *a.I*, and is always in the working directory. If the output file is named *//a.load*, then the IPA linker output file is named *//a.IPA*. If the output file specified already has a suffix, that suffix is replaced. Otherwise the suffix is appended. This file may also be specified on the command line, in which case it is used as a file to be link-edited.

file.i Specifies the name of a preprocessed C or C++ source file to be compiled. You can specify an MVS data set name, by preceding the file name with double slash (//), in which case the last qualifier of the data set name must be *CEX*.

When using the **c++** command, this source file is recognized as a C++ source file, otherwise it is recognized as a C source file. The **c++** command can be made to distinguish between the two. For more information see the environment variables *prefix*_IXXSUFFIX and *prefix*_IXXSUFFIX_HOST.

file.o Specifies the name of a C, C++, or assembler object file, produced by the **c89/cc/c++** command, to be link-edited.

When an object file is produced by the **c89/cc/c++** command, the default name is based upon the source file. If the source file is named *file.c*, then the object file is named *file.o*, and is always in the working directory. If the source file were a data set named *//file.C*, then the object file is named *//file.OBJ*.

If the data set specified as an object file has undefined (U) record format, then it is assumed to be a load module. Load modules are not processed by the prelinker.

You can specify an MVS data set name to be link-edited, by preceding the file name with double slash (//), in which case the last qualifier of the data set name must be *OBJ*.

Example: If a partitioned data set is specified, more than one member name may be specified by separating each with a comma (,):

```
c89 //file.OBJ(mem1,mem2,mem3)
```

file.p Specifies the name of a prelinker composite object file produced during the **c89/cc/c++** link-editing phase. By default, the composite object file is written to a temporary file. To have the composite object file written to a permanent file, see the environment variable *prefix*_TMPS under Environment variables.

When a composite object file is produced by the **c89/cc/c++** command, the default name is based upon the output file name. See the **-o** option description in the Options topic, for information on the name of the output file.

If the output file is named *a.out*, then the composite object file is named *a.p*, and is always in the working directory. If the output file is named *//a.load*, then the composite object file is named *//a.CPOBJ*. If the output file specified already has a suffix, that suffix is replaced. Otherwise the suffix is appended. This file may also be specified on the command line, in which case it is used as a file to be link-edited.

file.s Specifies the name of an assembler source file to be assembled. You can specify an MVS data set name, by preceding the file name with double slash (//), in which case the last qualifier of the data set name must be *ASM*.

file.x Specifies the name of a definition side-deck produced during the **c89/cc/c++** link-editing phase when creating a DLL (Dynamic Link Library), and used during the link-editing phase of an application using the DLL. DLLs are further described under the -W option.

When a definition side-deck is produced by the **c89/cc/c++** command, the default name is based upon the output file name. See the **-o** option description in the Options topic, for information on the name of the output file.

If the output file is named *a.dll*, then the definition side-deck is named *a.x*, and is always in the working directory. If the output file is named *//a.DLL*, then the definition side-deck is named *//a.EXP*. If the output file specified already has a suffix, that suffix is replaced. Otherwise the suffix is appended.

You can specify an MVS data set name to be link-edited, by preceding the file name with double slash (//), in which case the last qualifier of the data set name must be *EXP*.

Example: If a partitioned data set is specified, more than one member name may be specified by separating each with a comma (,):

```
c89 //file.EXP(mem1,mem2,mem3)
```

–l *name*

Specifies the name of an archive library. The **c89/cc/c++** command searches for the file `lib` *libname*`.a` in the directories specified on the -L option and then in the usual places. The first occurrence of the archive library is used. For a description of the usual places, see Usage Note 7.

You can also specify an MVS data set; you must specify the full data set name, because there are no rules for searching library directories.

The data set specified must be a C370LIB object library or a load library. If a data set specified as a library has undefined (U) record format, then it is assumed to be a load library. For more information about how load libraries are searched, see Usage Note 7.

Environment variables

You can use environment variables to specify necessary system and operational information to the **c89/cc/c++** command. When a particular environment variable

is not set, the **c89/cc/c++** command uses the default shown. For information about the JCL parameters used in these environment variables, see *z/OS MVS JCL User's Guide*.

Each environment variable has a *prefix* (shown in italics) that should be replaced by one of the following strings, depending on the command name used:

- _CC
- _CXX
- _C89

This means that to specify the **cc** environment variables, the name shown must be prefixed with _CC (for example, _CC_ACCEPTABLE_RC). To specify **c89** environment variables, the name shown must be prefixed with _C89 (for example, _C89_ACCEPTABLE_RC). To specify **c++**/**cxx** environment variables, the name shown must be prefixed with _CXX (for example, _CXX_ACCEPTABLE_RC). The following examples show how to code one or more MVS data sets:

- export _CXX_LSYSLIB=CEE.SCEELKED
- export _CXX_LSYSLIB=CEE.SCEELKED:CEE.SCEELKEX

Notes:

1. For most environment variables, you can use all three prefixes (_CC, _CXX, _C89). In the list of environment variables that follows, you should assume that all three prefixes can be used unless otherwise indicated.
2. The **c89/cc/c++** command can accept parameters only in the syntax indicated here. A null value indicates that the **c89/cc/c++** command should omit the corresponding parameters during dynamic allocation. Numbers in parentheses following the environment variable name correspond to usage notes, which indicate specific usage information for the environment variable.
3. The _CCN_IPA_WORK_SPACE environment variable does not include a prefix.

_CCN_32_RUNOPTS
Specifies Language Environment runtime options that apply to the environment in which the 32-bit compiler components are running.

_CCN_64_RUNOPTS
Specifies Language Environment runtime options that apply to the environment in which the 64-bit compiler components are running.

_CCN_IPA_WORK_SPACE
The SPACE parameter used by the z/OS XL C/C++ compiler for the unnamed temporary work data set related to IPALINK.

When _CCN_IPA_WORK_SPACE is not specified, the default is to use the settings from *prefix*_WORK_SPACE. In this case, *prefix*_WORK_SPACE must be set large enough for the potentially large work files that can be generated by IPALINK. If _CCN_IPA_WORK_SPACE is used, *prefix*_WORK_SPACE can be tuned for the typically smaller work files generated by the rest of the compiler.

*prefix*_**ACCEPTABLE_RC**
The maximum allowed return code (result) of any step (compile, assemble, IPA Link, prelink, or link-edit). If the result is between zero and this value (inclusive), then it is treated internally by the **c89/cc/c++** command exactly as if it were a zero result, except that message FSUM3065 is also issued. The default value is 4.

When used under the **c89/cc/c++** command, the prelinker by default returns at least a 4 when there are duplicate symbols or unresolved writable static symbols (but not for other unresolved references). The link editor returns at least a 4 when there are duplicate symbols, and at least an 8 when there are unresolved references and automatic library call was used.

*prefix*_**ASUFFIX (Usage Note 15)**
The suffix by which the **c89/cc/c++** command recognizes an archive file. This environment variable does not affect the treatment of archive libraries specified as **-l** operands, which are always prefixed with *lib* and suffixed with *.a*. The default value is a.

*prefix*_**ASUFFIX_HOST (Usage Note 15)**
The suffix by which the **c89/cc/c++** command recognizes a library data set. This environment variable does not affect the treatment of data set libraries specified as **-l** operands, which are always used exactly as specified. The default value is LIB.

*prefix*_**CCMODE**
Controls how the **c89/cc/c++** command does parsing. The default behavior of the **c89/cc/c++** command is to expect all options to precede all operands. Setting this variable allows compatibility with historical implementations (other **cc** commands). When set to 1, the **c89/cc/c++** command operates as follows:

- Options and operands can be interspersed.
- The double dash (—) is ignored.

Setting this variable to 0 results in the default behavior. The default value is 0.

*prefix*_**CLASSLIB_PREFIX (Usage Note 17)**
The prefix for the following named data sets used during the compilation phase and execution of your C++ application.

To be used, the following data sets must be cataloged:

- The data sets ${*prefix*_CLASSLIB_PREFIX}.SCLBH.+ contain the z/OS XL C++ Class Library include (header) files.
- The data set ${*prefix*_CLASSLIB_PREFIX}.SCLBSID contains the z/OS XL C++ Class Library definition side-decks.

The following data sets are also used:

The data sets ${*prefix*_CLASSLIB_PREFIX}.SCLBDLL and ${*prefix*_CLASSLIB_PREFIX}.SCLBDLL2 contain the z/OS XL C++ Class Library DLLs and messages.

The preceding data sets contain MVS programs that are invoked during the execution of a C++ application built by the **c++** command. To be executed correctly, these data sets must be made part of the MVS search order. Regardless of the setting of this or any other **c++** environment variable, the **c++** command does not affect the MVS search order. These data sets are listed here for information only, to assist in identifying the correct data sets to be added to the MVS program search order.

The default value is the value of the environment variable: _CXX_CLIB_PREFIXThe *prefix*_CLASSLIB_PREFIX environment variable applies only to the **c++** and **cxx** command names. _CXX is the only valid prefix.

*prefix*_**CLASSVERSION**
The version of the C++ Class Library to be invoked by the **c++** command. The setting of this variable allows **c++** to control which C++ Class Library named data sets are used during the **c++** processing phases. It also sets default values for other environment variables.

The format of this variable is the same as the result of the Language Environment C/C++ runtime library function `_librel()`. See *z/OS XL C/C++ Runtime Library Reference* for a description of the `_librel()` function. The default value is the same as the value for the _CVERSION environment variable. If _CVERSION is not set, then the default value will be the result of the C/C++ runtime library `_librel()` function.

The *prefix*_CLASSVERSION environment variable applies only to the **c++** and **cxx** command names. _CXX is the only valid prefix.

*prefix*_**CLIB_PREFIX (Usage Note 17)**
The prefix for the following named data set used during the compilation phase.

The data set ${*prefix*_CLIB_PREFIX}.SCCNCMP contains the compiler programs called by the **c89/cc/c++** command.

The preceding data set contains MVS programs that are invoked during the execution of the **c89/cc/c++** command and during the execution of a C/C++ application built by the **c89/cc/c++** command. To be executed correctly, the data set must be made part of the MVS search order. Regardless of the setting of this or any other **c89/cc/c++** environment variable, **c89/cc/c++** does not affect the MVS search order. The data set is listed here for information only, to assist in identifying the correct data set to be added to the MVS program search order.

The following data set is also used:

The data set ${*prefix*_CLIB_PREFIX}.SCCNOBJ contains object files required to instrument the code for profile-driven feedback optimization.

The default value is CBC.

*prefix*_**CMEMORY**
A suggestion as to the use of compiler C/C++ Runtime Library memory files. When set to `0`, the **c89/cc/c++** command will prefer to use the compiler NOMEMORY option. When set to 1, **c89/cc/c++** will prefer to use the compiler MEMORY option. When set to 1, and if the compiler MEMORY option can be used, **c89/cc/c++** needs not allocate data sets for the corresponding work files. In this case it is the responsibility of the user to not override the compiler options (using the -W option) with the NOMEMORY option or any other compiler option which implies the NOMEMORY option.

The default value is 1.

*prefix*_**CMSGS (Usage Note 14)**
The Language Environment national language name used by the compiler program. A null value will cause the default Language Environment NATLANG runtime name to be used, and a non-null value must be a valid Language Environment NATLANG runtime option name (Language Environment runtime options are described in *z/OS Language Environment Programming Guide* . The default value is `"" (null)`.

*prefix*_**CNAME (Usage Note 14)**
The name of the compiler program called by the **c89/cc/c++** command. It

must be a member of a data set in the search order used for MVS programs. The default value is CCNDRVR. If the **c89/cc/c++** command is being used with *prefix*_CVERSION set to a release prior to z/OS V1R2, the default value will be CBCDRVR.

*prefix*_**CSUFFIX (Usage Note 15)**
The suffix by which the **c89/cc/c++** command recognizes a C source file. The default value is `c`.

*prefix*_**CSUFFIX_HOST (Usage Note 15)**
The suffix by which the **c89/cc/c++** command recognizes a C source data set. The default value is C.

*prefix*_**CSYSLIB (Usage Note 4, Usage Note 16)**
The system library data set concatenation to be used to resolve `#include` directives during compilation.

Normally `#include` directives are resolved using all the information specified including the directory name. When the **c89/cc/c++** command can determine that the directory information can be used, such as when the Language Environment include (header) files are installed in the default location (in accordance with *prefix*_INCDIRS), then the default concatenation is `"" (null)`.

When the **c89/cc/c++** command cannot determine that the directory information can be used, then the default concatenation is:

```
"${prefix_PLIB_PREFIX}.SCEEH.H"
"${prefix_PLIB_PREFIX}.SCEEH.SYS.H"
"${prefix_PLIB_PREFIX}.SCEEH.ARPA.H"
"${prefix_PLIB_PREFIX}.SCEEH.NET.H"
"${prefix_PLIB_PREFIX}.SCEEH.NETINET.H"
```

When this variable is a null value, then no allocation is done for compiler system library data sets. In this case, the use of //DD:SYSLIB on the -I option and the `#include` directive will be unsuccessful. Unless there is a dependency on the use of //DD:SYSLIB, it is recommended that for improved performance this variable be allowed to default to a null value.

*prefix*_**CVERSION**
The version of the z/OS XL C/C++ compiler to be invoked by the **c89/cc/c++** command. The setting of this variable allows the **c89/cc/c++** command to control which z/OS XL C/C++ compiler program is invoked. It also sets default values for other environment variables.

The format of this variable is the same as the result of the Language Environment C/C++ runtime library function `_librel()`. See *z/OS XL C/C++ Runtime Library Reference* for a description of the `_librel()` function. The default value is the result of the C/C++ runtime library `_librel()` function.

*prefix*_**CXXSUFFIX (Usage Note 15)**
The suffix by which the **c++** command recognizes a C++ source file. The default value is C. This environment variable is only supported by the **c++** and **cxx** command names. _CXX is the only valid prefix.

*prefix*_**CXXSUFFIX_HOST (Usage Note 15)**
The suffix by which the **c++** command recognizes a C++ source data set. The default value is CXX. This environment variable is only supported by the **c++** and **cxx** command names. _CXX is the only valid prefix.

*prefix*_**DAMPLEVEL**
The minimum severity level of dynamic allocation messages returned by dynamic allocation message processing. Messages with severity greater than or equal to this number are written to `stderr`. However, if the number is out of the range shown here (that is, less than `0` or greater than `8`), then the **c89/cc/c++** dynamic allocation message processing is disabled. The default value is 4. Valid values are as follows:

0 Informational

1–4 Warning

5–8 Severe

*prefix*_**DAMPNAME (Usage Note 14)**
The name of the dynamic allocation message processing program called by the **c89/cc/c++** command. It must be a member of a data set in the search order used for MVS programs. The default dynamic allocation message processing program is described in *z/OS MVS Programming: Authorized Assembler Services Guide*. The default value is IEFDB476.

*prefix*_**DCBF2008 (Usage Note 21)**
The DCB parameters used by the **c89/cc/c++** command for data sets with the attributes of record format fixed unblocked and minimum block size of 2008. The block size must be in multiples of 8, and the maximum depends on the phase in which it is used but can be at least 5100. The default value is (RECFM=F,LRECL=4088,BLKSIZE=4088).

*prefix*_**DCBU (Usage Note 21)**
The DCB parameters used by the **c89/cc/c++** command for data sets with the attributes of record format undefined and data set organization partitioned. This DCB is used by the **c89/cc/c++** command for the output file when it is to be written to a data set. The default value is (RECFM=U,LRECL=0,BLKSIZE=6144,DSORG=PO).

*prefix*_**DCB121M (Usage Note 21)**
The DCB parameters used by the **c89/cc/c++** command for data sets with the attributes of record format fixed blocked and logical record length 121, for data sets whose records may contain machine control characters. The default value is (RECFM=FBM,LRECL=121,BLKSIZE=3630).

*prefix*_**DCB133M (Usage Note 21)**
The DCB parameters used by the **c89/cc/c++** command for data sets with the attributes of record format fixed blocked and logical record length 133, for data sets whose records may contain machine control characters. The default value is (RECFM=FBM,LRECL=133,BLKSIZE=3990).

*prefix*_**DCB137 (Usage Note 21)**
The DCB parameters used by the **c89/cc/c++** command for data sets with the attributes of record format variable blocked and logical record length 137. The default value is (RECFM=VB,LRECL=137,BLKSIZE=882).

*prefix*_**DCB137A (Usage Note 21)**
The DCB parameters used by the **c89/cc/c++** command for data sets with the attributes of record format variable blocked and logical record length 137, for data sets whose records may contain ISO/ANSI control characters. The default value is (RECFM=VB,LRECL=137,BLKSIZE=882).

*prefix*_**DCB3200 (Usage Note 21)**
The DCB parameters used by the **c89/cc/c++** command for data sets with

the attributes of record format fixed blocked and logical record length 3200. The default value is (RECFM=FB,LRECL=3200,BLKSIZE=12800).

*prefix*_**DCB80 (Usage Note 21)**
The DCB parameters used by the **c89/cc/c++** command for data sets with the attributes of record format fixed blocked and logical record length 80. This value is also used when the **c89/cc/c++** command allocates a new data set for an object file. The default value is (RECFM=FB,LRECL=80,BLKSIZE=3200).

*prefix*_**DEBUG_FORMAT (Usage Note 21)**
This variable is used to determine to which debug format (DWARF or ISD) the **-g** flag is translated. If _DEBUG_FORMAT is set to DWARF, then **-g** is translated to DEBUG(FORMAT(DWARF)). If _DEBUG_FORMAT is set to ISD, then **-g** is translated to TEST. The default value is DWARF.

Note: This environment variable only applies to 31-bit compiles.

*prefix*_**ELINES**
This variable controls whether the output of the -E option will include `#line` directives. `#line` directives provide information about the source file names and line numbers from which the preprocessed source came. The preprocessor only inserts `#line` directives where it is necessary. When set to `1`, the output of the **c89/cc/c++** -E option will include `#line` directives where necessary. When set to `0`, the output will not include any `#line` directives. The default value is `0`.

*prefix*_**EXTRA_ARGS**
The setting of this variable controls whether the **c89/cc/c++** command treats a file operand with an unrecognized suffix as an error, or attempts to process it. When the **c++** command **-+** option is specified, all suffixes which otherwise would be unrecognized are instead recognized as C++ source, effectively disabling this environment variable. See “Options” on page 80 for information on the **-+** option.

When set to `0`, the **c89/cc/c++** command treats such a file as an error and the command will be unsuccessful, because the suffix will not be recognized.

When set to `1`, the **c89/cc/c++** command treats such a file as either an object file or a library, depending on the file itself. If it is neither an object file nor a library then the command will be unsuccessful, because the link-editing phase will be unable to process it. The default value for the **c89** and **c++** commands is `0`. The default value for the **cc** command is 1.

*prefix*_**IL6SYSIX (Usage Note 7, Usage Note 16)**
The system definition side-deck list that is used to resolve symbols during the IPA Link step of the link-editing phase when using LP64 (see the description of LP64 in “Options” on page 80). The default value is whatever *prefix*_L6SYSIX is set to or defaults to.

*prefix*_**IL6SYSLIB (Usage Note 7, Usage Note 16)**
The system library data set list that is used to resolve symbols during the IPA Link step of the link-editing phase when using LP64 (see the description of LP64 in “Options” on page 80). The default value is whatever *prefix*_L6SYSLIB is set to or defaults to.

*prefix*_**ILCTL (Usage Note 14)**
The name of the control file used by the IPA linker program. By default the control file is not used, so the -W option must be specified to enable its use, as in:

```
c89 -WI,control ...
```

The default value is `ipa.ctl`.

*prefix*_**ILMSGS (Usage Note 14)**
The name of the message data set member, or the Language Environment national language name, used by the IPA linker program. The default value is whatever *prefix*_CMSGS is. So if *prefix*_CMSGS is set or defaults to `"" (null)`, the default value is `"" (null)`.

*prefix*_**ILNAME (Usage Note 14)**
The name of the IPA linker program called by the **c89/cc** command. It must be a member of a data set in the search order used for MVS programs. The default value is whatever *prefix*_CNAME is. So if *prefix*_CNAME is set or defaults to CCNDRVR the default value is CCNDRVR.

*prefix*_**ILSUFFIX (Usage Note 15)**
The suffix that the **c89/cc** command uses when creating an IPA linker output file. The default value is `I`.

*prefix*_**ILSUFFIX_HOST (Usage Note 15)**
The suffix that the **c89/cc** command uses when creating an IPA linker output data set. The default value is IPA.

*prefix*_**ILSYSLIB (Usage Note 7, Usage Note 16)**
The system library data set list to be used to resolve symbols during the IPA Link step of the link-editing phase of non-XPLINK programs. The default value is whatever *prefix*_PSYSLIB is set or defaults to, followed by whatever *prefix*_LSYSLIB is set or defaults to.

*prefix*_**ILSYSIX (Usage Note 7, Usage Note 16)**
The system definition side-deck list to be used to resolve symbols during the IPA Link step of the link-editing phase in non-XPLINK programs. The default value is whatever *prefix*_PSYSIX is set or defaults to.

*prefix*_**ILXSYSLIB (Usage Note 7, Usage Note 16)**
The system library data set list to be used to resolve symbols during the IPA Link step of the link-editing phase when using XPLINK (see XPLINK (Extra Performance Linkage) in “Options” on page 80). The default value is whatever *prefix*_LXSYSLIB is set or defaults to.

*prefix*_**ILXSYSIX (Usage Note 7, Usage Note 16)**
The system definition side-deck list to be used to resolve symbols during the IPA Link step of the link-editing phase when using XPLINK (see XPLINK (Extra Performance Linkage) in “Options” on page 80). The default value is whatever *prefix*_LXSYSIX is set or defaults to.

*prefix*_**INCDIRS (Usage Note 22)**
The directories used by the **c89/cc/c++** command as a default place to search for include files during compilation (before searching *prefix*_INCLIBS and *prefix*_CSYSLIB). If the **c++** command is not being used the default value is /usr/include. If the **c++** command is being used the default value is /usr/include /usr/lpp/cbclib/include.

*prefix*_**INCLIBS (Usage Note 22)**
The directories used by the **c89/cc/c++** command as a default place to

search for include files during compilation (after searching *prefix*_INCDIRS and before searching *prefix*_CSYSLIB). The default value depends on whether or not the **c++** command is being used. If the **c++** command is not being used the default value is //'${*prefix*_PLIB_PREFIX}.SCEEH.+'

If the **c++** command is being used, the default value is //'${*prefix*_PLIB_PREFIX}.SCEEH.+' //'${*prefix*_CLIB_PREFIX}.SCLBH.+'

*prefix*_**ISUFFIX (Usage Note 15)**
The suffix by which the **c89/cc/c++** command recognizes a preprocessed C source file. The default value is `i`.

*prefix*_**ISUFFIX_HOST (Usage Note 15)**
The suffix by which the **c89/cc/c++** command recognizes a preprocessed (expanded) C source data set. The default value is CEX.

*prefix*_**IXXSUFFIX (Usage Note 15)**
The suffix by which the **c++** command recognizes a preprocessed C++ source file. The default value is i. This environment variable is only supported by the **c++** and **cxx** command names. _CXX is the only valid prefix.

*prefix*_**IXXSUFFIX_HOST (Usage Note 15)**
The suffix by which the **c++** command recognizes a preprocessed (expanded) C++ source data set. The default value is CEX. This environment variable is only supported by the **c++** and **cxx** command names. _CXX is the valid prefix.

*prefix*_**L6SYSIX (Usage Note 7, Usage Note 16)**
The system definition side-deck list that resolves symbols during the link-editing phase when using `LP64` (see the description of LP64 in "Options" on page 80). A definition side-deck contains link-editing phase IMPORT control statements, which name symbols that are exported by a DLL. The default value depends on whether or not the **c++** command is used. If **c++** is not used, the default value is: ${*prefix*_PLIB_PREFIX}.SCEELLIB(CELQS003). If **c++** is used, the default value is the list concatenation:

```
"${prefix_PLIB_PREFIX}.SCEELIB(CELQS003,CELQSCPP,C64)"
"${prefix_CLASSLIB_PREFIX}.SCLBSID(IOSX64)"
```

*prefix*_**L6SYSLIB (Usage Note 7, Usage Note 16)**
The system library data set concatenation that is used to resolve symbols during the link-editing step when using LP64 (see the description of LP64 in "Options" on page 80). The default value is the concatenation:

```
"${prefix_PLIB_PREFIX}.SCEEBND2"
"${prefix_SLIB_PREFIX}.CSSLIB"
```

*prefix*_**LIBDIRS (Usage Note 22)**
The directories used by the **c89/cc/c++** command as the default place to search for archive libraries which are specified using the **-l** operand. The default value is `/lib /usr/lib`.

*prefix*_**LSYSLIB (Usage Note 7, Usage Note 16)**
The system library data set concatenation to be used to resolve symbols during the IPA Link step and the link-edit step of the non-XPLINK link-editing phase. The *prefix*_PSYSLIB libraries always precede the *prefix*_LSYSLIB libraries when resolving symbols in the link-editing phase. The default value is the concatenation:

```
"${prefix_PLIB_PREFIX}.SCEELKEX"
"${prefix_PLIB_PREFIX}.SCEELKED"
"${prefix_SLIB_PREFIX}.CSSLIB"
```

*prefix*_**LXSYSLIB (Usage Note 7, Usage Note 16)**
The system library data set concatenation to be used to resolve symbols during the IPA Link step and the link-editing phase when using XPLINK (see XPLINK (Extra Performance Linkage) in "Options" on page 80). The default value is the concatenation:

```
"${prefix_PLIB_PREFIX}.SCEEBND2"
"${prefix_SLIB_PREFIX}.CSSLIB"
```

*prefix*_**LXSYSIX (Usage Note 7, Usage Note 16)**
The system definition side-deck list to be used to resolve symbols during the link-editing phase when using XPLINK (see XPLINK (Extra Performance Linkage) in "Options" on page 80). A definition side-deck contains link-editing phase IMPORT control statements naming symbols which are exported by a DLL. The default value depends on whether or not the **c++** command is being used. For 32-bit objects, if **c++** is not being used, the default value is the list ${*prefix*_PLIB_PREFIX}.SCEELIB(CELHS003,CELHS001). For 32-bit objects, if **c++** is being used with *prefix*_PVERSION and *prefix*_CLASSVERSION defaulted to the current z/OS release, the default value is the list concatenation:

```
"${prefix_PLIB_PREFIX}.SCEELIB(CELHS003,CELHS001,CELHSCPP,C128)"
"${prefix_CLASSLIB_PREFIX}.SCLBSID(IOSTREAM,COMPLEX)"
```

For 32-bit objects, if the **c++** command is being used with *prefix*_PVERSION and *prefix*_CLASSVERSION set to a release prior to z/OS V1R2 for a 32-bit program, the default value is the list concatenation:

```
"${prefix_PLIB_PREFIX}.SCEELIB(CELHS003,CELHS001,CELHSCPP)"
"${prefix_CLASSLIB_PREFIX}.SCLBSID(ASCCOLL,COMPLEX,IOSTREAM)"
```

Note: For 64–bit objects, see *prefix*_L6SYSIX.

*prefix*_**MEMORY**
A suggestion as to the use of XL C/C++ runtime library memory files by the **c89/cc/c++** command. When set to 0, the **c89/cc/c++** command uses temporary data sets for all work files. When set to 1, the **c89/cc/c++** command uses memory files for all work files that it can. The default value is 1.

*prefix*_**NEW_DATACLAS (Usage Note 18)**
The DATACLAS parameter used by the **c89/cc/c++** command for any new data sets it creates. The default value is `"" (null)`.

*prefix*_**NEW_DSNTYPE (Usage Note 18, Usage Note 20)**
The DSNTYPE parameter used by the **c89/cc/c++** command for any new data sets it creates. The default value is `"" (null)`.

*prefix*_**NEW_MGMTCLAS (Usage Note 18)**
The MGMTCLAS parameter used by the **c89/cc/c++** command for any new data sets it creates. The default value is `"" (null)`.

*prefix*_**NEW_SPACE (Usage Note 18, Usage Note 19)**
The SPACE parameters used by the **c89/cc/c++** commandfor any new data sets it creates. A value for the number of directory blocks should always be specified. When allocating a sequential data set, the **c89/cc/c++** command automatically ignores the specification. The default value is `(,(10,10,10))`.

*prefix*_**NEW_STORCLAS (Usage Note 18)**
The STORCLAS parameter used by the **c89/cc/c++** command for any new data sets it creates. The default value is `"" (null)`.

*prefix*_**NEW_UNIT (Usage Note 18)**
The UNIT parameter used by the **c89/cc/c++** command for any new data sets it creates. The default value is "" (null).

*prefix*_**NOCMDOPTS (Usage Note 27)**
Controls how the compiler processes the default options set by the **c89** command. Setting this variable to 1, reverts the compiler to the behavior that was available prior to z/OS V1R5, when the compiler was unable to distinguish between the **c89** defaults and the user-specified options. Setting this variable to 0, results in the default behavior where the compiler is now able to recognize **c89** defaults. The default value is 0.

*prefix*_**OPERANDS (Usage Note 22)**
These operands are parsed as if they were specified after all other operands on the **c89/cc/c++** command line. The default value is "" (null).

*prefix*_**OPTIONS (Usage Note 22)**
These options are parsed as if they were specified before all other options on the **c89/cc/c++** command line. The default value is "" (null).

*prefix*_**OSUFFIX (Usage Note 15)**
The suffix by which the **c89/cc/c++** command recognizes an object file. The default value is o.

*prefix*_**OSUFFIX_HOST (Usage Note 15)**
The suffix by which the **c89/cc/c++** command recognizes an object data set. The default value is OBJ.

*prefix*_**OSUFFIX_HOSTQUAL**
The data set name of an object data set is determined by the setting of this option. If it is set to 0, then the suffix *prefix*_OSUFFIX_HOST is appended to the source data set name to produce the object data set name. If it is set to 1, then the suffix *prefix*_OSUFFIX_HOST replaces the last qualifier of the source data set name to produce the object data set name (unless there is only a single qualifier, in which case the suffix is appended). The default value is 1.

Note: Earlier versions of the c89 utility always appended the suffix, which was inconsistent with the treatment of files in the hierarchical file system. It is recommended that any existing data sets be converted to use the new convention.

*prefix*_**OSUFFIX_HOSTRULE**
The way in which suffixes are used for host data sets is determined by the setting of this option. If it is set to 0, then data set types are determined by the rule described in the note which follows. If it is set to 1, then the data set types are determined by last qualifier of the data set (just as a suffix is used to determine the type of hierarchical file system file). Each host file type has an environment variable by which the default suffix can be modified. The default value is 1.

Notes:

1. Earlier versions of the c89 utility scanned the data set name to determine if it was an object data set. It searched for the string OBJ in the data set name, exclusive of the first qualifier and the member name. If it was found, the data set was determined to be an object data set, and otherwise it was determined to be a C source data set. It is recommended that any existing data sets be converted to use the new

convention. Also, because the earlier convention only provided for recognition of C source files, assembler source cannot be processed if it is used.

2. The **c++** command does not support this environment variable, as the earlier convention would not provide for recognition of both C++ and C source files. Therefore regardless of its setting, the **c++** command always behaves as if it is set to 1.

*prefix*_**PLIB_PREFIX (Usage Note 17)**

The prefix for the following named data sets used during the compilation, assemble, and link-editing phases, and during the execution of your application.

To be used, the following data sets must be cataloged:

- The data sets ${*prefix*_PLIB_PREFIX}.SCEEH.+ contain the include (header) files for use with the runtime library functions (where + can be any of H, SYS.H, ARPA.H, NET.H, and NETINET.H).
- The data set ${*prefix*_PLIB_PREFIX}.SCEEMAC contains COPY and MACRO files to be used during assembly.
- The data sets ${*prefix*_PLIB_PREFIX}.SCEEOBJ and ${*prefix*_PLIB_PREFIX}.SCEECPP contain runtime library bindings which exploit constructed reentrancy, used during the link-editing phase of non-XPLINK programs.
- The data set ${*prefix*_PLIB_PREFIX}.SCEELKEX contains C runtime library bindings which exploit L-names used during the link-editing phase of non-XPLINK programs. For more information about L-names, see usage note 23.
- The data set ${*prefix*_PLIB_PREFIX}.SCEELKED contains all other Language Environment runtime library bindings, used during the link-editing phase of non-XPLINK programs.
- The data set ${*prefix*_PLIB_PREFIX}.SCEEBND2 contains all static Language Environment runtime library bindings, used during the link-editing phase of XPLINK programs.
- The data set ${*prefix*_PLIB_PREFIX}.SCEELIB contains the definition side-decks for the runtime library bindings, used during the link-editing phase of XPLINK programs.

The following data sets are also used:

- The data sets ${*prefix*_PLIB_PREFIX}.SCEERUN and ${*prefix*_PLIB_PREFIX}.SCEERUN2 contains the runtime library programs.

These data sets contain MVS programs that are invoked during the execution of the **c89/cc/c++** command and during the execution of a C/C++ application built by the **c89/cc/c++** command. To be executed correctly, these data sets must be made part of the MVS search order. Regardless of the setting of this or any other **c89/cc/c++** environment variable, the **c89/cc/c++** command does not affect the MVS program search order. These data sets are listed here for information only, to assist in identifying the correct data sets to be added to the MVS program search order. The default value is CEE.

*prefix*_**PMEMORY**

A suggestion as to the use of prelinker C/C++ Runtime Library memory files. When set to `0`, the **c89/cc/c++** command uses the prelinker

NOMEMORY option. When set to 1, the **c89/cc/c++** command uses the prelinker MEMORY option. The default value is 1.

*prefix*_**PMSGS (Usage Note 14)**
The name of the message data set used by the prelinker program. It must be a member of the cataloged data set ${*prefix*_PLIB_PREFIX}.SCEEMSGP. The default value is EDCPMSGE.

*prefix*_**PNAME (Usage Note 14)**
The name of the prelinker program called by the **c89/cc/c++** command. It must be a member of a data set in the search order used for MVS programs. The prelinker program is shipped as a member of the ${*prefix*_PLIB_PREFIX}.SCEERUN data set. The default value is EDCPRLK.

*prefix*_**PSUFFIX (Usage Note 15)**
The suffix that the **c89/cc/c++** command uses when creating a prelinker (composite object) output file. The default value is `p`.

*prefix*_**PSUFFIX_HOST (Usage Note 15)**
The suffix that the **c89/cc/c++** command uses when creating a prelinker (composite object) output data set. The default value is CPOBJ.

*prefix*_**PSYSIX (Usage Note 16)**
The system definition side-deck list to be used to resolve symbols during the non-XPLINK link-editing phase. A definition side-deck contains link-editing phase IMPORT control statements naming symbols which are exported by a DLL. The default value when the **c++** command is not being used is null. If the **c++** command is being used with *prefix*_PVERSION and *prefix*_CLASSVERSION set or defaulted to the current z/OS release, the default value is the list concatenation:

```
"${prefix_PLIB_PREFIX}.SCEELIB(C128)"
"${prefix_CLASSLIB_PREFIX}.SCLBSID(IOSTREAM,COMPLEX)"
```

If the **c++** command is being used with *prefix*_PVERSION and *prefix*_CLASSVERSION set to a release prior to z/OS V1R2, the default value is the list ${*prefix*_CLASSLIB_PREFIX}.SCLBSID(ASCCOLL,COMPLEX,IOSTREAM)

*prefix*_**PSYSLIB (Usage Note 16)**
The system library data set list to be used to resolve symbols during the non-XPLINK link-editing phase. The *prefix*_PSYSLIB libraries always precede the *prefix*_LSYSLIB libraries when resolving symbols in the link-editing phase. The default value depends on whether or not the **c++** command is being used. If **c++** is not being used, the default value is the list containing the single entry:

```
"${prefix_PLIB_PREFIX}.SCEEOBJ"
```

If **c++** is being used, the default value is the list:

```
"${prefix_PLIB_PREFIX}.SCEEOBJ:${prefix_PLIB_PREFIX}.SCEECPP"
```

*prefix*_**PVERSION (Usage Note 26)**
The version of the Language Environment runtime library to be used with the **c89/cc/c++** command. The setting of this variable allows **c89/cc/c++** to control which Language Environment named data sets are used during the **c89/cc/c++** processing phases. These named data sets include those required for use of the C/C++ runtime library as well as the ISO C++ Library. It also sets default values for other environment variables.

The format of this variable is the same as the result of the Language Environment C/C++ runtime library function `_librel()`. See *z/OS XL*

C/C++ Runtime Library Reference for a description of the `_librel()` function. The default value is the result of the C/C++ runtime library `_librel()` function.

*prefix*_**SLIB_PREFIX (Usage Note 17)**
The prefix for the named data sets used by the link editor (CSSLIB) and the assembler system library data sets (MACLIB and MODGEN). The data set ${*prefix*_SLIB_PREFIX}.CSSLIB contains the z/OS UNIX assembler callable services bindings. The data sets ${*prefix*_SLIB_PREFIX}.MACLIB and ${*prefix*_SLIB_PREFIX}.MODGEN contain COPY and MACRO files to be used during assembly. These data sets must be cataloged to be used. The default value is SYS1.

*prefix*_**SNAME (Usage Note 14)**
The name of the assembler program called by the **c89/cc/c++** command. It must be a member of a data set in the search order used for MVS programs. The default value is ASMA90.

*prefix*_**SSUFFIX (Usage Note 15)**
The suffix by which the **c89/cc/c++** command recognizes an assembler source file. The default value is `s`.

*prefix*_**SSUFFIX_HOST (Usage Note 15)**
The suffix by which the **c89/cc/c++** command recognizes an assembler source data set. The default value is ASM.

*prefix*_**SSYSLIB (Usage Note 16)**
The system library data set concatenation to be used to find COPY and MACRO files during assembly. The default concatenation is:

```
"${prefix_PLIB_PREFIX}.SCEEMAC"
"${prefix_SLIB_PREFIX}.MACLIB"
"${prefix_SLIB_PREFIX}.MODGEN"
```

*prefix*_**STEPS**
The steps that are executed for the link-editing phase can be controlled with this variable. For example, the prelinker step can be enabled, so that the inputs normally destined for the link editor instead go into the prelinker, and then the output of the prelinker becomes the input to the link editor.

This variable allows the prelinker to be used in order to produce output which is compatible with previous releases of the **c89/cc/c++** command. The prelinker is normally used by the **c89/cc/c++** command when the output file is a data set which is not a PDSE (partitioned data set extended).

Note: The prelinker and XPLINK are incompatible. When using the link editor XPLINK option, the prelinker cannot be used. Thus, specifying the prelinker on this variable will have no effect.

The format of this variable is a set of binary switches which either enable (when turned on) or disable (when turned off) the corresponding step. Turning a switch on will not cause a step to be enabled if it was not already determined by the **c89/cc/c++** command that any other conditions necessary for its use are satisfied. For example, the IPA Link step will not be executed unless the -W option is specified to enable the IPA linker. Enabling the IPA linker is described in “Options” on page 80.

Considering this variable to be a set of 32 switches, numbered left-to-right from 0 to 31, the steps corresponding to each of the switches are as follows:

0-27 Reserved

28 TEMPINC/IPATEMP

29 IPALINK

30 PRELINK

31 LINKEDIT

Example: To override the default behavior of the **c89/cc/c++** command and cause the prelinker step to be run (this is also the default when the output file is a data set which is not a PDSE), set this variable to: `0xffffffff` or the equivalent, `-1`. The default value when the output file is a z/OS UNIX file or a PDSE data set is `0xfffffffd` or the equivalent, `-3`.

Note: The IPATEMP step is the IPA equivalent of the TEMPINC (automatic template generation) step, just as the IPACOMP step is the IPA equivalent of the COMPILE step. See the description of IPA under the -W option for more information.

*prefix*_**SUSRLIB (Usage Note 16)**
The user library data set concatenation to be used to find COPY and MACRO files during assembly (before searching *prefix*_SSYSLIB). The default value is `"" (null)`.

*prefix*_**TMPS**
The use of temporary files by the **c89/cc/c++** command can be controlled with this variable.

The format of this variable is a set of binary switches which either cause a temporary file to be used (when turned on) or a permanent file to be used (when turned off) in the corresponding step.

The correspondence of these switches to steps is the same as for the variable *prefix*_STEPS. Only the prelinker and IPA linker output can be captured using this variable.

Example: To capture the prelinker output, set this variable to: `0xfffffffD` or the equivalent, `-3`. The default value is `0xffffffff` or the equivalent, -1.

*prefix*_**WORK_DATACLAS (Usage Note 18)**
The DATACLAS parameter used by the **c89/cc/c++** command for unnamed temporary (work) data sets. The default value is `"" (null)`.

*prefix*_**WORK_DSNTYPE (Usage Note 18, Usage Note 20)**
The DSNTYPE parameter used by the **c89/cc/c++** command for unnamed temporary (work) data sets. The default value is `"" (null)`.

*prefix*_**WORK_MGMTCLAS (Usage Note 18)**
The MGMTCLAS parameter used by the **c89/cc/c++** command for unnamed temporary (work) data sets. The default value is `"" (null)`.

*prefix*_**WORK_SPACE (Usage Note 18, Usage Note 19)**
The SPACE parameters used by the **c89/cc/c++** command for unnamed temporary (work) data sets. You must set *prefix*_MEMORY to 0 for the *prefix*_WORK_SPACE settings to take effect. The default value is (32000,(30,30)). See also _CCN_IPA_WORK_SPACE.

*prefix*_**WORK_STORCLAS (Usage Note 18)**
The STORCLAS parameter used by the **c89/cc/c++** command for unnamed temporary (work) data sets. The default value is `"" (null)`.

*prefix*_**WORK_UNIT (Usage Note 18)**
The UNIT parameter used by the **c89/cc/c++** command for unnamed temporary (work) data sets. The default value is SYSDA.

*prefix*_**XSUFFIX (Usage Note 15)**
The suffix by which the **c89/cc/c++** command recognizes a definition side-deck file of exported symbols. The default value is x.

*prefix*_**XSUFFIX_HOST (Usage Note 15)**
The suffix by which the **c89/cc/c++** command recognizes a definition side-deck data set of exported symbols. The default value is EXP.

Files

libc.a z/OS XL C/C++ runtime library function library (see Usage Note 7)

libm.a C/C++ Runtime Library math function library (see Usage Note 7)

libl.a lex function library

liby.a yacc function library

/dev/fd0, /dev/fd1, ...
Character special files required by the **c89/cc/c++** command. For installation information, see *z/OS UNIX System Services Planning*.

/usr/include
The usual place to search for include files (see Usage Note 4)

/lib The usual place to search for runtime library bindings (see Usage Note 7)

/usr/lib
The usual place to search for runtime library bindings (see Usage Note 7)

Usage notes

1. To be able to specify an operand that begins with a dash (–), before specifying any other operands that do not, you must use the double dash (—) end-of-options delimiter. This also applies to the specification of the –l operand. (See the description of environment variable *prefix*_CCMODE for an alternate style of argument parsing.)
2. When invoking the **c89/cc/c++** command from the shell, any option-arguments or operands specified that contain characters with special meaning to the shell must be escaped. For example, some -W option-arguments contain parentheses. Source files specified as PDS member names contain parentheses; if they are specified as fully qualified names, they contain single quotation marks.

   To escape these special characters, either enclose the option-argument or operand in double quotation marks, or precede each character with a backslash.
3. Some **c89/cc/c++** behavior applies only to hierarchical files (and not to data sets).
   - If the compile or assemble is not successful, the corresponding object file (*file.o*) is always removed.
   - If the DLL option is passed to the link-editing phase, and afterwards the *file.x* file exists but has a size of zero, then that file is removed.
4. MVS data sets may be used as the usual place to resolve C and C++ `#include` directives during compilation.

Such data sets are installed with the Language Environment runtime library. When it is allocated, searching for these include files can be specified on the -I option as *//DD:SYSLIB*. (See the description of environment variable *prefix*_CSYSLIB for information.

When include files are MVS PDS members, z/OS XL C/C++ uses conversion rules to transform the include (header) file name on a `#include` preprocessor directive into a member name. If the "//'*dataset_prefix*.+'" syntax is not used for the MVS data set which is being searched for the include file, then this transformation strips any directory name on the `#include` directive, and then takes the first 8 or fewer characters up to the first dot (`.`).

If the "//'*dataset_prefix*.+'" syntax is used for the MVS data set which is being searched for the include file, then this transformation uses any directory name on the `#include` directive, and the characters following the first dot (`.`), and substitutes the "+" of the data set being searched with these qualifiers.

In both cases the data set name and member name are converted to uppercase and underscores (`_`) are changed to at signs (`@`).

If the include (header) files provided by the Language Environment runtime library are installed into the hierarchical file system in the default location (in accordance with the *prefix*_INCDIRS environment variable), then the compiler will use those files to resolve `#include` directives during compilation. The **c89/cc/c++** command by default searches the directory `/usr/include` as the usual place, just before searching the data sets just described. See the description of environment variables *prefix*_CSYSLIB, *prefix*_INCDIRS, and *prefix*_INCLIBS for information about customizing the default directories to search.

5. Feature test macros control which symbols are made visible in a source file (typically a header file). The **c89/cc/c++** command automatically defines the following feature test macros along with the errno macro, according to whether or not the **cc** command was invoked.
   - Other than **cc**

     –D "errno=(*__errno())"

     –D _OPEN_DEFAULT=1
   - **cc**

     –D "errno=(*__errno())"

     –D _OPEN_DEFAULT=0

     –D _NO_PROTO=1

   The **c89/cc/c++** command adds these macro definitions only after processing the command string. Therefore, you can override these macros by specifying -D or -U options for them on the command string.
6. The default LANGLVL and related compiler options are set according to whether the **cc**, **c89**, or **c++** (**cxx**) command was invoked. These options affect various aspects of the compilation, such as z/OS XL C/C++ predefined macros, which are used like feature test macros to control which symbols are made visible in a source file (typically a header file), but are normally not defined or undefined except by this compiler option. They can also affect the language rules used by the compiler. For more information about the compiler options listed here, see *z/OS XL C/C++ User's Guide* . For more information about z/OS XL C/C++ predefined macros, see *z/OS XL C/C++ Language Reference*. The options are shown here in a syntax that the user can specify on the **c89/cc/c++** command line to override them:
   - **c89** (also **c++** (**cxx**) when using a C++ compiler older than z/OS v1r2)

     -W "c,langlvl(ansi),noupconv"

- **c++** (**cxx**)

  -W "c,langlvl(extended,nolibext,nolonglong)

- **cc**

  -W "c,langlvl(commonc),upconv"

7. By default the usual place for the -L option search is the `/lib` directory followed by the `/usr/lib` directory. See the description of environment variable *prefix*_LIBDIRS for information on customizing the default directories to search.

   The archive libraries `libc.a` and `libm.a` exist as files in the usual place for consistency with other implementations. However, the runtime library bindings are not contained in them. Instead, MVS data sets installed with the Language Environment runtime library are used as the usual place to resolve runtime library bindings. In the final step of the link-editing phase, any MVS load libraries specified on the **-l** operand are searched in the order specified, followed by searching these data sets. See the *prefix*_PLIB_PREFIX description, as well as descriptions of the environment variables featured in the following list.

   *prefix*_ILSYSLIB

   *prefix*_ILSYSIX

   *prefix*_LSYSLIB

   *prefix*_PSYSIX

   *prefix*_PSYSLIB

   This list of environment variables affects the link-editing phase of the c89 utility, but only for non-XPLINK link-editing. See XPLINK (Extra Performance Linkage) in "Options" on page 80.

   The following list of environment variables affects the link-editing phase of the c89 utility, but only for ILP32 XPLINK link-editing. See XPLINK (Extra Performance Linkage) in "Options" on page 80.

   *prefix*_ILXSYSLIB

   *prefix*_ILXSYSIX

   *prefix*_LXSYSLIB

   *prefix*_LXSYSIX

   The following list of environment variables affects the link-editing phase of the c89 utility, but only for LP64 link-editing. See the description of LP64 in "Options" on page 80.

   *prefix*_IL6SYSLIB

   *prefix*_IL6SYSIX

   *prefix*_L6SYSLIB

   *prefix*_L6SYSIX

8. Because archive library files are searched when their names are encountered, the placement of **-l** operands and *file.a* operands is significant. You may have to specify a library multiple times on the command string, if subsequent specification of *file.o* files requires that additional symbols be resolved from that library.

9. When the prelinker is used during the link-editing phase, you cannot use as input to the **c89/cc/c++** command an executable file produced as output from a previous use of the **c89/cc/c++** command. The output of **c89/cc/c++** when the **-r** option is specified (which is not an executable file) may be used as input.

10. All MVS data sets used by the **c89/cc/c++** command must be cataloged (including the system data sets installed with the z/OS XL C/C++ compiler and the Language Environment runtime library).
11. The **c89/cc/c++** operation depends on the correct setting of their installation and configuration environment variables (see "Environment variables" on page 94). Also, they require that certain character special files are in the `/dev` directory. For additional installation and configuration information, see *z/OS UNIX System Services Planning*.
12. Normally, options and operands are processed in the order read (from left to right). Where there are conflicts, the last specification is used (such as with **-g** and **-s**). However, some c89 utility flag options will override others, regardless of the order in which they are specified. The option priorities, in order of highest to lowest, are as follows:

    -v specified twice
    The pseudo-JCL is printed only, but the effect of all the other options and operands as specified is reflected in the pseudo-JCL.

    -E Overrides -0, -O, -1, -2, -3, -V, **-c**, **-g** and **-s** (also ignores any *file.s* files).

    -g Overrides -0, -O, -1, -2, -3, and **-s**.

    -s Overrides **-g** (the last one specified is honored).

    -0 (zero), -O (capital letter O), -1, -2, -3, -V, -c
    All are honored if not overridden. -0, -O, -1, -2, -3 override each other (the last one specified is honored).

    Note: The preferred way for specifying optimization options, is -O (capital letter O) followed by a number; for example, -O2.
13. For options that have option-arguments, the meaning of multiple specifications of the options is as follows:

    -D All specifications are used. If the same name is specified on more than one -D option, only the first definition is used.

    -e The entry function used will be the one specified on the last **-e** option.

    -I All specifications are used. If the same directory is specified on more than one -I option, the directory is searched only the first time.

    -L All specifications are used. If the same directory is specified on more than one -L option, the directory is searched only the first time.

    -o The output file used will be the one specified on the last **-o** option.

    -U All specifications are used. The name is *not* defined, regardless of the position of this option relative to any -D option specifying the same name.

    -u All specifications are used. If a definition cannot be found for any of the functions specified, the link-editing phase will be unsuccessful.

    -W All specifications are used. All options specified for a phase are passed to it, as if they were concatenated together in the order specified.
14. The following environment variables can be at most eight characters in length. For those whose values specify the names of MVS programs to be executed, you can dynamically alter the search order used to find those programs by using the STEPLIB environment variable.

c89/cc/c++ environment variables do not affect the MVS program search order. Also, for the **c89/cc/c++** command to work correctly, the setting of the STEPLIB environment variable should reflect the Language Environment library in use at the time that **c89/cc/c++** is invoked.

For more information on the STEPLIB environment variable, see *z/OS UNIX System Services Planning*. It is also described under the **sh** command. Note that the STEPLIB allocation in the pseudo-JCL produced by the **-v** verbose option is shown as a comment, and has no effect on the MVS program search order. Its appearance in the pseudo-JCL is strictly informational.

*prefix*_CMSGS
*prefix*_CNAME
*prefix*_DAMPNAME
*prefix*_ILCTL
*prefix*_ILNAME
*prefix*_ILMSGS
*prefix*_PMSGS
*prefix*_PNAME
*prefix*_SNAME

15. The following environment variables can be at most 15 characters in length. You should not specify any dots (**.**) when setting these environment variables since they would then never match their corresponding operands:

    *prefix*_ASUFFIX
    *prefix*_ASUFFIX_HOST
    *prefix*_CSUFFIX
    *prefix*_CSUFFIX_HOST
    *prefix*_CXXSUFFIX
    *prefix*_CXXSUFFIX_HOST
    *prefix*_ISUFFIX
    *prefix*_ISUFFIX_HOST
    *prefix*_ILSUFFIX
    *prefix*_ILSUFFIX_HOST
    *prefix*_IXXSUFFIX
    *prefix*_IXXSUFFIX_HOST
    *prefix*_OSUFFIX
    *prefix*_OSUFFIX_HOST
    *prefix*_PSUFFIX
    *prefix*_PSUFFIX_HOST
    *prefix*_SSUFFIX
    *prefix*_SSUFFIX_HOST
    *prefix*_XSUFFIX
    *prefix*_XSUFFIX_HOST

16. The following environment variables are parsed as colon-delimited data set names, and represent a data set concatenation or a data set list. The maximum length of each specification is 1024 characters:

    *prefix*_CSYSLIB
    *prefix*_IL6SYSIX
    *prefix*_IL6SYSLIB

*prefix*_ILSYSIX
*prefix*_ILSYSLIB
*prefix*_ILXSYSIX
*prefix*_ILXSYSLIB
*prefix*_L6SYSIX
*prefix*_L6SYSLIB
*prefix*_LSYSLIB
*prefix*_LXSYSIX
*prefix*_LXSYSLIB
*prefix*_PSYSIX
*prefix*_PSYSLIB
*prefix*_SSYSLIB
*prefix*_SUSRLIB

17. The following environment variables can be at most 44 characters in length:
    *prefix*_CLASSLIB_PREFIX
    *prefix*_CLIB_PREFIX
    *prefix*_PLIB_PREFIX
    *prefix*_SLIB_PREFIX
18. The following environment variables can be at most 63 characters in length:
    *prefix*_NEW_DATACLAS
    *prefix*_NEW_DSNTYPE
    *prefix*_NEW_MGMTCLAS
    *prefix*_NEW_SPACE
    *prefix*_NEW_STORCLAS
    *prefix*_NEW_UNIT
    *prefix*_WORK_DATACLAS
    *prefix*_WORK_DSNTYPE
    *prefix*_WORK_MGMTCLAS
    *prefix*_WORK_SPACE
    *prefix*_WORK_STORCLAS
    *prefix*_WORK_UNIT
19. The following environment variables are for specification of the SPACE parameter, and support only the syntax as shown with their default values (including all commas and parentheses). Also as shown with their default values, individual subparameters can be omitted, in which case the system defaults are used.
    _CCN_IPA_WORK_SPACE
    *prefix*_NEW_SPACE
    *prefix*_WORK_SPACE
20. The following environment variables are for specification of the DSNTYPE parameter, and support only the subparameters LIBRARY or PDS (or null for no DSNTYPE):
    *prefix*_NEW_DSNTYPE
    *prefix*_WORK_DSNTYPE
21. The following environment variables can be at most 127 characters in length:
    *prefix*_DCBF2008

*prefix*_DCBU
*prefix*_DCB121M
*prefix*_DCB133M
*prefix*_DCB137
*prefix*_DCB137A
*prefix*_DCB3200
*prefix*_DCB80
*prefix*_DEBUG_FORMAT

These environment variables are for specification of DCB information, and support only the following DCB subparameters, with the noted restrictions:

RECFM
Incorrect values are ignored.

LRECL
None

BLKSIZE
None

DSORG
Incorrect values are treated as if no value had been specified.

22. The following environment variables are parsed as blank-delimited words, and therefore no embedded blanks or other white-space is allowed in the value specified. The maximum length of each word is 1024 characters:
    *prefix*_INCDIRS
    *prefix*_INCLIBS
    *prefix*_LIBDIRS
    *prefix*_OPTIONS
    *prefix*_OPERANDS
23. An S-name is a *short* external symbol name, such as produced by the z/OS XL C/C++ compiler when compiling C programs with the NOLONGNAME option. An L-name is a *long* external symbol name, such as produced by the z/OS XL C/C++ compiler when compiling C programs with the LONGNAME option.
24. The z/OS XL C/C++ runtime library supports a file naming convention of // (the filename can begin with exactly two slashes). The **c89/cc/c++** command indicates that the file naming convention of // can be used.

    However, the Shell and Utilities feature *does not* support this convention. Do not use this convention (//) unless it is specifically indicated (as here in **c89/cc/c++**). The z/OS Shell and Utilities feature does support the POSIX file naming convention where the filename can be selected from the set of character values excluding the slash and the null character.
25. When coding in C and C++, the **c89**, **cc**, and **c++** commands, by default, produce reentrant executables. For more information about reentrancy, see *z/OS XL C/C++ Programming Guide*. When coding in assembly language, the code must not violate reentrancy. If it does, the resulting executable may not be reentrant.
26. The *prefix*_CVERSION, *prefix*_PVERSION and *prefix*_CLASSVERSION environment variables are set to a hex string in the format 0xPVVRRMMM where P is product, VV is version, RR is release and MMM is modification level. For example, the *prefix*_CVERSION and *prefix*_CLASSVERSION for the z/OS V1R2 compiler is 0x41020000.

27. c89 passes some options to the compiler so that expected behavior is achieved; for example, POSIX behavior. These options are passed onto the compiler as defaults that the user can overwrite. When default options passed by c89 are in conflict with options or pragmas that the user specified, the compiler issues diagnostic messages and may terminate processing. Since the user did not specify options that c89 passed as defaults, these messages may confuse the user. Prior to the z/OS V1R5 release, the compiler was unable to differentiate between the options that c89 passed as defaults and the user-specified options so it was unable to correctly resolve conflicting pragma/option combinations. In some cases, the compiler would overwrite pragmas with the options that c89 passed as defaults thus limiting a user's ability to use pragmas. As of z/OS V1R5, the compiler is now able to recognize c89 defaults and avoid confusion from messages for options, which were not explicitly specified by the user, and overriding pragmas, when the user did not explicitly request it. It is believed that most users will benefit from this feature so it is the default behavior. To enable the old behavior, environment variable *prefix*_NOCMDOPTS must have a nonzero value. **Example:** The following sequence will preserve the old behavior:

    ```
    export _C89_NOCMDOPTS=1
    c89 -o hello hello.c
    ```

28. The following example shows the concatenation of data sets in environment variables. It shows how to use an environment variable to setup the SYSLIB DD when using the **c89** command name:

    ```
    export _C89_LSYSLIB="CEE.SCEELKEX:CEE.SCEELKED:CBC.SCCNOBJ:SYS1.CSSLIB"
    ```

    This environment variable will produce the following SYSLIB concatenation:

    ```
    //SYSLIB   DD  DSN=CEE.SCEELKEX,DISP=SHR
    //         DD  DSN=CEE.SCEELKED,DISP=SHR
    //         DD  DSN=CBC.SCCNOBJ,DISP=SHR
    //         DD  DSN=SYS1.CSSLIB,DISP=SHR
    ```

Localization

The **c89/cc/c++** command uses the following localization environment variables:

- LANG
- LC_ALL
- LC_CTYPE
- LC_MESSAGES

Exit values

0 Successful completion.

1 Failure due to incorrect specification of the arguments.

2 Failure processing archive libraries:

- Archive library was not in any of the library directories specified.
- Archive library was incorrectly specified, or was not specified, following the **-l** operand.

3 Step of compilation, assemble, or link-editing phase was unsuccessful.

4 Dynamic allocation error, when preparing to call the compiler, assembler, IPA linker, prelinker, or link editor, for one of the following reasons:

- The file or data set name specified is incorrect.
- The file or data set name cannot be opened.

5 Dynamic allocation error, when preparing to call the compiler, assembler, prelinker, IPA linker, or link editor, due to an error being detected in the allocation information.

6 Error copying the file between a temporary data set and a hierarchical file system file (applies to the **-2** option, when processing assembler source files, and **-r** option processing).

7 Error creating a temporary control input data set for the link-editing phase.

8 Error creating a temporary system input data set for the compile or link-editing phase.

Portability

For the **c89** command, X/Open Portability Guide, POSIX.2 C-Language Development Utilities Option.

For the **cc** command, POSIX.2 C-Language Development Utilities Option, UNIX systems.

Extensions to the POSIX standard are as follows:

- The **-v**, -V, -0, -1, -2 and -3 options
- DLL support
- IPA optimization support
- The behavior of the **-o** option in combination with the **-c** option and a single source file.

Note: **-0x** (where **x** is 0, 1, 2, or 3) is equivalent to **-x** because **-x** overrides -O. This happens to match the standard compliant syntax of optimization level **x** (**-0x**), but **0x** is not treated as a single entity. It may appear redundant to use **-0x** but it is recommended because it improves portability. In order to avoid creating non-portable legacy, the xlc utility does not support **-x** extension syntax. For example, the following commands are equivalent but the first syntax is recommended:

```
c89 -O2 hello.c
c89 -2 hello.c
```

Features have been added to z/OS releases, which have made it easier to port applications from other platforms to z/OS and improve performance. For compatibility reasons, these portability and performance enhancements could not be made the default. If you are porting an application from another platform to z/OS, you may want to start by specifying the following options:

```
c89 -o HelloWorld -2 -Wc,NOANSIALIAS -Wc,XPLINK\
-Wl,XPLINK -Wc,'FLOAT(IEEE)' -Wc,'GONUM' HelloWorld.c
```

Note: The string shown in this example is one line (it had to be split to fit the page). A space exists between `-Wc,XPLINK` and `-Wl,XPLINK`.

Related information

ar, dbx, file, lex, makedepend, nm, strings, strip, yacc

c99 — Compile C source code, link-edit and create an executable file

See **xlc**.

Note: When working in the shell, to view man page information about **c99**, type: **man xlc**.

cal — Display a calendar for a month or year

Format

cal [*month*] [*year*]

Description

cal displays a calendar on standard output (stdout).

- With no arguments, **cal** displays a calendar for the current month of the current year.
- If one argument is given and it is numeric, **cal** interprets it as a year (for example, 1991); if a single argument is not numeric, **cal** interprets it as the name of a month, possibly abbreviated (for example, apr).
- If two arguments are given, **cal** assumes that the first argument is the *month* (either a number from 1 to 12 or a month name) and the second is the *year*.

Localization

cal uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Usage notes

Year numbers that are less than 100 refer to the early Christian era, not the current century. This command prints the Gregorian calendar, handling September 1752 correctly. Many cultures observe other calendars.

Exit values

0 Successful completion.

1 Failure due to any of the following:
- An incorrect command-line argument
- An incorrect date
- A year outside the range 1 to 9999 A.D.

Portability

X/Open Portability Guide, UNIX systems.

calendar — Display all current appointments

Format

calendar [–]

The **calendar** utility is fully supported for compatibility with older UNIX systems. However, because it is no longer supported by POSIX.2 IEEE standard 1003.2-1992, this utility should be avoided for applications intended to be portable to other UNIX-branded systems.

Description

If you do not specify any options, **calendar** displays all current appointments on standard output (**stdout**). It searches the file **calendar** in the current directory, looking for lines that match either today's date or tomorrow's date. On Friday, Saturday, or Sunday, *tomorrow* extends through to Monday. Each appointment must fit on a single line, with the date formatted as one of:

```
January 27
1/27
jan 27
```

The name of the month can be abbreviated to three letters. Also, the case is not significant and the month can be given numerically.

Options

– Searches the RACF data base to find user IDs. **calendar** uses the **mailx** command (or, alternatively, the command named in the MAILER environment variable) to send mail to the corresponding user for any appointments that are found to be current. Because **calendar** cannot determine each user's locale, it runs in the POSIX locale when this option is used; otherwise it runs in the user's locale, processing data in single-byte mode.

Examples

If today is Friday April 7th and the following **calendar** file is found in the current directory:

```
tue mar 7 1:00 pm dentist
Sat April 8 Trip to the zoo
mon april 10 3:30 pm job interview
4/11  vacation starts
```

calendar prints the following:

```
Sat April 8 Trip to the zoo
mon april 10 3:30 pm job interview
```

Environment variables

calendar uses the following environment variable:

MAILER
Contains the name of the command that **calendar** uses to send mail. If this variable is not set, **calendar** uses **/bin/mail** as the default mail command.

Files

calendar uses the following file:

calendar
File used in the current directory, or user's home directory.

Localization

calendar uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- An incorrect command-line argument
- An inability to open the calendar file

Portability

X/Open Portability Guide, UNIX systems

The MAILER environment variable is an extension to traditional implementations of **calendar**.

Related information

mailx

cancel - Cancel print queue requests (stub command)

Format

cancel [*print_ID ...*] *printer ...*
cancel *print_ID ...* [*printer ...*]

The **cancel** utility is fully supported for compatibility with older UNIX systems. However, because it is no longer supported by POSIX.2 IEEE standard 1003.2-1992, this utility should be avoided for applications intended to be portable to other UNIX-branded systems.

Description

cancel cancels print queue requests. *print_ID* specifies the particular job (or jobs) to be canceled; the *print_ID* number is reported by **lp** when the job is submitted, or by **lpstat**.

cancel is recognized, but its functions are not supported.

If you are using the z/OS Infoprint Server feature, your system automatically uses that version of the **cancel** command.

captoinfo — Print the terminal entries in the terminfo database

Format

captoinfo [**–1vV**] [**–w width**] [**file ...**]

Description

captoinfo prints all of the terminal entries in the terminfo database to standard output (stdout) in terminfo format. You can either look at the output or send it to a file that can be processed by **tic**.

The Curses application uses the terminfo database, which contains a list of terminal descriptions. This enables you to manipulate a terminal's display regardless of the terminal type. To create the terminfo database, use **tic**. See the section on customizing the terminfo database in *z/OS UNIX System Services Planning* for information about defining the terminfo database.

For more information about curses, see *z/OS C Curses*.

Options

1 Single-column output

V Print the program version

v Print debugging information (verbose) to standard error (**stderr**)

w Specifies the width of the output

filename
Specifies the termcap entries to be processed

Examples

1. This example shows how to print all the terminal entries in the file **/etc/termcap.src** in terminfo format. The entry for a vt52 is shown. Issue:

   ```
   captoinfo  /etc/termcap.src
   ```

   You get the following display:

   ```
   captoinfo: obsolete 2 character name 'dv' removed.
         synonyms are: 'vt52|dec vt52'
   #
   vt52|dec vt52,
         xon,
         cols#80, lines#24,
         bel=^¬, clear=-E-310-E-321, cub1=^½, cud1=^-,
         cuf1=-E-303,
         cup=-E-350%-227-361%'-s'%+%-203%-227-362%'-s'%+%-203,
         cuu1=-E-301, ed=-E-321, el=-E-322, ind=^-,
         kbs=^½, kcub1=-E-304, kcud1=-E-302, kcuf1=-E-303,
         kcuu1=-E-301, ri=-E-311,
   # END OF TERMCAP
   #  ------------------------
   ```

2. To print all the terminal entries in the file **/etc/termcap.src** in terminfo format with each entry on a separate line, issue:

   ```
   captoinfo  –1 /etc/termcap.src
   ```

   You get the following display:

   ```
   captoinfo: obsolete 2 character name 'dv' removed.
         synonyms are: 'vt52|dec vt52'

   #
   vt52|dec vt52,
        xon,
        cols#80,
        lines#24,
        clear=-E-310-E-321,
   ```

```
        cub1=^½,
        cud1=^-,
        cuf1=-E-303,
        cup=-E-350%-227-361%'-s'%+%-203%-227-362%'-s'%+%-203,
        cuu1=-E-301,
        ed=-E-321,
        el=-E-322,
        ind=^-,
        kbs=^½,
        kcub1=-E-304,
        kcud1=-E-302,
        kcuf1=-E-303,
        kcuu1=-E-301,
        ri=-E-311,
    # END OF TERMCAP
    #  ------------------------
```

3. This example shows how to write all the terminal entries in the file **/etc/termcap.src** to the file **/test/terminfo.ti**. The resulting file can be processed by **tic**. Notice that the error messages are written to **stderr**.

   ```
   captoinfo  /etc/termcap.src  1> /test/terminfo.ti
   ```

   You get the following:

   ```
   captoinfo: obsolete 2 character name 'dv' removed.
         synonyms are: 'vt52|dec vt52'
   #
   ```

Related information

infocmp, **tic**

---

cat — Concatenate or display text files

Format

cat [**–Bsu**] [**–v**[**et**]] [**-W** *option*[,*option*]...] [*file ...file ...*]

Description

cat displays and concatenates files. It copies each *file* argument to the standard output (stdout). If you specify no files or specify a dash (**–**) as a file name, **cat** reads the standard input (stdin).

You can use **cat** with the scrolling facility of the z/OS UNIX TSO/E command to browse data files.

Options

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–e Displays a $ character at the end of each line. This option works only if you also specify **–v**.

–s Does not produce an error message if **cat** cannot find or read a specified file.

–t Displays tabs as ^I. This option works only if you also specify **–v**.

–u Does not buffer output.

–v Displays all characters including those that are unprintable characters.

With a double-byte character set, an unprintable wide character is converted back to its double-byte representation. Each byte is then checked as if it were a single-byte character. If the character is unprintable, one of the following three representations is used:

- `M-X` is used for character `X` if the significant bit is set.
- `^X` is used for the control character `X` (for example, `^A` for CTRL-A).
- `\xxx` represents a character with the octal value `xxx`.

The `\xxx` form is used if neither of the other representations can be used.

-W *option*[**,***option*]**...**

Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*

Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name that is known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*

Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name that is known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B**

option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

The only supported values for **pgmcodeset** are IBM-1047 and 1047.

Examples

1. To display the contents of a text file to the standard output (stdout):

   ```
   cat myTextFile
   ```

2. To display the concatenation of two text files to the standard output (stdout):

   ```
   cat myTextFile01 myTextFile02
   ```

3. To display the contents of a text file containing UTF-8 characters to the standard output (stdout), assuming that:
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are displaying an untagged public text file or a read-only text file):

   ```
   cat -W filecodeset=UTF-8,pgmcodeset=IBM-1047 myutf8File
   ```

4. To display the contents of a text file that contains UTF-8 characters to the standard output (stdout), assuming that automatic conversion was enabled but the text file is incorrectly tagged as ASCII:

   ```
   cat -W filecodeset=UTF-8,pgmcodeset=IBM-1047 myUtf8File
   ```

Localization

cat uses the following localization environment variables:
- LANG
- LC_ALL
- LC_CTYPE
- LC_MESSAGES
- LC_SYNTAX
- NLSPATH

See Appendix F, “Localization,” on page 997 for more information.

Environment variables

cat uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

Exit values

0 Successful completion

1 Failure due to any of the following:
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion
- An incorrect command-line argument
- Inability to open the input file
- End of the file detected on stdout

- The input file is the same as the output file

2 An incorrect command-line argument

Portability

POSIX.2, X/Open Portability Guide, UNIX systems

The **–B**, **–e**, **–s**, **–t**, **–v**, and **-W** options are extensions of the POSIX standard.

Related information

cp, **more**, **mv**

cc — Compile C source code, link-edit and create an executable file

See **c89/xlc** or **man xlc**.

Note:

1. The **cc** command is fully supported for compatibility with older UNIX systems. However, it is recommended that the **c89** command be used instead because it may provide greater functionality and is considered the standard for portable UNIX applications as defined by POSIX.2 IEEE standard 1003.2-1992.
2. When working in the shell, to view man page information about **cc**, type: `man c89` or `man xlc`.

cd — Change the working directory

Format

cd [*directory*]
cd *old new*
cd –

tcsh shell: **cd** [**-p**] [**-l**] [**-n**|**-v**] [*name*]

Description

The command **cd** *directory* changes the working directory of the current shell execution environment (see **sh**) to *directory*. If you specify *directory* as an absolute path name, beginning with /, this is the target directory. **cd** assumes the target directory to be the name just as you specified it. If you specify *directory* as a relative path name, **cd** assumes it to be relative to the current working directory.

If the variable CDPATH is defined in the shell, the built-in **cd** command searches for a relative path name in each of the directories defined in CDPATH. If **cd** finds the directory outside the working directory, it displays the new working directory.

Use colons to separate directories in CDPATH. In CDPATH, a null string represents the working directory. For example, if the value of CDPATH begins with a separator character, **cd** searches the working directory first; if it ends with a separator character, **cd** searches the working directory last.

In the shell, the command **cd -** is a special case that changes the current working directory to the previous working directory by exchanging the values of the variables PWD and OLDPWD.

Note: Repeating this command toggles the current working directory between the current and the previous working directory.

Calling **cd** without arguments sets the working directory to the value of the HOME environment variable, if the variable exists. If there is no HOME variable, **cd** does not change the working directory.

The form **cd** *old new* is an extension to the POSIX standard and optionally to the Korn shell. The shell keeps the name of the working directory in the variable PWD. The **cd** command scans the current value of PWD and replaces the first occurrence of the string *old* with the string *new*. The shell displays the resulting value of PWD, and it becomes the new working directory.

If either directory is a symbolic link to another directory, the behavior depends on the setting of the shell's **–o** logical option. See the **set** command for more information.

For **cd** in the tcsh shell, if a directory name is given, **cd** changes the tcsh shell's working directory to *name*. If not, it changes the directory to home. If *name* is '-' it is interpreted as the previous working directory. If *name* is not a subdirectory of the current directory (and does not begin with /, ./ or ../), each component of the tcsh variable *cdpath* is checked to see if it has a subdirectory name. Finally, if all else fails but *name* is a tcsh shell variable whose value begins with /, then this is tried to see if it is a directory (see also the *implicitcd* tcsh shell variable).

Options for the **cd** tcsh built-in command are:

-l Output is expanded explicitly to home or the path name of the home directory for the user.

-n Entries are wrapped before they reach the edge of the screen.

-p Prints the final directory stack.

-v Entries are printed one per line, preceded by their stack positions.

If more than one of **-n** or **-v** is given, **-v** takes precedence. **-p** is accepted but does nothing.

Environment variables

cd uses the following environment variables:

CDPATH
Contains a list of directories for **cd** to search in when *directory* is a relative path name.

HOME
Contains the name of your home directory. This is used when you do not specify *directory* on the command line.

OLDPWD
Contains the path name of the previous working directory. This is used by **cd –**.

PWD Contains the path name of the current working directory. This is set by **cd** after changing to that directory.

Localization

cd uses the following localization environment variables:
- LANG
- LC_ALL
- LC_CTYPE
- LC_MESSAGES
- NLSPATH

See Appendix F, "Localization," on page 997 for more information.

Usage notes

cd is a built-in shell command.

Exit values

0 Successful completion

1 Failure due to any of the following reasons:
- No HOME directory
- No previous directory
- A search for *directory* failed
- An *old*-to-*new* substitution failed

2 An incorrect command-line option, or too many arguments

Messages

Possible error messages include:

dir **bad directory**
cd could not locate the target directory. This does not change the working directory.

Restricted
You are using the restricted version of the shell (for example, by specifying the **–r** option for **sh**). The restricted shell does not allow the **cd** command.

No HOME directory
You did not assign a value to the HOME environment variable. Thus, when you run **cd** in order to return to your home directory, **cd** cannot determine what your home directory is.

No previous directory
You tried the command **cd –** to return to your previous directory; but there is no record of your previous directory.

Pattern *old* **not found in** *dir*
You tried a command of the form **cd** *old new*. However, the name of the working directory *dir* does not contain any string matching the regular expression *old*.

Portability

POSIX.2, X/Open Portability Guide.

All UNIX systems feature the first form of the command.

The **cd** *old new* form of the command is an extension of the POSIX standard.

Related information

dirs, **popd**, **pushd**, **set**, **sh**, **tcsh**

---

ceebldtx — Transform message source files into assembler source files

Format

ceebldtx

[**-C** *csect_name*][**-I** *secondary_file_name*]
[**-P**] [**-S**] [**-c** *class*] [**-d APOST** | **'** | **QUOTE** | **"**]
[**-l BAL** | **C** | **COBOL** | **FORTRAN** | **PLI**] [**-s** *id*]
in_file out_file

Restriction: The **ceebldtx** utility only works with z/OS UNIX files; MVS data sets are not applicable.

Description

The **ceebldtx** utility creates several files from the message source file. It creates an assembler source file, which can be assembled into an object (text) file and link-edited into a module in an MVS load library. When the name of the module is placed in a message module table, the Language Environment message services can dynamically access the messages. See Creating a Message Module Table in the Language Environment Programming Guide for more information about creating a message module table.

The **ceebldtx** utility optionally creates secondary input files (COPY or INCLUDE), which contain declarations for the condition tokens associated with each message in the message source file. When a program uses the secondary input file, the condition tokens can then be used to reference the messages from the message table. The :msgname. tag indicates the symbolic name of the condition token.

See the topic on Using and Handling Messages in *z/OS Language Environment Programming Guide* for a description of creating message source files and other corresponding information.

Operands

in_file The name of the file containing the message source.

out_file
The name of the resulting assembler source file containing the messages, inserts, and others items, suitable for input into the High Level Assembler. An extension of ".s" is assumed if none is present.

Options

-C *csect_name*
This option is used to explicitly specify the CSECT name. An uppercase version of the CSECT name will be used. By default, the CSECT name is the output file base name.

-I *secondary_file_name*
The **-I** (uppercase i) option provides the name of the secondary input file generated for the language specified with the **-l** (lowercase L) option. If no

suffix is present in the *secondary_file_name* specified, the extension will be ".h" for C, ".fortran" for Fortran, and ".copy" for all others.

-P This option is used to save previous prologs, if files being generated exist in the directory and contain prologs. By default, previous prologs are not reused.

-S This option is used to indicate sequence numbers should be generated in the files produced. By default, no sequence numbers are generated.

-c *class* This option is used to specify the default value for :msgclass. in cases where the tag is not coded.

-d APOST | ' | QUOTE | "
This option is used to specify which COBOL delimiter to use and is used in combination with the -l (lowercase L) COBOL option. By default, APOST is used as the delimiter.

Tip: Quotation marks should be escaped in order to prevent them from being treated as shell metacharacters, for example:

```
ceebldtx -l COBOL -I secondary_file_name -d \' in_file out_file
ceebldtx -l COBOL -I secondary_file_name -d \" in_file out_file
ceebldtx -l COBOL -I secondary_file_name -d QUOTE in_file out_file
```

-l BAL | C | COBOL | FORTRAN | PLI
The **-l** (lowercase L) option is used to specify the language to be used in generating a secondary input file and is used in combination with the I *secondary_file_name* option. The file will contain declarations for the condition tokens associated with each message in the message source file. The language is accepted in lowercase and uppercase. **C370** is also supported.

-s id This option is used to specify the default value for :msgsubid. in cases where the tag is not coded.

Examples

```
ceebldtx -l PLI -I exmplcop example exmplasm
```

Where the *in_file* is **example**, the *out_file* is **exmplasm.s,** and the PL/I *secondary_file_name* is **exmplcop.copy**.

After the *out_file* is generated, the High Level Assembler can be used to assemble the *out_file* into an object file

```
as exmplasm.s
```

and the binder can be used to link-edit it into an MVS load library:

```
ld -o "//mylib(exmplasm)" -e// -u//exmplasm exmplasm.o
```

Rule: A CSECT name greater than 8 characters requires the use of the High Level Assemble GOFF option for assembling the primary output file.

Exit values

-1 Rexx terminated execution due to lack of storage. (See IRX0005I in *z/OS TSO/E Messages*.)

Attempt one of the following options:

1. Increase the virtual storage space available on the system.
2. Split up the script in_file, into two or more files, and adjust the Message Module Table for the corresponding split.

0 Successful completion.

5 Error reading file *ssssssss*.

6 Error erasing file *ssssssss*.

7 Error writing file *ssssssss*.

8 Bad file name *ssssssss*: forward slash not allowed at the end of a file name.

9 Option *x* requires an argument.

10 Invalid option = *x*. Valid options are: **CIPScdls**.

11 Bad data set name *ssssssss*.

20 CSECT name *ssssssss* is greater than 63 characters.

21 CSECT name *ssssssss* does not begin with a letter, $, #, @ or underscore (_).

28 *ssssssss* SCRIPT not found on any accessed disk.

40 Error on line *nnn* in message *nnnn*. Insert number greater than *mmmm*.

44 Error on line *nnn*. Duplicate: FACID. tags found with the given script file.

48 No :FACID. tag found within the given script file.

52 Error on line *nnn*. Message number *nnnn* found out of range *mmmm* to *mmmm*.

56 Number of hexadecimal digits not divisible by 2 on line *nnn* in message *nnnn*.

60 Invalid hexadecimal digits on line *nnn* in message *nnnn*.

64 Number of DBCS bytes not divisible by 2 on line *nnn* in message *nnnn*.

68 PLAS *out_file* name must be longer than the message facility ID *pppp*.

72 Message facility ID *pppp* on line *nnn* was longer than 4 characters.

76 Message class on line *nnn* was not a valid message class type: IWESCFA.

80 Tag not recognized on line *nnn*.

84 The first tag was not a :FACID. tag on line *nnn*.

88 Unexpected tag found on line *nnn*.

92 Duplicate tags *ttt* found on line *nnn*.

96 No :MSGNO. tags found within the given SCRIPT file.

98 No :MSGCLASS. (or :MSGCL.) tag found for message *nnnn*.

100 Insert number was not provided or was less than 1 on line *nnn*.

104 Message subid was out of the range *mmmm* to *mmmm* on line *nnn*.

108 Existing secondary file, *ssssssss*, found, but not on A-disk.

112 The current ADDRESS environment not CMS, TSO/E, or z/OS UNIX.

nnn Undefined error number *nnn* issued. Contact your service representative.

chaudit — Change audit flags for a file

Format

chaudit [–Fdai] *attr pathname ...*

Description

chaudit changes the audit attributes of the specified files or directories. Audit attributes determine whether or not accesses to a file are audited by the system authorization facility (SAF) interface.

Restriction: The **chaudit** command can be used only by the file owner or a superuser for non-auditor-requested audit attributes. Only a user with auditor authority can change the auditor-requested audit attributes.

Options

–F If you specify a directory as a path name on the command, **chaudit** changes the audit characteristics of all files in that directory. Subdirectory audit characteristics are not changed.

–d If you specify a directory as a path name on the command, **chaudit** changes the audit characteristics of all the subdirectories in that directory. File audit characteristics are not changed.

–a Auditor-requested audit attributes are to be changed for the files or directories specified. If **–a** is not specified, user-requested audit attributes are changed.

–i Does not issue error messages concerning file access authority, even if **chaudit** encounters such errors.

The symbolic form of the *attr* argument has the form:

```
[operation]
op auditcondition[op auditcondition ...]
```

The *operation* value is any combination of the following:

r Sets the file to audit read attempts.
w Sets the file to audit write attempts.
x Sets the file to audit execute attempts.

The default is **rwx**.

The *op* part of a symbolic mode is an operator telling whether **chaudit** should turn file auditing on or off. The possible values are:

+ Turns on specified audit conditions.
- Turns off specified audit conditions.
= Turns on the specified audit conditions and turns off all others.

The *auditcondition* part of a symbolic mode is any combination of the following:

s Audit on successful access if the audit attribute is on.
f Audit on failed access if the audit attribute is on.

You can specify multiple symbolic *attr* values if you separate them with commas.

Examples

1. The command:

   ```
   chaudit –s file
   ```

   changes the file **file** so that successful file accesses are not audited.
2. The command:

   ```
   chaudit rwx=sf file1
   ```

changes the file **file1** so that all successful and unsuccessful file accesses are audited.

3. The command:

```
chaudit r=f file2
```

changes the file **file2** so that unsuccessful file read accesses are audited.

4. The command:

```
chaudit r-f,w+s file3
```

changes the file **file3** to not audit unsuccessful file read accesses and to audit successful write accesses.

Localization

chaudit uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to access a specified file
- Inability to change the audit attributes for a specified file
- Inability to not read the directory containing item to change
- Irrecoverable error when using the **–F** or **–d** option

2 Failure due to any of the following:
- Missing or incorrect *attr* argument
- Too few arguments

Messages

Possible error messages include:

fatal error during -F or -d option
You specified the **–F** or **–d** option, but some file or directory in the directory structure was inaccessible. This may happen because of permissions or because you have removed a removable unit.

read directory *name*
You do not have read permissions on the specified directory.

Portability

None. This is a security extension that comes with z/OS UNIX services.

Related information

chmod, **chown**, **ls**

chcp — Set or query ASCII/EBCDIC code pages for the terminal

Format

chcp [**–r** | **–q**]
chcp [**–s**] [**–a** *ASCII_cp*] [**–e** *EBCDIC_cp*]

Description

chcp sets, resets, or queries the current ASCII/EBCDIC code conversion in effect for the controlling terminal. Use it when the terminal requires ASCII data and the shell application uses EBCDIC. Do not use **chcp** if you are logged on through the TSO/E OMVS command. The _BPX_TERMPATH environment variable enables shell scripts to tell if the user logged on from TSO, rather from rlogin or telnet.

Options

–a *ASCII_cp*
: The name of the ASCII code page used by the terminal. EBCDIC data from the shell application is converted to this ASCII code page before it is sent out to the terminal. Data from the terminal is converted from this ASCII code page to EBCDIC before the application receives it.

  The name of the ASCII code page is case-sensitive.

  For a list of code pages supported by the shell, see *z/OS XL C/C++ Programming Guide*.

–e *EBCDIC_cp*
: The name of the EBCDIC code page used for this session. EBCDIC data from the shell application is converted from this EBCDIC code page to ASCII before it is sent out to the terminal. ASCII data from the terminal is converted to this EBCDIC code page before the application receives it.

  The name of the EBCDIC code page is case-sensitive.

  For a list of code pages supported by the z/OS shell, see *z/OS XL C/C++ Programming Guide*.

–q
: Queries the current ASCII and EBCDIC code pages for this terminal. The results are written to standard output. You cannot use any other options if you use the **–q** option.

–r
: Resets the ASCII/EBCDIC conversion for the terminal to the default code pages. The default ASCII code page is ISO8859-1, and the default EBCDIC code page is IBM-1047.

  You cannot use **–r** with any other options.

–s
: Specifies that the ASCII/EBCDIC conversion for the terminal is to use the code pages specified by the **–a** and **–e** options. You cannot use **–s** with any other options other than **–a** or **–e**. Either **–a** or **e** (or both) must also be specified if **–s** is used.

The **chcp** query output is written to standard output. For example, if you enter

```
chcp –q
```

You get the following output:

```
Current ASCII  code page = ISO8859-1
Current EBCDIC code page = IBM-1047
```

Examples

1. To set the ASCII and EBCDIC code pages to IBM-eucJP and IBM-939, enter:

   ```
   chcp –a IBM-eucJP –e IBM-939
   ```

2. To change just the EBCDIC code page to IBM-277, enter:

   ```
   chcp –seIBM-277
   ```

3. To change just the ASCII code page to IBM-850, enter:

   ```
   chcp –a IBM-850
   ```

4. To reset ASCII/EBCDIC code page conversion to the default code pages for this terminal, enter:

   ```
   chcp –r
   ```

5. To query the current ASCII and EBCDIC code pages for this terminal, enter:

   ```
   chcp –q
   ```

Usage notes

1. Do not use **chcp** when you are logged on from the TSO/E OMVS command because the OMVS command does not do any ASCII/EBCDIC code page conversion.

   Shell scripts can test the _BPX_TERMPATH environment variable and bypass **chcp** when the user is logged on through OMVS. (The _BPX_TERMPATH environment variable enables shell scripts to tell if the user logged on from TSO/E rather than from rlogin or telnet.)

   Before starting the session, the TSO/E OMVS command sets _BPX_TERMPATH to “OMVS”.

   Sample shell script code:

   ```
   #  ---------------------------------------------
   #  Issue chcp only if not using TSO/E OMVS command
   #  ---------------------------------------------

   if
   test "$_BPX_TERMPATH" != "OMVS"
   then
   chcp –a IBM-850 –e IBM-1047
   fi
   ```

2. After running **chcp –s** to change the EBCDIC code page for the session, you may also need to alter or set the following environment variables to match the new code page:
   - LANG
   - LC_ALL
   - LC_COLLATE
   - LC_CTYPE
   - LC_MESSAGES
   - LC_SYNTAX
   - NLSPATH

3. The code page names supplied with the **–a** and **–e** options are passed to **iconv_open()** without any uppercase or lowercase conversion. Code page converters that convert between the specified ASCII and EBCDIC code pages must be available for **iconv()**.

4. If ASCII/EBCDIC conversion is not active for this terminal, both the ASCII and EBCDIC code pages must be specified on the **chcp –s** command. At other times, omit **–a** when just the EBCDIC code page needs to be changed. Omit **–e** when just the ASCII code page needs to be changed.

5. All code pages with names not known to **chcp** are considered to be single-byte (SBCS) user-defined code pages. User-defined multibyte code pages are not supported.
6. **chcp** cannot check user-defined code page names to make sure that **–a** really specifies an ASCII code page and **–e** specifies an EBCDIC code page. In this case, specifying the wrong code pages may cause terminal input and output to be completely unreadable. It may also be impossible to enter any more shell commands.
7. **chcp** operates on the controlling terminal.
8. **chcp** should not be run as a background job.
9. The **–d** option specifies that special debugging information be printed. Specify this option only when requested by IBM.

Localization

chcp uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Incorrect command-line arguments or options

2 Any of the following errors:
- There is no controlling terminal.
- The controlling terminal does not support ASCII/EBCDIC code page conversion (the TSO/E OMVS command, for example).
- **iconv**_() fails when passed the code page names specified on the command line.
- **chcp** cannot build SBCS conversion tables using **iconv()** when required.
- An I/O error occurred on the controlling terminal.
- Either the **–a** or **–e** was omitted and the **chcp –s** command was run while the terminal code page conversion is in binary mode.

Portability

None. **chcp** is not described in any standard.

Related information

lm, **rlogin**

chgrp — Change the group owner of a file or directory

Format

chgrp [–fhR] *group pathname ...*

Description

chgrp sets the group ID to *group* for the files and directories named by the *pathname* arguments. *group* can be a group name from a group database, or it can be a numeric group ID (GID).

Rule: chgrp can be used only by the file owner or a superuser. The file owner must have the new group as his or her group or one of the supplementary groups.

chgrp also turns off the set-user-ID bit and set-group-ID bit of the named files and directories.

Options

–f Does not issue an error message if **chgrp** cannot change the group ID. In this case, **chgrp** always returns a status of `0`.

–h Does not attempt to follow the symbolic link (or external link), but instead makes changes to the symbolic link (or external link) itself.

–R If a *pathname* on the command line is the name of a directory, **chgrp** changes the group ID of all files and subdirectories in that directory. If **chgrp** cannot change some file or subdirectory in the directory, it continues to try to change the other files and subdirectories in the directory, but exits with a nonzero status.

Localization

chgrp uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

`0` You specified **–f**, or **chgrp** successfully changed the group ownership of all the specified files and directories.

`1` Failure due to any of the following:
- Inability to access a specified file
- Inability to change the group of a specified file
- An unrecoverable error was encountered when you specified the **–R** option

`2` Failure due to any of the following:
- The command line contained an unknown option or too few arguments
- **chgrp** did not recognize the specified *group*

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–f** and **–h** options are an extension of the POSIX standard.

Related information

chmod, **chown**

---

chlabel — Set the security label of files and directories

Format

chlabel [*–cqR*] [*–h* | *–L*] *seclabel pathname* ...

Description

chlabel sets the security label of the files and directories specified by *pathname*. Setting the security label is only allowed if the user has RACF SPECIAL authority, and no security label currently exists on the resource. Once a security label is set, it cannot be changed.

seclabel is a 1-8 character security label that corresponds to a RACF security level with a set of zero or more security categories. See *z/OS Planning for Multilevel Security and the Common Criteria* for restrictions on security label.

If **chlabel** could not set the security label for a file or object, it continues to try to change the other files but exits with a nonzero status.

When **–R** is specified, **chlabel** will not cross device boundaries from the directory specified by *pathname* unless the **–c** option is used.

Options

–c Cross device boundaries.

–h Does not follow the symbolic link (or external link), but instead makes changes to the symbolic link (or external link) itself. Cannot be used with **–L**.

–L Follow symbolic links. Cannot be used with **–h**.

–q Quiet mode. **chlabel** suppresses all warning messages. The condition that caused the warning does not affect the exit value.

–R **chlabel** sets the security label on all the file objects and subdirectories under the directory specified by *pathname*.

Usage notes

1. See *z/OS Planning for Multilevel Security and the Common Criteria* for more information about multilevel security, and security labels.
2. **chlabel** will not set the security label for a symbolic link, or for the file to which it points, unless either the **–h** or **–L** option is specified. If neither option is specified, **chlabel** prints a warning, continues to the next file and exits with a nonzero status.
3. **chlabel** is typically run to set up security labels on file systems before multilevel security is activated.
4. Only the zFS file system supports the setting of security labels.
5. The SECLABEL class must be active before the **chlabel** command will set a security label. If the SECLABEL class is not active, security labels will not be set.

Exit values

0 Successful completion

1 Failure due to any of the following reasons:
- The user does not have RACF SPECIAL authority
- The user specified a security label with more than 8 characters
- The file system does not support setting security labels
- The RACF SECLABEL class is not active

2 Command syntax error

3 One or more warnings occurred, due to any of the following:
- The path name already has a security label assigned
- A symbolic link was encountered, but neither **–h** nor **–L** was specified
- Device boundary not crossed

Examples

1. To set the security label TOPSEC for file "secret_file":
   ```
   chlabel  TOPSEC  secret_file
   ```
2. To set the security label SYSLOW for a symbolic link "mylink":
   ```
   chlabel  -h SYSLOW mylink
   ```
3. To set the security label l SYSLOW for the file to which the symbolic link "mylink" points:
   ```
   chlabel  -L SYSLOW mylink
   ```
4. To recursively set the security label SYSHIGH for all files, symbolic links, and subdirectories under the directory "Team":
   ```
   chlabel -Rh SYSHIGH  Team
   ```

chmod — Change the mode of a file or directory

Format

chmod [**–fhR**] *mode pathname*

Description

chmod changes the access permissions, or *modes,* of the specified file or directory. (Modes determine who can read, write, or search a directory or file.) Users with read access to SUPERUSER.FILESYS.CHANGEPERMS (a UNIXPRIV class profile), can use the **chmod** command to change the permission bits of any file.

Rule: chmod can be used only by the file owner or a superuser.

Options

–f Does not issue error messages concerning file access permissions, even if **chmod** encounters such errors.

–h Suppresses a mode change for the file or directory pointed to by the encountered symbolic link (or external link). Symbolic link (or external link) permissions cannot be changed on a z/OS system.

–R Recursively change file mode bits. For each path name operand that names a directory, **chmod** will change the file mode bits of the directory and all files in the file hierarchy below it.

chmod never changes the permissions of symbolic links (or external links), because, on a z/OS system, the permissions on symbolic links (and external links) are never used. When **-h** is not specified, and symbolic links (or external links) are specified or encountered during the file hierarchy traversal, the links are followed, and the resolved directory (and files and subdirectories) are changed.

You can specify the *mode* value on the command line in either symbolic form or as an octal value.

The symbolic form of the *mode* argument has the form:

```
[who] op permission[op permission ...]
```

The *who* value is any combination of the following:

u Sets owner (user or individual) permissions.

g Sets group permissions.

o Sets other permissions.

a Sets all permissions; this is the default. If a *who* value is not specified, the default is **a**, modified by **umask**.

The *op* part of a symbolic mode is an operator that tells **chmod** to turn the permissions on or off. The possible values are:

+ Turns on a permission.
- Turns off a permission.
= Turns on the specified permissions and turns off all others.

The *permission* part of a symbolic mode is any combination of the following:

r Read permission. If this is off, you cannot read the file.

x Execute permission. If this is off, you cannot run the file.

X Execute or search permission for a directory; or execute permission for a file only when the current mode has at least one of the execute bits set.

w Write permission. If this is off, you cannot write to the file.

s If in owner permissions section, the *set-user-ID* bit is on; if in group permissions section, the *set-group-ID* bit is on.

A superuser or the file owner can use a **chmod** command or chmod() function to change two options for an executable file. The options are set in two file mode bits:

- *Set-user-ID* (S_ISUID) with the setuid option
- *Set-group-ID* (S_ISGID) with the setgid option

If one or both of these bits are on, the effective UID, effective GID, or both, plus the saved UID, saved GID, or both, for the process running the program are changed to the owning UID, GID, or both, for the file. This change temporarily gives the process running the program access to data the file owner or group can access.

In a new file, both bits are set off. Also, if the owning UID or GID of a file is changed or if the file is written in, the bits are turned off. In shell scripts, these bits are ignored.

If the RACF profile named FILE.GROUPOWNER.SETGID exists in the UNIXPRIV class, then the *set-group-ID* bit for a directory determines how the group owner is initialized for new objects created within the directory:

- If the set-gid bit is on, then the owning GID is set to that of the directory.
- If the set-gid bit is off, then the owning GID is set to the effective GID of the process.

t This represents the sticky bit. For a file, the sticky bit causes a search for the program in the user's STEPLIB, the link pack area, or link list concatenation. For a directory, the sticky bit allows files in a directory or subdirectories to be deleted or renamed only by the owner of the file, by the owner of the directory, or by a superuser.

You can specify multiple symbolic names if you separate them with commas.

Absolute modes are octal numbers specifying the complete list of attributes for the files; you specify attributes by ORing together these bits.

```
4000   Set-user-ID bit
2000   Set-group-ID bit
1000   Sticky bit
0400   User read
0200   User write
0100   User execute (or list directory)
0040   Group read
0020   Group write
0010   Group execute
0004   Other read
0002   Other write
0001   Other execute
```

Examples

1. To remove write permission from **orgcht**:

   ```
   chmod –w orgcht
   ```

2. To turn on read, write, and execute permissions, and turn off the set-user-ID bit, set-group-ID bit, and sticky bit attributes. This is equivalent to `chmod 0777 aprsal`:

   ```
   chmod a=rwx aprsal
   ```

3. To set all permission bits on (anyone can read/write/execute):

   ```
   chmod 777 scratch
   ```

4. To set user (owner) executable permission bit on:

   ```
   chmod u+x file
   ```

5. To set group read / write permission bits:

   ```
   chmod g+rw file
   ```

6. To set other write permission off on 2 files:

   ```
   chmod o-w file1 file2
   ```

7. To set group read/write/execute permissions on the directory /public/teamdir and all its files and subdirectories:

   ```
   chmod -R g+rwx /public/teamdir
   ```

8. To set group read/execute on, group write off on /u/ateam/pgm:

   ```
   chmod g=rx /u/ateam/pgm
   ```

Localization

chmod uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**

- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to access a specified file
- Inability to change the modes on a specified file
- Inability to read the directory containing the item to change
- An unrecoverable error was encountered when using the **–R** option

2 Failure due to any of the following:
- Missing or incorrect *mode* argument
- Too few arguments

Messages

Possible error messages include:

function not implemented
This error may occur if the directory is under automount control.

irrecoverable error during –R option
The **–R** option was specified, but some file or directory in the directory structure was inaccessible. This may happen because of permissions.

read directory *name*
Read permissions are not on the specified directory.

Portability

POSIX.2, X/Open Portability Guide.

The **–f** and **–h** options and the **t** permission are extensions of the POSIX standard.

Related information

ls, **setfacl**, **umask**

chmount — Change the mount attributes of a file system

Format

chmount [**–DRrsw**] [**-d***sysname*] [**–d** *destsys*] [**–a**
yes | **no** | **unmount** | **include,***sysname1,...,sysnameN* | **exclude,***sysname1,...,sysnameN*]
pathname...

Description

The **chmount** shell command, located in **/usr/sbin**, changes the mount attributes of a specified file system.

Rule: A **chmount** user must have UID(0) or at least have READ access to the SUPERUSER.FILESYS.MOUNT resource found in the UNIXPRIV class.

Options

–a yes | no | unmount | include,*sysname1,...,sysnameN* **| exclude,***sysname1,...,sysnameN*
The **-a** option specifies the AUTOMOVE attribute of the file system in a sysplex environment where systems are exploiting the shared file system capability.

–a yes allows the system to automatically move logical ownership for a specified file system as needed. This is the default.

–a no prevents ownership movement in some situations.

–a umount unmounts the file system in some situations.

–a include,*sysname1,...,sysnameN* specifies a list of systems, in priority order, to which the file system's ownership can be moved. **include** can be abbreviated to **i**.

–a exclude,*sysname1,...,sysnameN* specifies a list of systems, in priority order, to which the file system's ownership cannot be moved. **exclude** can be abbreviated to **e**.

See the data movement section in *z/OS UNIX System Services Planning* for details about the behavior of the AUTOMOVE options.

–D Reassigns logical ownership of a file system to any available file system participating in shared file system.

–d *destsys*
To designate a specific reassignment, use **–d** *destsys*, where *destsys* becomes the logical owner of a file system in a shared file system environment.

–R Changes the attributes of a specified file system and all file systems mounted below it in the file system hierarchy.

–r Switches the specified file system to read-only mode.

–s Remounts the specified file system but does not change the current mode.

–w Switches the specified file system to read-write mode.

pathname... specifies the path names to use for locating the file systems that need attributes changed.

Examples

To move ownership of the file system that contains **/u/wjs** to SY1:

```
chmount -d SY1 /u/wjs
```

Usage notes

Because the path name for **chmount** and **unmount** is a node, symbolic links cannot be followed unless a trailing slash is added to the symbolic link name. For example, if **/etc** has been converted into a symbolic link, **/etc -> $SYSNAME/etc**, issuing **chmount -w /etc** without the trailing slash will result in trying to **chmount -w /etc -> $SYSNAME/etc**. Depending on the security access for the symbolic link, RACF errors might occur. However if you specify **chmount -w /etc/** with the trailing slash, the symbolic link will be followed and RACF will determine the access from the file being linked to.

Exit values

0 Successful completion

Related information

mount, unmount

---

chown — Change the owner or group of a file or directory

Format

chown [**–fhR**] *owner*[**:***group*] *pathname ...*

Description

chown sets the user ID (UID) to *owner* for the files and directories named by *pathname* arguments. *owner* can be a user name from the user data base, or it can be a numeric user ID. (If a numeric owner exists as a user name in the user data base, the user ID number associated with that user name is used.) If there is no change to the UID, then specify **– – –1**.

If you include a *group* name (that is, if you specify *owner* followed immediately by a colon (**:**) and then *group* with no intervening spaces, such as *owner*:*group*) **chown** also sets the group ID (GID) to *group* for the files and directories named. *group* can be a group name from the security facility group data base, or it can be a numeric group ID. If a numeric group exists as a group name in the group data base, the group ID number associated with that group is used. If there is no change to the GID, then specify **–1** (or do not specify the *:group*).

Restriction: Only a superuser can change the UID. To change the GID, you must either be a superuser, or the effective user ID of the process must be equal to the user ID of the file owner, and the owner argument is also equal to the user ID of the file owner or **–1**, and the group argument is the calling process's effective group ID or one of its supplementary group IDs.

chown also turns off the set-user-ID bit and set-group-ID bit of the named files and directories.

For additional information related to **chown** usage, see the description of the UNIXPRIV class profiles CHOWN.UNRESTRICTED and SUPERUSER.FILESYS.CHOWN in *z/OS UNIX System Services Planning*.

Options

–f Does not issue an error message if **chown** cannot change the owner. In this case, **chown** always returns a status of zero. Other errors may cause a nonzero return status.

–h Does not attempt to follow the symbolic link (or external link), but instead makes the changes on the symbolic link (or external link) itself.

–R If *pathname* on the command line is the name of a directory, **chown** changes all the files and subdirectories in that directory to belong to the specified *owner* (and *group*, if *:group* is specified).

If a symbolic link is specified or encountered during the traversal of a file hierarchy, **chown** changes the directory referenced by the symbolic link and all files in the file hierarchy below it.

If **chown** cannot change some file or subdirectory in the directory, it continues to try to change the other files and subdirectories in the directory, but exits with a nonzero status.

Localization

chown uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 You specified **–f**, or **chown** successfully changed the ownership of all the specified files and directories.

1 Failure due to any of the following:
- Inability to access a specified file.
- Inability to change the owner of a specified file.
- Inability to read the directory containing the directory entry of the file.
- An irrecoverable error was encountered when using the **–R** option.

2 Failure due to any of the following:
- The command line contained an incorrect option.
- The command line had too few arguments.
- An owner was specified with a user ID that the system did not recognize.

Messages

function not implemented
This error may occur if the directory is under automount control.

Portability

POSIX.2, UNIX systems.

The **–f** and **–h** options are an extension of the POSIX standard.

Related information

chgrp, **chmod**

chroot — Change the root directory for the execution of a command

Format

chroot *directory command*

Description

If you have appropriate privileges, the **chroot** command changes the root directory to the directory specified by the directory parameter of a specific command. The new root directory will also contain its children.

Rule: In order to use **chroot**, you must either be a superuser (UID=0), or have READ permission to the BPX.SUPERUSER resource profile in the FACILITY class.

The directory path name is always relative to the current root. If a nested **chroot** command is in effect, the directory path name is still relative to the current (new) root of the running process.

In order for your process to operate properly after the **chroot** is issued, you need to have in your new root all the files that your program depends on. For example, if your new root is **/tmp** and you issue an **ls**, you will get a not found error. To use **ls** with **/tmp** as your new root, you will need a **/tmp/bin** with **ls** in it before you issue the **chroot** command.

In addition, utilities that depend on locale-sensitive files (**/usr/lib/nis/***) may be unsuccessful if these files are not in the new root file system.

After **chroot** is issued, your current working directory is the new root (directory), **chroot** does not change environment variables.

directory
Specifies the new root directory

command
Specifies a command to run with the **chroot** command

Examples

1. To run the **ls** command with the **/tmp** directory as the root file system, enter:

   ```
   mkdir /tmp/bin
   cp /bin/ls /tmp/bin
   chroot /tmp ls
   ```

2. To run a child shell with another file system as the root file system (assuming that **/tmp** is the mount point of a file system), enter:

   ```
   mkdir /tmp/bin
   cp /bin/sh /tmp/bin
   chroot /tmp sh       or      chroot /tmp /bin/sh
   ```

   This makes the directory name / (slash) refer to the **/tmp** for the duration of the **/bin/sh** command. It also makes the original root file system inaccessible. The file system on the **/tmp** file must contain the standard directories of a root file system.

   Running the **sh** command creates a child shell that runs as a separate process from your original shell. Press the END OF FILE (Crtl-D) key sequence or type exit to end the child shell and go back to where you were in the original shell. This restores the environment of the original shell, including the meanings of the . (current directory) and the / (root directory).

3. To create a file relative to the original root, not the new one, enter:

   ```
   chroot Directory Command > file
   ```

   For example, `chroot /tmp ls > /bin/file` will create the file in **/bin/file**.

   Note: Redirection is handled by the current shell before **chroot** is executed.

4. To create a file relative to the new root, enter:

   ```
   chroot Directory 'Command > file'
   ```

   For example, `chroot /tmp 'ls > /bin/file'` will create the file in **/tmp/bin/file**.

5. Examples of how the current root changes:

```
Given the standard directories of the file system plus:

# echo $PATH
/bin
# ls /tmp/bin
bin file2 sh
# ls /tmp/bin/bin
file1 sh

# whence file2
#
# whence file1
#

# chroot /tmp 'whence file1'
#
# chroot /tmp 'type file2'
/bin/file2

# chroot /tmp/bin 'type file1'
/bin/file1
```

Exit values

0 The command completed successfully

1 Failure due to any of the following:
- **chroot** seteuid failed
- User not authorized to issue **chroot**

2 Failure due to any of the following:
- Cannot **chdir** to directory specified
- **chroot** cannot change root
- Unable to execute the shell
- Incorrect command syntax

If the SHELL environment variable is set, **chroot** uses its value to invoke the shell.

chtag — Change file tag information

Format

chtag –b | **–r** [**–hqRv**] *pathname...*
chtag –c *codeset* [**–hqRv**] *pathname...*
chtag –m | **–t** [**–c** *codeset*] [**–hqRv**]*pathname...*
chtag –p [**–hqRv**]*pathname...*

Rule: You must have write permission to the file or be a superuser in order to use **chtag**.

Description

chtag allows you to set, modify, remove, or display information in a file tag. A file tag is composed of a text flag (txtflag) and a coded character set:

codeset
Represents the coded character set in which text data is encoded. The code set can be used for uniformly encoded text files or files that contain mixed text/binary data.

txtflag Indicates whether or not a file contains uniformly encoded or non-uniformly encoded text data.

```
txtflag = ON indicates the file has uniformly encoded text data
txtflag = OFF indicates the file has non-uniformly encoded text data
```

Only files with txtflag = ON and a valid code set are candidates for automatic conversion. If txtflag = OFF and a code set is associated with it, automatic conversion will not take effect. However, user applications can take advantage of the associated code set information and perform code set conversion by themselves.

For information about enabling automatic conversion, see the section on using enhanced ASCII functionality in *z/OS UNIX System Services Planning*.

Options

–b Indicates that the file contains only binary (non-uniformly encoded) data. Automatic conversion is disabled with this option.

–b is mutually exclusive with the **–c, –m, –t,** or **–r** options.

–c *codeset*
Allows the user to modify the coded character set associated with the file. *codeset* can be a code set name known to the system or the numeric coded character set identifier (CCSID). If a code set name exists, the numeric CCSID associated with that name is used. **–c** is mutually exclusive with the **–r** and **–b** options. Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names.

Modifying the code set associated with an untagged file without specifying **-t** causes the file to be marked as "mixed".

–h Does not change file tag information if the file is a symbolic link or an external link.

–m Indicates that the file contains mixed text and binary data. The data is not uniformly encoded, but to identify the encoding of portions of the file that are text, this option allows the specifications of a code set with the **–c** option. This option sets txtflag = OFF. When used without **–c**, the existing coded character set that is associated with the file is retained.

Automatic conversion is disabled with this option. However, user applications can independently convert any text data residing in the file by knowing the code set associated with it. **–m** is mutually exclusive with the **–b, –t** and **–r** options.

Specifying **-m** without **-c** on an untagged file will not have any effect on the tagging of the file.

–p Prints file tag information associated with a file. If a code set name is not associated with the numeric CCSID in the file tag, the numeric CCSID is presented instead.

The following example is a sample of the output you might see:

```
t   IBM-1047    T=on    file1
-   untagged    T=on    file2
b   binary      T=off   file3
m   ISO-8859-1  T=off   file4
-   untagged    T=off   file5
b   binary      T=on    file6
```

where:
t Text

b Binary
m Mixed

Note: Code sets that are aliases of each other exist, which might cause the test to fail because the file inquiry operator might return an alias of the code set you are testing.

–q Suppresses warning messages.

–r Removes any tagging information associated with the file and sets the status of the file to "untagged". This option disables automatic conversion for the files. **–r** is mutually exclusive with the **–b, –c, –m,** and **–t** options.

–R Recursively changes the file tag information. For each *pathname* operand that names a directory, **chtag** changes the file tag information about all of the files in the file hierarchy below it. When **–h** is not specified, and symbolic links (or external links) are specified or encountered during the file hierarchy traversal, the links are followed, and the resolved file (or files in the directory) are changed.

–t Indicates that the specified file contains pure (uniformly encoded) text data. Used alone, this option sets txtflag = ON and retains the existing coded character set associated with the file. To set or change the code set, use the **–c** option. Files that are tagged with this option and contain a valid code set are candidates for automatic conversion. **–t** is mutually exclusive with the **–b, –m,** and **–r** options.

–v Gives verbose output. Displays what state the file tag is currently in, and what state the user is trying to change it to. This option is only useful for the **–t, –b, –m, –r** and **–c** options. Output will be displayed in the following format:

```
txtflag  Char Set  Char Set ---> txtflag  Char Set  Char Set  Filename
         Name      Type                   Name      Type
```

If a code set name is not associated with the numeric CCSID in the file tag, the numeric CCSID is presented instead. The following example is a sample of the output you might see:

```
chtag -mvc IBM-1047 file3.c
t   ISO-8859  A --->  m  IBM-1047 E file3.c
```

where:
A ASCII
E EBCDIC
? Unknown

Examples

1. To specify a text file with IBM-1047 code set, issue:

   ```
   chtag -tc IBM-1047 filename
   ```

2. To specify a binary file, issue:

   ```
   chtag -b filename
   ```

3. To specify a file of mixed binary and text data, with a new code set of ISO8859-1, issue:

   ```
   chtag -mc ISO8859-1 filename
   ```

4. To remove the tag from a file issue:

```
chtag -r filename
```

Usage notes

1. Table 5 illustrates how the different combinations of txtflag and coded character set / CCSID affect a file's candidacy for automatic conversion. **txtflag** indicates whether this field is turned ON, OFF, binary or untagged. **Coded character set / CCSID** indicates whether the stored coded character set is valid, invalid, or does not exist. **Candidate for automatic conversion** indicates whether this file is a candidate for automatic conversion.

Table 5. Possible txtflag / CCSID combinations

txtflag	Coded character set / CCSID	Candidate for automatic conversion
t (on)	Defined	Yes (text file)
t (off)	Defined	No
b (off)	—	No
m (off)	Defined	No (mixed data)
— (off)	—	No

2. The tagging of the following files is ignored:
   - `/dev/null`
   - `/dev/random`
   - `/dev/urandom`
   - `/dev/zero`

Exit values

0 Successful completion

1 **chtag** failed to change the tag of a specified file for the following reasons:
- Calling process does not have appropriate privileges to change file attributes
- An invalid txtflag / coded character set combination was issued

2 Incorrect command line syntax

Related information

iconv, **ls**

cksum — Calculate and display checksums and byte counts

Format

cksum [**–ciprtT**] [*file ...file ...*]

Description

cksum calculates and displays a checksum for each input *file*. A *checksum* is an error-checking technique used by many programs as a quick way to compare files that have been moved from one location to another to ensure that no data has been lost. It also displays the number of 8-bit bytes in each *file*.

If you do not specify any files on the command line, or if you specify – as the file name, **cksum** reads the standard input (**stdin**).

When _UNIX03 is YES, the **cksum** output has the space-separated form:
checksum bytecount filename

When _UNIX03 is unset or not YES, the **cksum** output has the tab-separated form:
checksum bytecount filename

If the *file* operand is not specified, the path name and its leading white space is omitted.

Read error messages are controlled by the _UNIX03 variable.

- If **cksum** fails with a read error and _UNIX03 is YES, it sends a diagnostic message to standard error, and does not show a checksum for that file.
- If _UNIX03 is unset or not YES, **cksum** displays the checksum up to that point and marks the output line with FSUM6199 [read error].

cksum continues processing files in either case.

All other error messages are sent to standard error (stderr).

Options

cksum can calculate checksums in a variety of ways. The default is compatible with the POSIX standard. You can specify other algorithms with the following options. The POSIX standard does not recognize these algorithms; they are provided for compatibility with the UNIX **sum** command.

–c Uses a standard 16-bit cyclic redundancy check (CRC-16).

–i Uses the CCITT standard cyclic redundancy check (CRC-CCITT). Data communication network protocols often use a cyclic redundancy check to ensure proper transmission. This algorithm is more likely to produce a different sum for inputs—the only difference is byte order.

–p Uses the POSIXchecksum algorithm. This is the default.

–r Enables the use of an alternate checksum algorithm that has the advantage of being sensitive to byte order.

–t Produces a line containing the total number of bytes of data read as well as the checksum of the concatenation of the input files.

–T Enables the autoconversion of tagged files.

Localization

cksum uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TYPE**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Environment variables

- **_UNIX03**

For more information about the effect of _UNIX03 on the **cksum** command, see Appendix N, “Shell commands changed for UNIX03,” on page 1039.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to open input file
- An error reading the input file
- Error turning off the autoconversion of the input file

2 Unknown command-line option

Portability

POSIX.2, X/Open Portability Guide.

All the listed options are extensions of the POSIX standard.

Related information

cmp, **diff**, **ls**, **sum**, **wc**

clear — Clear the screen of all previous output

Format

clear

Description

The **clear** command clears the screen of all output and places the cursor at the top of the screen.

Localization

clear uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Environment variables

clear uses the following environment variables:

TERM Contains the current terminal type.

TERMINFO
Contains the terminal information database, if different than the default.

Exit values

0 Successfully cleared the screen according to the current terminal's characteristics.

1 The terminal definition does not define a "clear" capability.
2 Syntax error.
3 The terminal definition specified by TERM is invalid.
4 Invalid terminfo capability.

Related information

tput

---

cmp — Compare two files

Format

cmp [**–Bblsx**] [**-W** *option*[,*option*]...] *file1 file2* [*seek1* [*seek2*]]

Description

cmp compares two files. If either file name is –, **cmp** reads the standard input (stdin) for that file. By default, **cmp** begins the comparison with the first byte of each file. If you specify either *seek1* or *seek2* (or both), **cmp** uses it as a byte offset into *file1* or *file2* (respectively), and comparison begins at that offset instead of at the beginning of the files. The comparison continues, one byte at a time, until a difference is found. At that point, the comparison ends and **cmp** displays the byte and line number where the difference occurred. **cmp** numbers bytes and lines beginning with 1.

Options

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–b Compares single blocks at a time. Typically, **cmp** reads large buffers of data into memory for comparison.

–l Causes the comparison and display to continue to the end. However, **mp** does not attempt any resynchronization. **cmp** displays the byte number (in decimal) and the differing bytes (in octal format) for each difference found.

–s Suppresses output and returns a nonzero status if the files are not identical.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable

indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

–x Displays the differing bytes shown by the **–l** option in hexadecimal format. Typically, **cmp** displays them in octal format.

Examples

1. To compare two files and display the first byte and line number of the difference:

   ```
   cmp myFile01 myFile02
   ```

2. To compare two text files containing ASCII characters and display all the differences by byte number and octal byte format in EBCDIC, assuming that:
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are displaying an untagged public text file or a read-only text file):

   ```
   cmp -l -W filecodeset=ISO8859-1,pgmcodeset=IBM-1047 myAsciiFile01 myAsciiFile02
   ```

3. To compare two files and display the first byte and line number of the difference, assuming that automatic conversion has been enabled but the files are incorrectly tagged as UTF-8:

   ```
   cmp -B myMisTaggedFile01 myMisTaggedFile02
   ```

Localization

cmp uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

cmp uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 The files were identical
1 The files were not identical
2 Failure due to any of the following:
- The command-line option is not correct.
- The code set is not valid.

3 Failure due to any of the following:
- An error opening or reading an input file
- Could not turn off automatic conversion
- Could not perform requested text conversion

Messages

Possible error messages include:

EOF on *filename*
cmp reached the end of the file on the specified file before reaching the end of the file on the other file.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–B**, **–b**, **–W** and **–x** options and the *seek* pointers are extensions of the POSIX standard.

Related information

comm, **diff**, **uniq**

col — Remove reverse line feeds

Format

col [**–bfpx**] [*file ...*]

The **col** utility is fully supported for compatibility with older UNIX systems. However, because it is no longer supported by POSIX.2 IEEE standard 1003.2-1992, this utility should be avoided for applications intended to be portable to other UNIX-branded systems.

Description

col processes control characters for vertical line feeds and writes the processed text to the standard output. If you do not specify any files, **col** reads from the standard input (stdin). Otherwise, **col** will read and process each specified file in sequence. It is intended to be used as a filter between a program such as **nroff** and an output device that cannot handle reverse line feeds.

Where possible, blank characters (spaces) are converted to tabs; tab stops are assumed to be every eight characters.

col also removes all escape sequences except for those shown in the following list. ESC is the ASCII escape character, octal code 033.

Character
: **ASCII control character**

Backspace
: 010

Carriage-return
: 015

Newline
: 012

Vertical Tab
: 013

SO 016

SI 017

Space 040

Tab 011

Reverse line feed
: ESC-7

Reverse half-line feed
: ESC-8

Forward half-line feed
: ESC-9

The ASCII control characters SO and SI denote the beginning and end of text in an alternative character set. The set of each input character is remembered. **col** generates SO and SI characters as needed to output each character in the correct character set.

Options

–b Ignores backspace (**CRTL-H**) characters. If two characters are supposed to appear in the same space, the first character is ignored and the second is output.

–f Allows forward half-line motions. Typically, these are changed to forward full-line motions.

–x Prevents conversion of spaces to tab characters.

Localization

col uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Usage notes

1. Because **col** ignores vertical motions that back up over the first line, you might get unexpected results if the first line contains superscripts.
2. Because **–f** allows escape sequences, it might cause unexpected results on terminals.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Incorrect command-line option
- Insufficient memory

Portability

UNIX systems.

This implementation does not handle double-byte characters.

: (colon) — Do nothing, successfully

Format

: [*argument ...*]

tcsh shell: **:**

Description

The **:** (colon) command is used when a command is needed, as in the **then** condition of an **if** command, but nothing is to be done by the command. This command simply yields an exit status of zero (success). This can be useful, for example, when you are evaluating shell expressions for their side effects.

colon is a special built-in shell command.

In the tcsh shell, **colon** performs as indicated for the z/OS version of : (colon).

Examples

```
: ${VAR:="default value"}
```

sets *VAR* to a default value if and only if it is not already set.

Localization

colon uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

Because this command always succeeds, the only possible exit status is:

0 Successful completion

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

sh, **tcsh**, **true**

---

comm — Show and select or reject lines common to two files

Format

comm [**–B123**] [**-W** *option*[,*option*]...] *file1 file2*

Description

comm locates identical lines within files sorted in the same collating sequence, and produces three columns; the first contains lines found only in the first file, the second lines only in the second file, and the third lines that are in both files. If you specify - in place of either *file1* or *file2*, **comm** reads from the standard input (stdin).

Options

–1 Suppresses lines that appear only in *file1*

–2 Suppresses lines that appear only in *file2*

–3 Suppresses lines that appear both in *file1* and *file2*

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command

`iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

The options suppress individual columns. Thus, to list only the lines common to both files, use:

```
comm -12
```

To find lines unique to one file or the other, use:

```
comm -3
```

Observe that `comm -123` displays nothing.

Examples

1. To display the lines that are unique to each text file and the lines that are common to both text files:

```
comm myFile01 myFile02
```

2. To display the lines that are unique to a text file containing UTF-8 characters, assuming that
   - The text files are untagged and you do not want to tag them or enable automatic conversion, and
   - You cannot alter the tag (for example, you are comparing untagged public text files or read-only text files)

   then issue:

   ```
   comm -23 -W filecodeset=UTF-8,pgmcodeset=IBM-1047 myUtf8File01 myUtf8File02
   ```
3. To display the lines that are common to both text files containing EBCDIC characters, assuming that automatic conversion has been enabled but the files are incorrectly tagged as ASCII:

   ```
   comm -12 -B myMisTaggedFile01 myMisTaggedFile02
   ```

Localization

comm uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

comm uses the following environment variable:

_TEXT_CONV
: Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 Successful completion

1 Failure due to any of the following:
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

2 Failure that generated a usage message, such as naming only one input file

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–B** and **-W** options are extensions of the POSIX standard.

Related information

cmp, **diff**, **sort**, **uniq**

command — Run a simple command

Format

command [**–p**] *command-name* [*argument*...]

command [**–V**|**–v**] *command-name*

Description

command causes the shell to suppress its function lookup and execute the given *command-name* and arguments as though they made up a standard command line. In most cases, if *command-name* is not the name of a function, the results are the same as omitting **command**. If, however, *command-name* is a special built-in command, (see **sh**), some unique properties of special built-in commands do not apply:

- A syntax error in the command does not cause the shell running the command to stop.
- Variable assignments specified with the special built-in command do not remain in effect after the shell runs the command.

Options

–p Searches for *command-name* using the system default **PATH** variable.

–v Writes a string indicating the path name or command that the shell uses to invoke *command-name*.

–V Writes a string indicating how the shell interprets *command-name*. If *command-name* is a command, a regular built-in command, or an implementation-provided function found using the PATH variable, the string identifies it as such and includes the absolute path name. If *command-name* is an alias, function, special built-in command, or reserved word, the string identifies it as such and includes its definition if it is an alias. If the command is a tracked alias, the string identifies it as *cached*.

Examples

Typically, you use **command** when you have a command that might have the same name as a function. For example, here's a definition of a **cd** function that not only switches to a new directory but also uses **lc** to list the contents of that directory:

```
function cd {
    command cd $1
    lc
}
```

Inside the function, use **command** to get at the real **cd**. Otherwise, the **cd** function would call itself in an infinite recursion.

Localization

command uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Usage notes

command is a built-in shell command.

Exit values

If you specified **–v**, possible exit status values are:

0 Successful completion
1 **command** could not find *command-name*, or an error occurred
2 Failure due to incorrect command-line argument

If you did not specify **–v**, possible exit status values are:

126 **command** found *command-name*, but failed to invoke it.
127 An error occurred in the command or it could not find *command-name*.

Otherwise, the exit status of **command** is the exit status of *command-name*.

Portability

POSIX.2.

Related information

sh

compress — Lempel-Ziv file compression

Format

compress [**–cDdfVv**] [**–b** *bits*] [*file ...*]

Description

compress compresses each input file using Lempel-Ziv compression techniques. If you do not specify any input files, **compress** reads data from standard input (**stdin**) and writes the compressed result to standard output (**stdout**).

The output files have the same names as the input files but with a **.Z** suffix. For example, **abc** is compressed into **abc.Z**. If the **.Z** file already exists and you did not specify the **–f** option, **compress** gives an error and asks whether it should overwrite the existing file.

compress uses the modified Lempel-Ziv algorithm described in *A Technique for High Performance Data Compression*, Terry A. Welch, *IEEE Computer,* vol. 17, no. 6 (June 1984), pp.8-19. **compress** first replaces common substrings in the file by 9-bit codes starting at 257. After it reaches code 512, **compress** begins with 10-bit codes and continues to use more bits until it reaches the limit set by the **–b** option.

After attaining the bits limit, **compress** periodically checks the compression ratio. If it is increasing, **compress** continues to use the existing code dictionary. However, if the compression ratio decreases, **compress** discards the table of substrings and rebuilds it from scratch. This allows the algorithm to compensate for files, such as archives, where individual components have different information content profiles.

Options

–b *bits* Limits the maximum number of bits of compression to *bits*. The value *bits* can be an integer from 9 to 16. The default is 16.

–c Writes the output to **stdout**. When you use this option, you can only specify one file on the command line.

–D Allows an extra degree of compression to be done for files such as sorted dictionaries where subsequent lines normally have many characters in common with the preceding line.

–d Decompresses argument files instead of compressing them. This works by overlaying the **compress** program with the **uncompress** program. For this to work, **uncompress** must be available somewhere in your search path (given by the **PATH** environment variable). Decompressing files this way is slower than calling **uncompress** directly.

–f Forces compression even if the resulting file is larger or the output file already exists. When you do not specify this option, files which are larger after compression are not compressed. **compress** does not print an error message if this happens.

–V Prints the version number of **compress**.

–v Prints statistics giving the amount of compression achieved. Statistics give the name of each file compressed and the compression ratio, expressed as a percentage. If the file resulting from compression is larger than the original, the compression ratio is negative.

Localization

compress uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to one of the following:
- Missing number of bits after the **–b** option
- Incorrect number of bits specified
- Failed to execute **uncompress**
- Unknown option
- Dictionary option —same count of string exceeded
- Output path or file name too long
- Cannot stat file
- Argument file not a regular file: unchanged
- Argument file has other links: unchanged
- No space for compression tables

2 One or more files were not compressed because the compressed version was larger than the original

Limits

This implementation of **compress** is limited to a maximum of 16-bit compression.

Portability

A binary-compatible version of **compress** with more options is often found on UNIX systems.

The **–D** option is an extension to traditional implementations of **compress**. The **–D**, **–d** and **–V** options are extensions of the POSIX standard.

For portability, you should restrict the number of bits in the code (**–b** option) to a value between 9 and 14.

Related information

cpio, **pack**, **pax**, **tar**, **uncompress**, **unpack**, **zcat**

confighfs — Invoke the vfs_pfsctl function for HFS file systems

Format

confighfs [**–l**] [**–v n**] [**–f n**] [**–q**] [**pathname**] [**–x**[**n**] **size pathname**]

Note: The **l** option signifies a lowercase **L**, not an uppercase **i**.

Description

confighfs gives interactive shell users the ability to invoke the vfs_pfsctl function. The vfs_pfsctl function is used to pass control information to the PFS (physical file system). For more information about vfs_pfsctl, see the *z/OS UNIX System Services File System Interface Reference*. Detailed information about its use can be found in *z/OS DFSMS Using Data Sets*.

confighfs resides in the following directory: **/usr/lpp/dfsms/bin/**. This directory is not part of the default search path definition. Therefore, the directory must be included in the command specification when invoking the command.

Restriction: You can only use the **confighfs** command when working with the DFSMS file system (HFS).

For the zFS file system, use the zfsadmn command. For more information about the zFS file system, see *z/OS Distributed File Service zFS Administration*.

Options

–l Query HFS limits.

Note: **l** signifies a lowercase **L**, not an uppercase **i**.

–v n Set virtual storage max to n (where n is in MB). Requires superuser authority.

–f n Set fixed storage min to n (where n is in MB). Requires superuser authority.

–q Query your global statistics.

pathname
Query file system statistics for the file system containing each of the path names specified.

–x *size pathname*
Extend the specified file system, where size is the amount to be extended suffixed by the extend unit of M, T, or C (for megabytes, tracks, or cylinders), and the path name is a full or simple path name to a file or directory in the file system to extend. Requires superuser authority.

–xn *size pathname*
Extend the specified file system to a new volume using the **-x** rules. Requires superuser authority.

The following are internal debug options:

–dn Prints incoming and outgoing pfsctl buffers (where n is 0, 1, or 2).

–t Skips issuing the pfsctl.

Examples

Restriction: On systems running shared file systems, this command should only be issued on the server system (file system owner) for the file system pointed to by the path name. Issuing it on client systems results in fields of zeros.

1. To set virtual and fixed buffer limits for the HFS file system:
   ```
   > confighfs –v 128 –f 32
   ```
2. To extend the file system for your current directory 100 cylinders:
   ```
   > confighfs –x 100c .
   ```
3. If you need to get statistics for the root file system and the file system mounted over **/tmp**, you would do the following:
   ```
   > confighfs / /tmp .
   ```

   Note: The **.** (period) in examples two and three indicates the current directory.

Usage notes

1. If the HFS file system encounters an out of space condition during SYNC processing producing message IGW022S, then the following can result:
   a. If **confighfs** is used to successfully extend the file system (by specifying **confighfs -x** *size pathname*, for example) and the extent was large enough to accommodate the pages required to complete the SYNC processing, **confighfs** invokes the SYNC function again to complete its update and then resets the `Out of Space` error flag. It will no longer be necessary to unmount and remount the file system to use it further. After the error flag is reset, all file system functions will work properly again.
   b. If the extend size is not large enough to provide the amount of space required to complete the SYNC process, **confighfs** issues the following response:

      `Inadequate space added to HFS. At least another` *nn* `tracks required.`

      These results only apply when the IGW022S message indicates an Error Loc: EXTEND value. If it indicates an Error Loc: ARPN value, it goes into the out of space error state and require an unmount followed by a mount to reset the error condition and make it reusable. The updates applied to the HFS since the last successful SYNC will also be lost.

2. Unlike most z/OS UNIX commands, which are located in **/bin**, **confighfs** is found in the **/usr/lpp/dfsms/bin** directory. You can symbolically link to the actual location of **confighfs**. The symbolic link is found in **/usr/sbin**:

```
/usr/sbin/confighfs -> /usr/lpp/dfsms/bin/confighfs
```

configstk — Configure the AF_UEINT stack

Format

configstk {**–s**} *Configuration_file_name*

Description

configstk is used to configure the AF_UEINT stack. This command should initially be run from the **/etc/rc** script, which is run when z/OS UNIX System Services is initialized. It should also be run each time the AF_UEINT network topology changes after z/OS UNIX services have been initialized.

This command requires superuser authority.

Options

–s Does syntax checking only.

Files

configstk uses the following file:

Configuration_file_name
Specifies the configuration for the AF_UEINT stack. As with any system-wide configuration file, it should have the appropriate permissions set.

This file has two types of specifications, HOME and GATEWAY. Be careful when modifying the configuration file to insure that the F_UEINT environment is not corrupted due to user error.

HOME *ip_address* **BUFFERS(***number***) blocking**
This statement is required but you can only specify it once. The entire statement must be on a single line.

ip_address
Defines the single virtual IP address to be used by all RS/6K clients when accessing the z/OS host, independent of how many RS/6K gateways are connected to a given z/OS image. This implementation differs from the standard IP model which defines an IP address per physical adapter.

number
Defines the maximum number of 32K page-fixed buffers (in OMVS private memory) that are to be used by the protocol stack. The number specified is be distributed equally among the read and write flows. As new ESCON fibers are added to the configuration, additional IO buffers are required. Thruput decreases and overhead increases if the number specified is too restrictive. You should initially specify a value of 10 times the number of defined gateways for low-to-average use and increase it proportionally as the number of users increase). The maximum number of buffers

allocated is the larger of six times the number of active gateways, or the number specified. A decrease in the number is not honored until the next IPL.

blocking
Indicates whether the internal blocking algorithm should be activated for outgoing packets. The default is BLOCKING. Specifying NOBLOCKING causes the internal optimization routines, which attempt to group multiple packets into a single blocked I/O, to be bypassed (such as single packet per block written on demand). Specifying BLOCKING minimizes the z/OS overhead and maximizes the ESCON channel bandwidth, but can delay the packet delivery slightly.

GATEWAY *device_number checksum*
At least one of these statements is required and up to 32 can be specified. The entire statement must be on a single line. This statement maps the target RS/6K IP addresses to the gateway that will process the request. The device number to define the gateway must be the first of an even-odd pair of subchannels (both configured thru a single ESCON fiber) between the z/OS image and the RS/6K gateway. Multiple target IP addresses can be mapped to a given gateway. A given target IP address can be mapped to at most one gateway.

device_number
Specifies the hexadecimal address of device to be configured. This number must be four hexadecimal digits and must be an even number.

checksum
Indicates whether a reliable communications path exists between the communicating applications. Specify CHECKSUM if any portion of the path between the communicating applications is unreliable (such as a LAN). Specify NOCHECKSUM if the entire path is reliable (such as a SP2 fast switch or ESCON).

A list of IP addresses immediately follows this statement, one IP address per line. At least one IP address must be specified for each gateway device. Up to 256 IP addresses can be specified in the configuration file.

Blank lines are permitted and lines beginning with /* are treated as comments.

Examples

```
/* configure AF_UEINT sockets

/* name the ip address for this node, default to blocking enabled
home 10.32.166.20 buffers(20)

/* configure device 324
gateway 0324 nochecksum
10.34.166.20
10.34.166.24
10.34.166.26

/* configure device b28
gateway 0b28 checksum
10.36.166.20
10.36.166.22
10.36.166.24
10.36.166.26
```

configstrm — Set and query the STREAMS physical file system configuration

Format

configstrm [**–bimv**] [**–h** *high_mem* | ?] [**–l** *loadmod*]... [**–t** *trace_opt* | ?]... [**–u** *loadmod*]

Note: The **l** option signifies a lowercase **L**, not an uppercase **i**.

Description

configstrm sets and queries the STREAMS physical file system configuration. It can be used to view statistics and change configuration options for the STREAMS physical file system without changing your BPXPRMxx member and reIPLing.

Options

–b Print current buffer pool utilization.

–h *high_mem*
Set and query the maximum allowed storage utilization and query the current utilization. *high_mem* is specified in kilobytes.

–i Print internal diagnostic information.

–l *loadmod*
Load a new device driver set.

Note: **l** signifies a lowercase **L**, not an uppercase **i**.

–m Print device major information.

–t *trace_opt*
Set and query trace options. The valid trace options are:

all | none
Enables or disables all trace points.

proc | noproc
Enables or disables procedure entry and exit trace points.

data | nodata
Enables or disables data trace points.

nw | nonw
Enables or disables NetWare trace points.

code | nocode
Enables or disables code trace points.

diag | nodiag
Enables or disables diagnostic trace points.

–u *loadmod*
Unload a device driver.

–v Avoid output truncation when information is excessive.

Usage notes

1. Must be a superuser to use the **configstrm** command.

2. **configstrm** can be used to dynamically configure the physical file system for Netware.

Examples

To display device information for the configured STREAMS device drivers, issue:

```
configstrm -m
```

continue — Skip to the next iteration of a loop in a shell script

Format

continue [*n*]

Description

continue skips to the next iteration of an enclosing **for**, **select**, **until**, or **while** loop in a shell script. If a number *n* is given, execution continues at the loop control of the *n*th enclosing loop. The default value of *n* is 1.

Usage notes

continue is a special built-in shell command.

Localization

continue uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

`0` Successful completion

`1` The value of *n* given was not an unsigned decimal greater than `0`.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

break, **sh**, **tcsh**

copytree — Make a copy of a file hierarchy while preserving all file attributes

Format

/samples/copytree [**–afos**] *sourcedir* [*targetdir*]

Description

copytree is a REXX sample that enables you to use a number of z/OS UNIX capabilities. Included is a recursive routine to descend a hierarchical directory. You can also use it to accomplish the following tasks:
- Retrieve and set attributes for files
- Read and write files
- Read and set access control lists (ACLs)

copytree replicates a source tree starting under the source directory within a file system to a target directory. It:
- Tolerates errors when setting target attributes with messages.
- Tolerates errors in the source tree, skipping those files.
- Copies sparse files as sparse files.
- Handles both symbolic links and external links
- Does not cross mount points
- Preserves file links

copytree is installed in the z/OS UNIX file system. Run it as **/samples/copytree**.

To run it under TSO, copy **/samples/copytree** to a PDS where REXX execs can be run, or in a PDS to run under TSO.

Restriction: copytree cannot handle files greater than 1 GB in TSO/E.

Guideline: Every attribute that can be set should be copied if you have sufficient authorization.

Options

Any combination of the option flags can be used, with no spaces between flags.

-a Specifies that the 30,000 node limit warning is not to be issued.

-f Specifies that full file reads are to be done when **copytree** is run in check mode.

-o Specifies that file ownership is not to be preserved.

-s Specifies that the effective UID is to be set to 0 before **copytree** is started.

<sourcedir>
The path name for the source directory where the copy begins. The path name must be used, not the file system name.

<targetdir>
The path name for the target directory. This directory must exist and must be empty. The permissions and other attributes of the target directory are not modified to be the same as the source directory. If <targetdir> is not specified, **copytree** runs in a mode to check the source file tree.

Exit values

0 Successful completion

>0 An error occurred

Any other value means that there were errors.

Related information

pax

---

cp — Copy a file

Format

If the variable _UNIX03=YES is set:

cp [**–cfimMUv**] [**–p** | **F** *format* | **B** | **T** | **X**] [**-W seqparms=***params*] [**–Z**] [**–O u** | **c=***codeset*] *file1 file2*

cp [**–ACcfimMUv**] [**–p** | **F** *format* | **B** | **T** | **X**] [**–S** *suffix*] [**–Z**] [**–O u** | **c=***codeset*] *file ...file ... directory*

cp –R [**-H** | **L** | **P**] [**–cfimp**] [**–Z**] [**–O u** | **c=***codeset*] *source... directory*

cp –r [**-H** | **L** | **P**] [**–cfimp**] [**–Z**] [**–O u** | **c=***codeset*] *source... directory*

If the variable _UNIX03 is unset or not "YES":

cp [**–cfimMUv**] [**–p** | **F** *format* | **B** | **T** | **X**] [**–P** *params*] [**-W seqparms=***params*] [**–Z**] [**–O u** | **c=***codeset*] *file1 file2*

cp [**–ACcfimMUv**] [**–p** | **F** *format* | **B** | **T** | **X**] [**–S** *suffix*] [**–Z**] [**–O u** | **c=***codeset*] *file ...file ... directory*

cp –R [**-H** | **L**] [**–cfimp**] [**–Z**] [**–O u** | **c=***codeset*] *source... directory*

cp –r [**-H** | **L**] [**–cfimp**] [**–Z**] [**–O u** | **c=***codeset*] *source... directory*

Description

cp copies files to a target named by the last argument on its command line. If the target is an existing file, **cp** overwrites it; if it does not exist, **cp** creates it. If the target file exists and does not have write permission, **cp** denies access and continues with the next copy.

If you specify more than two path names, the last path name (that is, the target) must be a directory. If the target is a directory, **cp** copies the sources into that directory with names given by the final component of the source path name.

You can also use **cp** to copy files to and from MVS data sets. If you specify more than one file to be copied, the target (last path name on command line) must be either a directory or a partitioned data set. If the target is an MVS partitioned data set, the source cannot be a UNIX directory.

cp does not support the copying to or from generation data groups (GDGs). To use those MVS data sets, the user must specify the real data set name. **cp** also does not support copying to a temporary PDSE.

When copying records, the string " \n" is copied the same way as the string "\n": both are read back as "\n", where "\n" indicates that z/OS XL C++ will write a record containing a single blank to the file (the default behavior of z/OS XL C/C++). All other blanks in your output are read back as blanks, and any empty (zero-length) records are ignored on input. However, if the environment variable _EDC_ZERO_RECLEN is set to Y before calling **cp**, an empty record is treated as a single newline character and is not ignored. Also, if _EDC_ZERO_RECLEN is set to Y, a single newline character is written to the file as an empty record, and a single blank will be represented by " \n".

You can copy:
- One file to another file in the working directory
- One file to a new file on another directory
- A set of directories and files to another place in your file system
- A UNIX file to an MVS data set
- An MVS data set to a file system
- An MVS data set to an MVS data set

Options

–A Specifies that all suffixes (from the first period to the end of the target) be truncated. **–A** has precedence over **–M** and **–C** options. **–S** will be turned off if **–A** is the last option specified.

–B Specifies that the data to be copied contains binary data. When you specify **–B**, **cp** operates without any consideration for <newline> characters or special characteristics of DBCS data. (This type of behavior is typical when copying across a UNIX system.) Because **–B** is mutually exclusive with **–F**, **–X**, and **–T**, you will get an error if you specify more than one of these options.

–C Specifies truncating the file name to 8 characters to meet the restriction in the MVS data set member.

–c (UNIX to UNIX only)
Prompts you to change the diskette if there is not enough room to complete a copy operation. This option has no effect on systems without diskette drives.

Rule: The parent directories must exist on the new target diskette.

–F *format*

Specifies whether the file is to be treated as binary, text, or record file format when copied; for text files, specifies the end-of-line delimiter. Also sets the file format to *format* if the target is a UNIX file. For text files, when copying from UNIX to MVS, the end-of-line delimiter is stripped. When copying from MVS to UNIX, the end-of-line delimiter is added. (Code page IBM-1047 is used to check for end-of-line delimiters.) Record file format files are treated as if they were binary files.

If **-F** is used when copying from UNIX to UNIX, **cp** sets only the target file format and does not replace the end-of-line delimiters.

If setting *format* fails, a warning is displayed but **cp** will continue to copy any remaining files that were specified to be copied.

–F is mutually exclusive with **–B**, **–X**, **–p**, and **–T**. If you specify one of these options with **–F**, you will get an error. If **–F** is specified more than once, the last **–F** specified will be used.

For *format*, you can specify:
not Not specified
bin Binary data
rec Record. (File data consists of records with prefixes. The record prefix contains the length of the record that follows. From the shell command perspective, files with this format will be treated as if they were binary files.)

Or the following text data delimiters:
nl Newline character

cr Carriage return
lf Line feed
crlf Carriage return followed by line feed
lfcr Line feed followed by carriage return
crnl Carriage return followed by new line

–f Attempts to remove and replace a UNIX destination file that cannot be opened.

-H Follows symbolic links specified as source operand on the command line. Symbolic links encountered in the tree traversal are not followed. This is the default behavior when the **-R** or **-r** option is specified but none of the **-H**, **-L** or **-P** options are specified.

Restriction: This option can only be used with the **-R** or the **-r** option.

–i When copying to a UNIX target, **–i** asks you if you want to overwrite an existing file, whether or not the file is read-only.

-L Follows symbolic links specified as source operand on the command line and those encountered in the tree traverse.

Restriction: This option can only be used with the **-R** or the **-r** option.

–M Specifies that some characters of the file name are translated when copying between a UNIX file and an MVS data set member. Characters are translated as follows:

- _ (underscore) in UNIX is translated to @ in MVS data set members and vice versa.
- . (period) in UNIX is translated to # in MVS data set members and vice versa.
- – (dash) in UNIX is translated to $ in MVS data set members and vice versa.

–m (UNIX to UNIX only)
Sets the modification and access time of each destination file to that of the corresponding source file. Typically, **cp** sets the modification time of the destination file to the present.

–O u | c=*codeset*
Allow automatic conversion on source and target files.

–O u If the target exists and is not empty nor already tagged, **cp** will not change the target's tag in order for the target to be a candidate for automatic conversion.

For new targets and existing, untagged, empty files, this option has no effect and **cp** behaves the same as the default. For a description of the default behavior, see Automatic conversion and file tagging behavior for cp.

When using **cp** to copy from a UNIX file to a MVS data set, if the source is a tagged text file, then it might be a candidate for automatic conversion.

When copying executables from or to MVS, the automatic conversion is disabled for both source and target.

–O c=*codeset*
For a detailed description of the behavior of this option on **cp**, see Automatic conversion and file tagging behavior for cp.

codeset can be a code set name known to the system or the numeric coded character set identifier (CCSID). If a code set name exists, the numeric CCSID associated with that name is used. Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names.

To prevent the corruption of text files, **cp** will fail if it cannot set the tag to text or code set.

Attention: If automatic conversion is not set properly or if the source is not tagged properly, the target might end up with a tag code set that does not match the file content.

-P If **_UNIX03** is YES, does not follow any symbolic links, neither those specified as source operand on the command line not those encountered in the tree traverse.

Restriction: This option can only be used with the **-R** or the **-r** option.

–P *params*
If **_UNIX03** is unset or not YES, then the **-P** option will be treated as specifying parameters needed to create a new sequential data set if one does not exist. You can specify the RECFM, LRECL, BLKSIZE, and SPACE in the format the CRTL **fopen()** function uses.

`SPACE=(units,(primary,secondary)` where the following values are supported for units:
- Any positive integer indicating BLKSIZE
- CYL (mixed case)
- TRK (mixed case)

For example:

```
SPACE=(500,(100,500)) units, primary, secondary
SPACE=(500,100) units and primary only
```

For information about how to specify these parameters, see *z/OS XL C/C++ Programming Guide*.

Note: CRTL fopen() arguments: LRECL specifies the length, in bytes, for fixed-length records and the maximum length for variable-length records. BLKSIZE specifies the maximum length, in bytes, of a physical block of records. RECFM refers to the record format of a data set and SPACE indicates the space attributes for MVS data sets.

–p (UNIX to UNIX only)
Preserves the modification and access times (as the **–m** option does). In addition, it preserves the file mode, file format, owner, and group owner, if authorized. It also preserves extended attributes. It preserves the ACLs of files and directories, if possible. The ACLs are not preserved if a file system does not support ACLs.

–p is mutually exclusive with **–F**. If you specify both, you will get an error message.

–R (UNIX to UNIX only)
"Clones" the source trees. **cp** copies all the files and subdirectories specified by *source...* into *directory*, making careful arrangements to duplicate special files (FIFO, character special). **cp** only follows symbolic link specified as source operand on the command line.

–r (UNIX to UNIX only)
"Clones" the source trees, but makes no allowances for special files (FIFO,

character special). Consequently, **cp** attempts to read from a device rather than duplicate the special file. This is similar to, but less useful than, the preferred **–R**.

–S *d=suffix*|*a=suffix*

- *d=suffix*

  Removes the specified suffix from a file.

- *a=suffix*

  Appends the specified suffix to a file.

–S has precedence over **–M** and **–C**. It also turns off the **–A** option (if **–S** is the last specified option).

–T Specifies that the data to be copied contains text data. See "Usage notes" on page 180 for details on how to treat text data. This option looks for IBM-1047 end-of-line delimiters, and is mutually exclusive with **–F**, **–X**, and **–B**. That is, you will get an error if you specify more than one of these options.

Note: **–T** is ignored when copying across UNIX file systems.

–U Keeps file names in uppercase when copying from MVS data set members to UNIX files. The default is to make file names lowercase.

–v Verbose

-W seqparms=*params*

Specifies the parameters needed to create a sequential data set if one does not exist. You can specify the RECFM, LRECL, BLKSIZE, and SPACE in the format the CRTL fopen() function uses.

`SPACE=(units,(primary,secondary)` where the following values are supported for units:

- Any positive integer indicating BLKSIZE
- CYL (mixed case)
- TRK (mixed case)

For example:

```
SPACE=(500,(100,500)) units, primary, secondary
SPACE=(500,100) units and primary only
```

For information about how to specify these parameters, see *z/OS XL C/C++ Programming Guide*.

Note: CRTL fopen() arguments: LRECL specifies the length, in bytes, for fixed-length records and the maximum length for variable-length records. BLKSIZE specifies the maximum length, in bytes, of a physical block of records. RECFM refers to the record format of a data set and SPACE indicates the space attributes for MVS data sets.

This option is the same as **-P** *params* with _UNIX03 unset or not YES. If multiple **-P** *params* and **-W** are specified, the value of the last one specified on the command will be used.

–X Specifies that the data to be copied is an executable. Cannot be used with **–F**, **–T**, or **–B**.

-Z Specifies that error messages are not to be displayed when setting ACLs on the target. The return code will be zero. If default behavior is used to set the file tag, failure is suppressed. For a description of the default behavior, see Automatic conversion and file tagging behavior for cp.

If you do not specify either **–F | B | T** or **X**, **cp** will first check the format of the MVS data set indicated and then try to determine the type of file.

The **–p** option on **cp** does not affect file tagging.

Automatic conversion and file tagging behavior for cp

The following tables describe the behavior of file tagging and automatic conversion for various source and target scenarios depending on whether the **-O** option is specified on the **cp** command.

Table 6. Automatic conversion and file tagging behavior for cp: Copying files to files

	Default (without -O option)			
	If the target file system supports setting file tags...	**If the target file system does not support setting file tags (For example, NFS)...**	**With -O u option**	**With -O c=*codeset* option**
File tagging	Target file is tagged the same as the source file.	An existing target's tag is unchanged. A new target is created with a tag according to the file system's attributes (MOUNT parameter can specify TAG).	Target's tag is unchanged. (The source or target file is a candidate for automatic conversion when its TXTFLAG is tagged TEXT.)	Target's TXTFLAG is set to TEXT and its codeset is set to *codeset*.
Automatic conversion	Disabled for source and target files	Allowed for source and target files		

Table 7. Automatic conversion and file tagging behavior for cp: Copying MVS data sets to files

	Default (without -O option)			
	If the target file system supports setting file tags...	**If the target file system does not support setting file tags (For example, NFS)...**	**With -O u option**	**With -O c=*codeset* option**
If the SOURCE is text:				
File tagging	Target is set to UNTAG	An existing target's tag is unchanged. A new target is created with a tag according to the file system's attributes (MOUNT parameter can specify TAG).	Target's tag is unchanged	Target's TXTFLAG is set to TEXT and its code set is set to *codeset*.

Table 7. Automatic conversion and file tagging behavior for cp: Copying MVS data sets to files (continued)

	Default (without -O option)			
	If the target file system supports setting file tags...	**If the target file system does not support setting file tags (For example, NFS)...**	**With -O u option**	**With -O c=*codeset* option**
Automatic conversion	Disabled for target file	Allowed for target file (The target file is a candidate for automatic conversion when its TXTFLAG is tagged TEXT.)		
If the SOURCE is binary or executable:				
File tagging	Target is set to UNTAG		Target's tag is unchanged	Target's TXTFLAG is set to BINARY and its code set is set to *codeset*.
Automatic conversion	Disabled for target file			

Table 8. Automatic conversion and file tagging behavior for cp: Copying files to MVS data sets

	Default (without -O option)	**With -O u option**	**With -O c=*codeset* option**
If the SOURCE is text or binary:			
File tagging	Not applicable for target data set		
Automatic conversion	Disabled for source file	Allowed for source file (The source file is a candidate for automatic conversion when its TXTFLAG is tagged TEXT.)	Disabled for source file
If the SOURCE is executable:			
File tagging	Not applicable for target data set		
Automatic conversion	Disabled for source file		

Limits and requirements

In general:

1. To specify an MVS data set name, precede the name with double slashes (//). For example, to specify the fully qualified data set names 'turbo.gammalib' and 'turbo.gammalib(pgm1)', write:

   ```
   "//'turbo.gammalib'"
   "//'turbo.gammalib(pgm1)'"
   ```

   The same goes for data set names that are not fully qualified:

   ```
   //turbo
   ```

2. For PDS (partitioned data set) or PDSE (partitioned data set extended), to avoid parsing by the shell, the name should be quoted or minimally, the parenthesis should be escaped. For example, to specify 'turbo(pgm1)', use quotes:

   ```
   "//turbo(pgm1)"
   ```

   or escape the parenthesis:

   ```
   //turbo\(pgm1\)
   ```

   As indicated, a fully qualified name must be single-quoted (as is done within TSO). To prevent the single quotes from being interpreted by the shell, they must be escaped or the name must be placed within regular quotation marks. See the 'turbo.gammalib' examples.
3. If you specify a UNIX file as source and the MVS data set (target) does not exist, a sequential data set will be created. If the partitioned data set exists, the UNIX file will be copied to the partitioned data set member.
4. If source is an MVS data set and target is a UNIX directory, the UNIX directory must exist.
5. You cannot have a UNIX directory, partitioned data set, or sequential data set as source if the target is a partitioned data set.
6. To copy all members from a partitioned data set, you can specify the partitioned data set as source and a UNIX directory as target.

MVS data set naming limitations. The naming of MVS data sets has some limitations.

- Data set names can only contain uppercase alphabetic characters (A-Z). Lowercase characters will be converted to uppercase during any copies to MVS data sets.
- Data set names can contain numeric characters 0–9 and special characters @, #, and $.
- Data set names cannot begin with a numeric character.
- A data set member name cannot be more than 8 characters. If a file name is longer than 8 characters or uses characters that are not allowed in an MVS data set name, the file is not copied. You can use the **–C** option to truncate names to 8 characters.

Limitations: UNIX to MVS data set. The limitations are as follows:

1. If you specify a sequential MVS data set that is in undefined record format, the file is copied as binary.
2. If you specify a PDSE that is in undefined record format, the first file successfully copied determines in what format files will be copied. Note that PDSE does not allow a mixture of formats. If the first successfully copied file is an executable, the PDSE will have program objects only and all other files will fail. On the other hand, if the first file is data, then all files are copied as binary.
3. If you specify a PDS that is in undefined record format, UNIX executables are saved as PDS load modules. All other files are copied as binary.
4. If you specify an MVS data set that is either in variable length or fixed record length and you have not set the file format, text files are copied as text, binaries as binary, and executables as binary. (IBM-1047 end-of-line delimiters are detected in the data)
5. If you set the file format, the set value is used to determine if data is binary, text, or record file format.

Limitations: MVS data set to UNIX. The limitations are as follows:

1. If an UNIX file does not exist, one is created using 666 mode value, whether the data to be copied is binary or text:

   ```
   666 mode value:  owner(rw-)  group(rw-)  other(rw-)
   ```

   If the data to be copied is a shell script or executable in a PDS or PDSE with undefined record format, the UNIX file is created using 777 mode value:

   ```
   777 mode value:  owner(rwx)  group(rwx)  other(rwx)
   ```

2. If a UNIX file exists and the file format is set, **cp** copies the file as that format. Otherwise,
   - Load modules (PDS) are stored as UNIX executables and program objects (PDSE) are copied because they are the same as executables;
   - Data within data sets of undefined record format are copied as binary if the data is not a program object or load module;
   - Data found within data sets of fixed length or variable record length are copied as text. (IBM-1047 end-of-line delimiters are detected in the data)

Limitations: MVS to MVS. The limitations are as follows:

1. Options **–A**, **–C**, **–f**, and **–S** are ignored.
2. If target and source are in undefined record format (and neither is a sequential data set), **cp** will attempt to copy the data as a load module. If that fails, then **cp** will copy the data as binary.
3. If target and source are in undefined record format and either is a sequential data set, **cp** copies the data as binary.
4. If the source has a fixed or variable record length and the target is in undefined record format, **cp** copies the data as binary.
5. If the source is in undefined record format and the target has a fixed or variable record length, **cp** copies the data as binary.
6. If both source and target are in fixed or variable record length, **cp** copies the data as text.

Limitations: Copying executables into a PDS. The limitations are as follows:

1. A PDS cannot store load modules that incorporate program management features.
2. **c89**, by default, produces objects using the highest level of program management.
3. If you plan on copying a load module to a PDS, you can use a prelinker, which produces output compatible with linkage editor. Output generated by a linkage editor generated can be stored in a PDS.

The following table is a quick reference for determining the correct use of options with **cp**.

Table 9. Options allowed for cp: File to File and File ... (multiple files) to directory

Source/target	Options allowed	Options ignored	Options failed
UNIX file/UNIX file	Ffip	ABCMPSTUX	
UNIX file/sequential data set	BFiPT	ACfMpSU	X
UNIX file/PDS or PDSE member	BFiTX	ACfMPpSU	
Sequential data set/UNIX file	BFfiTU	ACMPpS	X

Table 9. Options allowed for cp: File to File and File ... (multiple files) to directory (continued)

Source/target	Options allowed	Options ignored	Options failed
Sequential data set/sequential data set	BFiPT	ACfMpSU	X
Sequential data set/PDS or PDSE member	BFiT	ACfMPpSU	X
PDS or PDSE member/UNIX file	BFfiTUX	ACMPpS	
PDS or PDSE member/sequential data set	BFiPT	ACfMpSU	X
PDS or PDSE member/PDS or PDSE member	BFiTX	ACfMPpSU	
UNIX file/UNIX directory	ACFipS	BMPTUX	
PDSE or PDSE member/UNIX directory	BFfiMSTUX	ACMPp	
UNIX file/partitioned data set	ABCFiMSTX	fPpU	
PDS or PDSE member/partitioned data set	BFiTX	ACfMPpSU	
Partitioned data set/UNIX directory	ABCFfiMSTUX	Pp	

The tables that follow indicate the kind of copies allowed using **cp**.

Table 10. Copies allowed for cp: File to File

Source	Target	Allowed
UNIX file, sequential data set, or partitioned data set member	UNIX file, sequential data set, or partitioned data set member	Yes
UNIX directory	UNIX directory	No (unless **cp** is used with **–R** or **–r**)
Partitioned data set	UNIX directory (dir) NOTE: results in each member of data set are moved to dir.	Yes
UNIX directory	Partitioned data set	No
Partitioned data set	Partitioned data set	No
UNIX file or partitioned data set member	UNIX directory (must exist) or partitioned data set	Yes
Partitioned data set member	Partitioned data set	Yes

Table 11. Copies allowed for cp: File... (multiple files) to Directory

Source	Target	Allowed
Any combination of UNIX file or partitioned data set member	UNIX directory or Partitioned data set	Yes

Table 11. Copies allowed for cp: File... (multiple files) to Directory (continued)

Source	Target	Allowed
Any combination of UNIX directory or sequential data set	Partitioned data set or UNIX directory	No
Partitioned data set	UNIX directory	Yes
Partitioned data set	Partitioned data set	No

Usage notes

For **UNIX to MVS**:

1. To copy from UNIX to a partitioned data set, you must allocate the data set before doing the **cp**.
2. If an MVS data set does not exist, **cp** will allocate a new sequential data set of variable record format.
3. For text files, all <newline> characters are stripped during the copy. Each line in the file ending with a <newline> character is copied into a record of the MVS data set. If text file format is specified or already exists for the source file, that file format will be used for end-of-line delimiter instead of <newline>. Note that **cp** looks for IBM-1047 end-of-line delimiters in data.

   You cannot copy a text file to an MVS data set that has an undefined record format:

   - For an MVS data set in fixed record format, any line copied longer than the record size will cause **cp** to fail with a displayed error message and error code. If the line is shorter than the record size, the record is padded with blanks.
   - For an MVS data set in variable record format: Any line copied longer than the largest record size will cause **cp** to fail with a displayed error message and error code. Record length is set to the length of the line.
4. For binary files, all copied data is preserved:
   - For an MVS data set in fixed record format, data is cut into chunks of size equal to the record length. Each chunk is put into one record. The last record is padded with blanks.
   - For an MVS data set in variable record format, data is cut into chunks of size equal to the largest record length. Each chunk is put into one record. The length of the last record is equal to length of the data left.
   - For an MVS data set in undefined record format, data is cut into chunks of size equal to the block size. Each chunk is put into one record. The length of the last record is equal to the length of the data left.
5. For load modules, the partitioned data set specified must be in undefined record format otherwise the executable will not be copied.
6. If more than one file name is the same, the file is overwritten on each subsequent copy.
7. If a UNIX file name contains characters that are not allowed in an MVS data set, it will not be copied. If the UNIX file name has more than 8 characters, it can not be copied to an MVS data set member. (See the **–ACMS** options for converting file names)
8. You are not allowed to copy files into data sets with spanned records.
9. PDSE cannot have a mixture of program objects and data members. PDS allows mixing, but it is not recommended.

10. Special files such as external links and FIFO will not be copied to MVS data sets. However, you can copy character special files to MVS data sets.
11. If a file is a symbolic link, **cp** copies the resolved file, not the link itself.
12. UNIX file attributes are lost when copying to MVS. If you want to preserve file attributes, you should use the **pax** utility.

For **MVS to UNIX**:

1. If the target UNIX file exists, the new data overwrites the existing data. The mode of the file is unchanged (except the S_ISUID and S_ISGID bits are turned off).
2. If the specified UNIX file does not exist, it will be created using 666 mode value if binary or text (this is subject to **umask**). If the data to be copied is a shell script or executable, the UNIX file will be created with 777 mode value (also subject to **umask**).
3. For an MVS data set in variable record format RECFM(VB) or undefined record format RECFM(U), trailing blanks are preserved when copying from MVS to UNIX. For an MVS data set in fixed record format, trailing blanks are not preserved when copying from MVS to UNIX.
4. When you copy MVS data sets to text files in the z/OS UNIX file system, a <newline> character is appended to the end of each record. If trailing blanks exist in the record, the <newline> character is appended after the trailing blanks. If the file format option is specified or the target file has the file format set, that file format is used as the end-of-line delimiter instead of <newline>.
5. When you copy MVS data sets to UNIX binary files, the <newline> character is not appended to the record.
6. You cannot use **cp** to copy data sets with spanned record lengths.
7. Due to an XL C/C++ Run-Time restriction, when copying a file from a file system to an MVS sequential data set with the same name and case, you must prefix the file in the file system with "./". For example:

   ```
   cp ./SMPL.DATA   "//'SMPL.DATA'"
   ```

Examples

1. If _UNIX03 is unset or not 'YES', to specify **–P params** for a nonexisting sequential target:

   ```
   cp -P "RECFM=U,space=(500,100)" file "//'turbo.gammalib'"
   ```

   This **cp** command is equivalent to:

   ```
   cp -W "seqparms='RECFM=U,space=(500,100)'" file "//'turbo.gammalib'"
   ```

2. To copy file **f1** to a fully qualified sequential data set `'turbo.gammalib'` and treat it as a binary:

   ```
   cp -F bin f1 "//'turbo.gammalib'"
   ```

3. To copy all members from a fully qualified PDS `'turbo.gammalib'` to an existing UNIX directory `dir`:

   ```
   cp "//'turbo.gammalib'" dir
   ```

4. To drop .c suffixes before copying all files in UNIX directory `dir` to an existing PDS `'turbo.gammalib'`:

   ```
   cp -S d=.c dir/* "//'turbo.gammalib'"
   ```

Localization

cp uses the following localization environment variables:

- **LANG**

- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

Appendix I, “Format of the TZ environment variable,” on page 1021 explains how to set the local time zone with the TZ environment variable.

Environment variables

cp uses the following environment variable when copying records to or from MVS data sets:

_EDC_ZERO_RECLEN
If set to Y before calling **cp**, an empty record (zero-length) is treated as a single newline character and is not ignored. Also, a single newline character is written to the file as an empty record, and a single blank will be represented by " \n". If you do not set this environment variable when copying records, then the string " \n is" copied the same way as the string "\n": both are read and written as "\n", where "\n" indicates that z/OS XL C/C++ will write a record containing a single blank to the file (the default behavior of z/OS XL C/C++). All other blanks in the output are read back as blanks, and any empty records are ignored.

cp also uses the following environment variable:

_UNIX03
For more information about the effect of _UNIX03 on this command, see Appendix N, “Shell commands changed for UNIX03,” on page 1039.

Exit values

0 Successful completion

1 Failure due to any of the following:
- An argument had a trailing slash (/) but was not a directory
- Inability to find a file
- Inability to open an input file for reading
- Inability to create or open an output file
- A read error occurred on an input file
- A write error occurred on an output file
- The input and output files were the same file
- An unrecoverable error when using **–r** or **–R**. Possible unrecoverable **–r** or **–R** errors include:
  - Inability to access a file
  - Inability to change permissions on a target file
  - Inability to read a directory
  - Inability to create a directory
  - A target that is not a directory
  - Source and destination directories are the same

2 Failure due to any of the following:
- An incorrect command-line option
- Too few arguments on the command line
- A target that should be a directory but isn't
- No space left on target device

- Insufficient memory to hold the data to be copied
- Inability to create a directory to hold a target file

Messages

Possible error messages include:

cannot allocate target string
cp has no space to hold the name of the target file. Try to release some memory to give **cp** more space.

name **is a directory (not copied)**
You did not specify **–r** or **–R**, but one of the names you asked to copy was the name of a directory.

*target name***?**
You are attempting to copy a file with the **–i** option, but there is already a file with the target name. If you have specified **–f**, you can write over the existing file by typing `y` and pressing <Enter>. If you do not want to write over the existing file, type `n` and press <Enter>. If you did not specify **–f** and the file is read-only, you are not given the opportunity to overwrite it.

source *name* **and target** *name* **are identical**
The source and the target are actually the same file (for example, because of links). In this case, **cp** does nothing.

unreadable directory *name*
cp cannot read the specified directory—for example, because you do not have appropriate permission.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–f** and **–m** options are extensions of the POSIX standard.

Related information

cat, **cpio**, **ln**, **mv**, **rm**

cpio — Copy in/out file archives

Format

cpio –o [**–aBcvyz**] [**–C** *blocksize*] [**–O** *file*] [**–V** *volpat*]
cpio –i [**–BbcdfmrsStuvqyz**] [**–C** *blocksize*] [**–I** *file*]
[**–V** *volpat*] [*pattern ...*]
cpio –p [**–aBdlmruv**] *directory*

The **cpio** utility is fully supported for compatibility with older UNIX systems. However, it is recommended that the **pax** utility be used instead because it may provide greater functionality and is considered the standard for portable UNIX applications as defined by POSIX.2 IEEE standard 1003.2-1992.

Description

cpio reads and writes files called **cpio** archives. A **cpio** archive is a concatenation of files and directories preceded by a header giving the filename and other file

system information. With **cpio**, you can create a new archive, extract contents of an existing archive, list archive contents, and copy files from one directory to another.

Options

Every call to **cpio** must specify one and only one of the following *selector* options:

–i Reads an existing archive (created with the **–o** option) from the standard input (**stdin**). Unless you specify the **–t** option, **cpio** extracts all files matching one or more of the given *pattern* arguments from the archive. Patterns are the same as those used by filename generation (see **sh**). When you do not specify a *pattern* argument, the default pattern * is used; as a result, **cpio** extracts all files.

–o Writes a new archive to the standard output (**stdout**), using the list of files read from **stdin**. Such a list might be produced by the **ls** or **find** commands. For example:

```
ls . | cpio –o >arch
```

uses **ls** to list the files of the working directory and then pipes this list as input to **cpio**. The resulting archive contains the contents of all the files, and is written to **arch**.

–p Is shorthand for:

```
cpio –o | (cd directory; cpio –i)
```

where **cpio –i** is performed in the given directory. You can use this option to copy entire file trees.

Consult the syntax lines to determine which of the following additional options can be applied with a particular selector option:

–a Resets the access time (of each file accessed for copying to the archive) to what it was before the copy took place.

–B Uses buffers of 5120 bytes for input and output rather than the default 512-byte buffers.

–b Causes 16-bit words to be swapped within each longword and bytes to be swapped within each 16-bit word of each extracted file. This facilitates the transfer of information between different processor architectures. This is equivalent to specifying both the **–s** and **–S** options.

–C *blocksize*
Sets the buffer size to a specified block size, rather than the default 512-byte buffers.

–c Reads and writes header information in ASCII form. Normally, **cpio** writes the header information in a compact binary format. This option produces an archive more amenable to transfer through nonbinary streams (such as some data communication links) and is highly recommended for those moving data between different processors.

–d Forces the creation of necessary intermediate directories when they do not already exist.

–f Inverts the sense of pattern matching. More precisely, **cpio** extracts a file from the archive if and only if it does *not* match any of the *pattern* arguments.

–I *file* Causes input to be read from the specified file, rather than from **stdin.**

–l Gives permission to create a link to a file rather than making a separate copy.

–m Resets the modification time of an output file to the modification time of the source file. Normally, when **cpio** copies data into a file, it sets the modification time of the file to the time at which the file is written. This option has no effect on directories.

–O *file* Causes output to be written to the specified file, rather than to **stdout.**

–q Assumes all created files are text. This means that any `\r` (carriage return) characters are stripped, and only the `\n` (newlines) are retained.

Do not use the **–q** option for converting text to a system-independent format, because that would require all files to be read twice.

–r Lets you rename files as **cpio** works. When extracting, **cpio** displays the name of the component it is about to extract and gives you the chance to specify a name for the extracted file. If you enter **.** as the name, **cpio** processes the file or directory with no modification to the name. If you just press Enter, **cpio** skips the file.

–S For portability reasons, swaps pairs of 16-bit words within longwords (a 32-bit or 64-bit word) only when extracting files. This option does not affect the headers.

–s For portability reasons, swaps pairs of bytes within each 16-bit word only when extracting files. **–s** does not affect the headers.

–t Prevents files extraction, producing instead a table of filenames contained in the archive. See the description of the **–v** option.

–u Copies an archive file to a target file even if the target is newer than the archive. Normally, **cpio** does not copy the file.

–V *volpat*
Provides automatic multivolume support. **cpio** writes output to files, the names of which are formatted using *volpat*. The current volume number replaces any occurrence of # in *volpat*. When you invoke **cpio** with this option, it asks for the first number in the archive set, and waits for you to type the number and a carriage return before its precedes with the operation. **cpio** issues the same sort of message when a write error or read error occurs on the archive; the reasoning is that this kind of error means that **cpio** has reached the end of the volume and should go on to a new one.

–v Provides more verbose information than usual. **cpio** prints the names of files as it extracts them from or adds them to archives. When you specify both **–v** and **–t**, **cpio** prints a table of files in a format similar to that produced by the **ls –l** command.

–y When used with **–V**, does not ask for a volume number to begin with, but does ask if it gets a read or write error.

–z Performs Lempel-Ziv compression. Output is always a 16-bit compression. On input, any compression up to 16-bit is acceptable.

Usage notes

1. Use the **pax** command if you need to use multibyte patterns when searching for filenames.

2. The POSIX 1003.1 standard defines formats for **cpio** archives that limit the UIDs and GIDs that can be stored to the maximum value of 262143. Values larger than this will not be properly restored.
3. The byte and word swapping done by the **–b**, **–S**, and **–s** options is effective only for the file data written. With or without the **–c** option, header information is always written in a machine-invariant format.

Localization

cpio uses the following localization environment variable:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- An incorrect option
- Incorrect command-line arguments
- Out of memory
- Compression error
- Failure on extraction
- Failure on creation

Portability

X/Open Portability Guide, non-Berkeley UNIX systems after Version 7.

The **–q**, **–V**, **–y**, and **–z** options are specific to the z/OS shell.

Related information

compress, **cp**, **dd**, **find**, **ls**, **mv**, **pax**, **tar**, **cpio**, **uncompress**

The **pax** file format description in Appendix H, "File formats," on page 1003.

cron daemon — Run commands at specified dates and times

Format

cron

Description

cron is a clock daemon that runs commands at specified dates and times. You can specify regularly scheduled commands as described in **crontab**. You can also submit jobs that are to be run only once using the **at** command. **cron** runs commands with priorities and limits set by the **queuedefs** file. **cron** uses the value from **queuedefs** to lower the priority for non-UID=0 users only. The priority is unchanged for UID=0 users.

cron only examines **crontab** files and **at** command files when initializing or when a file changes using **crontab** or **at**. This reduces the overhead of checking for new or changed files at regularly scheduled intervals.

The setuid bit for **cron** should never be set; however, it must be started by a user with appropriate privileges to issue the setuid call for any UID. Because **cron** never exits, it should only be run once, normally during the system initialization process. **cron** automatically forks and runs itself in the background, in a new shell session. **cron** uses the **pid** file to prevent more than one **cron** running at the same time.

When matching the date and time expressions given in **crontab** entries, **cron** uses the time zone in effect when the system started the daemon. As a result, you should ensure that the TZ environment variable is set at this time. For information about setting the TZ environment variable, see Appendix I, "Format of the TZ environment variable," on page 1021. For **at** jobs, **cron** uses the value of TZ in effect when you submitted the job.

at, **batch**, and **crontab** submit jobs to **cron**; the data for those jobs can contain double-byte characters. When the jobs are executed, the data in the jobs are interpreted in the locale that **cron** is using. Because it is strongly recommended that **cron** be started in the POSIX locale, double-byte characters in the jobs may not be interpreted correctly. You can get around this by calling the **setlocale()** system call in the job itself.

The **crontab**, **batch**, and **at** job files store information about the MVS identity and the UNIX identity (the real UID) of the user who created the jobs. The cron daemon uses that information to set up the environment in which to run the jobs as follows:

- The MVS identity is set to the user's MVS identity.
- The UNIX real and effective UIDs are set to the user's real UID.

cron handles the following externally generated signals in a special way:

SIGTERM
: Causes **cron** to exit. You can cause **cron** to exit with the following command:

```
kill –TERM pid
```

: where *pid* is the cron's PID number. To find the cron's PID number, you can use:

```
ps -e | grep cron
```

SIGUSR1
: Is sent by either **at** or **crontab** to indicate a new **at** job or an updated **crontab** entry. **cron** does not delete **at** jobs until they finish running. If the **cron** daemon is terminated while **at** jobs are running, **cron** runs them again when the daemon is restarted.

SIGUSR2
: Writes internal **cron** queue information to the log file.

The following is an example of output to a **cron** log from `'kill -USR2 5'`. The output was written to the log on a test system when the **queuedefs** job limit of 5 was exceeded. The number of jobs that are running is 5 (the limit is 500):

```
Queue `c' 5j2n15w:
queued 4, running 5, jobs 5
Next try for queued jobs 13 seconds
```

```
RUNNING: uid/gid: 0/512: pid 33554441: sleep 10000 RUNNING: uid/gid: 0/512:
pid 385875972: echo start; sleep 10000; echo end RUNNING: uid/gid: 0/512: pid
67108876: echo start; sleep 10000; echo end RUNNING: uid/gid: 0/512: pid
33554445: echo start; sleep 10000; echo end RUNNING: uid/gid: 0/512: pid
67108879: echo start; sleep 10000; echo end QUEUED: uid/gid: 0/512: echo Hello!
QUEUED: uid/gid: 0/512: echo start; sleep 10000; echo end
QUEUED: uid/gid: 0/512: echo Hello!
QUEUED: uid/gid: 0/512: echo start; sleep 10000; echo end
```

cron uses a number of files in the **/usr/lib/cron** directory to determine which users may and may not use the **at** and **crontab** commands.

- The file **at.allow** contains the list of users who have permission to use **at**.
- The file **at.deny** contains the list of users who do not have permission to use **at**.

If these files do not exist, only the superuser can use the **at** command. To allow all users access to **at**, there must be a null **at.deny** file and no **at.allow** file.

cron uses the files **cron.allow** and **cron.deny** in a similar manner.

- **cron.allow** contains the list of users who have permission to use **crontab**.
- **cron.deny** contains the list of users who do not have permission to use **crontab**.

If these files do not exist, only the superuser can use **crontab**. To allow all users access to **crontab**, there must be a null **cron.deny** file and no **cron.allow** file.

Files

cron uses the following files which reside in a system-defined directory:

/etc/mailx.rc
: Although **cron** does not use this file directly, **cron** may call **mailx** which uses this file for configuration settings. Specifically, for **cron** to deliver messages properly, this file should contain a valid setting for the mailx sendmail variable. This file is generally copied from **/samples/mailx.rc**.

/usr/spool/cron
: The main **cron** directory.

/usr/spool/cron/atjobs
: A directory containing **at** files.

/usr/spool/cron/crontabs
: A directory containing **crontab** files.

/usr/spool/cron/log
: A file that maintains a history of the commands being run. The systems administrator should truncate this file periodically.

/usr/spool/cron/pid
: A file that **cron** uses to ensure that only one version of **cron** is currently running on the system. This file must be unique per system which is particularly important when you are setting up a sysplex. See the section in *z/OS UNIX System Services Planning* about customizing **cron** for a read-only file system.

/usr/lib/cron/at.allow
: Contains a list of the users who can use the **at** command (one per line).

/usr/lib/cron/at.deny
: Contains a list of the users who cannot use the **at** command (one per line).

/usr/lib/cron/cron.allow
Contains a list of the users who can use the **crontab** command (one per line).

/usr/lib/cron/cron.deny
Contains a list of the users who cannot use the **crontab** command (one per line).

/usr/lib/cron/queuedefs
The queue description file (see the description of **queuedefs** in "queuedefs — Queue description for at, batch, and cron" on page 1011).

Related information

at, **crontab**, **mailx**

Appendix I, "Format of the TZ environment variable," on page 1021 explains how to set the local time zone with the TZ environment variable.

For more information about customizing **cron**, see the section on customizing the **cron**, **uucp**, and **mail** utilities for a read-only root file system in *z/OS UNIX System Services Planning*. Also see the section about customizing the cron and uucp utilities in *z/OS UNIX System Services Planning*.

crontab — Schedule regular background jobs

Format

crontab [**–e** | **–l** | **–r**] [**–u user**] [*file*]

Description

crontab creates or changes your crontab entry. The crontab is a system facility that automatically runs a set of commands for you on a regular schedule. For example, you might set up your crontab entry so it runs a job every night at midnight, or once a week during low-use hours. This job could perform regular maintenance chores, for example, backing up files or getting rid of unnecessary work files.

To set up a crontab entry, use:

```
crontab file
```

If you omit the **file** argument, **crontab** takes input from standard input (**stdin**). **Requirement:** In this mode, you must provide your entire crontab file. This replaces any other existing crontab entries. If you issue **crontab** with no options, do not enter the end-of-file character or you will end up with an empty crontab file. Press INTERRUPT instead.

Input consists of six fields, separated by blanks. All blank lines and any input that contains a # as the first non-blank character are ignored. The first five give a date and time in the following form:

- A minute, expressed as a number from 0 through 59
- An hour, expressed as a number from 0 through 23
- A day of the month, expressed as a number from 1 through 31
- A month of the year, expressed as a number from 1 through 12

- A day of the week, expressed as a number from 0 through 6 (with 0 standing for Sunday)

Requirement: Always use a system default time zone. Your system administrator can tell you what it is. The **cron** daemon does not use the value of the TZ environment variable when **crontab** is invoked.

Any of these fields may contain an asterisk (*) standing for all possible values. For example, if you have an * as the day of the month, the job runs every day of the month. A field can also contain a set of numbers separated by commas, or a range of numbers, with the first number followed by a minus sign – followed by the second number. If you give specific days for both day of the month and day of the week, the two are ORed together. Here are some examples:

```
0 0 * * *          -- Midnight every day
0 0 * * 1-5        -- Midnight every weekday
0 0 1,15 * *       -- Midnight on 1st and 15th of month
0 0 1 * 5          -- Midnight on 1st of month and every Friday
```

The sixth field of a crontab entry is a string that your shell executes at the specified time. When the shell executes this string, it sets the HOME, LOGNAME, PATH, and SHELL environment variables to default values for you.

If the string in your crontab entry contains percent characters %, the shell interprets them as newline characters, splitting your string in several logical lines. The first logical line (up to the first %) is interpreted as the command you want to execute; subsequent logical lines are used as standard input to the command. If any real (not logical) line in the file is blank or begins with #, the shell ignores the line (treats it as a comment).

To obtain the output of the command in your crontab entry, redirect the standard output (stdout) and the standard error (stderr) into a file. If you do not do this, the system mails you the output from the command.

at, **batch**, and **crontab** submit jobs to **cron**; the data for those jobs may contain double-byte characters. When the jobs are run, the data in the jobs are interpreted in the locale that **cron** is using. Because it is strongly recommended that **cron** be started in the POSIX locale, double-byte characters in the jobs may not be interpreted correctly. You can get around this by calling **setlocale()** in the job itself.

Options

–e Lets you edit your crontab entry. **crontab** invokes an editor to edit the entry. if you have an **editor** environment variable defined, **crontab** assumes that the variable's value is the name of the editor you want to use. if you do not have **editor** defined, **crontab** uses **vi**.

if you do not have a crontab entry, **crontab** sets up a blank entry for you. when you exit from the editor, **crontab** uses the edited entry as your new entry.

–l Displays your current crontab entry on **stdout**.

–r Removes (deletes) your current crontab entry.

–u user
Uses the crontab entry of **user**. the user specified has to be the same username that the crontab entry was created under in **/usr/spool/cron/crontabs**. this requires the appropriate privileges.

You can specify only one of the **–e**, **–l**, or **–r** options.

Environment variables

crontab uses the following environment variables:

EDITOR
Specifies the editor that the **–e** option invokes. The default editor is **vi**.

HOME
Is set to your user ID's home directory (not necessarily the current value of HOME when the commands in your crontab entry are run.

LOGNAME
Is set to your user ID when the commands in your crontab entry are run.

PATH Is set to a system-wide default value when the commands in your crontab entry are run.

TZ Is not used in time calculations. The **cron** daemon does, however, use this variable when **cron** is first started, typically when the system is started.

Localization

crontab uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Returned if the command fails for any reason. In this case, **crontab** does not change your crontab entry.

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

The **–u** option is an extension to the POSIX standard.

Related information

at, **batch**, **bg**, **cron**

The **queuedef** file format description in Appendix H, “File formats,” on page 1003.

csplit — Split text files

Format

csplit [**–Aaks**] [**–f** *prefix*] [**–n** *number*] *file arg arg ...*

Description

csplit takes a text file as input and breaks up its contents into pieces, based on criteria given by the *arg* value on the command line. For example, you can use **csplit** to break up a text file into chunks of ten lines each, then save each of those chunks in a separate file. See "Splitting criteria" for more information. If you specify **–** as the *file* argument, **csplit** uses the standard input (stdin).

The files created by **csplit** normally have names of the form
`xx`*`number`*

where *number* is a 2-digit decimal number that begins at zero and increments by one for each new file that **csplit** creates.

csplit also displays the size, in bytes, of each file that it creates.

Options

–A Uses uppercase letters in place of numbers in the number portion of created file names. This generates names of the form `xxAA`, `xxAB`, and so on.

–a Uses lowercase letters in place of numbers in the number portion of created file names. This generates names of the form `xxaa`, `xxab`, and so on.

–f *prefix*
Specifies a prefix to use in place of the default `xx` when naming files. If it causes a file name longer than `NAME_MAX` bytes, an error occurs and **csplit** exits without creating any files.

–k Leaves all created files intact. Normally, when an error occurs, **csplit** removes files that it has created.

–n *number*
Specifies the number of digits in the number portion of created file names.

–s Suppresses the display of file sizes.

Splitting criteria

csplit processes the *arg*s on the command line sequentially. The first argument breaks off the first chunk of the file, the second argument breaks off the next chunk (beginning at the first line remaining in the file), and so on. Thus each chunk of the file begins with the first line remaining in the file and goes to the line given by the next *arg*.

arg values can take any of the following forms:

/regexp/
Takes the chunk as all the lines from the current line up to but not including the next line that contains a string matching the regular expression *regexp*. After **csplit** obtains the chunk and writes it to an output file, it sets the current line to the line that matched *regexp*.

/regexp/offset
Is the same as the previous criterion, except that the chunk goes up to but not including the line that is a given *offset* from the first line containing a string that matches *regexp*. The *offset* can be a positive or negative integer. After **csplit** has obtained the chunk and written it to an output file, it sets the current line to the line that matched *regexp*.

Note: This current line is the first one that was not part of the chunk just written out.

%*regexp***%**
Is the same as */regexp/*, except that **csplit** does not write the chunk to an output file. It simply skips over the chunk.

%*regexp***%***offset*
Is the same as */regexp/offset*, except **csplit** does not write the chunk to an output file.

linenumber
Obtains a chunk beginning at the current line and going up to but not including the *linenumber*th line. After **split** writes the chunk to an output file, it sets the current line to *linenumber*.

{*number***}**
Repeats the previous criterion *number* times. If it follows a regular expression criterion, it repeats the regular expression process *number* more times. If it follows a *linenumber* criterion, **csplit** splits the file every *linenumber* lines, *number* times, beginning at the current line. For example,

```
csplit file 10 {10}
```

obtains a chunk from line 1 to line 9, then every 10 lines after that, up to line 109.

Errors occur if any criterion tries to "grab" lines beyond the end of the file, if a regular expression does not match any line between the current line and the end of the file, or if an *offset* refers to a position before the current line or past the end of the file.

Localization

csplit uses the following localization variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- **csplit** could not open the input or output files
- A write error on the output file

2 Failure due to any of the following:
- Unknown command-line option
- The *prefix* name was missing after **–f**
- The *number* of digits was missing after **–n**
- The input *file* was not specified
- No *arg* values were specified
- The command ran out of memory

- An *arg* was incorrect
- The command found end-of-file before it was expected
- A regular expression in an *arg* was badly formed
- A line offset/number in an *arg* was badly formed
- A {number} repetition count was misplaced or badly formed
- Too many file names were generated when using **–n**
- Generated file names would be too long

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

The **–A** and **–a** options are extensions to the POSIX standard.

Related information

awk, **sed**

For more information about **regexp**, see Appendix C, "Regular expressions (regexp)," on page 971.

ctags — Create tag files for ex, more, and vi

Format

ctags [**–aBFwx**] [**–f** *tagfile*] *sourcefile ...*

Description

ctags creates a file named **tags** in the current directory. It summarizes the locations of various objects in the C source files named on the command line. All files with a **.c** or **.h** suffix are treated as C source files.

For C source code, **ctags** summarizes function, macro and `typedef` definitions. See "tags — Format of the tags file" on page 1012 for a description of the format of the **tags** file.

The **tags** file is used by **ex**, **more**, and **vi** to support the **tag** command. The **tag** command can be used to edit the file containing a *name* in the **tags** file.

For **ex** and **vi**, the command is:

```
: tag name
```

For **more**, the command is:

```
:tname
```

After these commands are run, the **tags** file is searched for *name*. If it is found, the file associated in the **tags** file with that name is loaded and the line containing the *name* is made the current line.

Options

–a Appends output to the existing **tags** file rather than overwriting the file.

–B Produces a **tags** file that searches backward from the current position to find the pattern matching the tag.

–F Searches for tag patterns in the forward direction. This is the default.

–f Generates a file named **tagfile** rather than the default **tags** file.

–w Suppresses warning messages.

–x Produces a report on the standard output. The report gives the definition name, the line number of where it appears in the file, the name of the file in which it appears, and the text of that line. **ctags** arranges this output in columns and sorts it in order by tag name according to the current locale's collation sequence. This option does not produce a **tags** file.

Localization

ctags uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLECT**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**

See Appendix F, "Localization," on page 997 for more information.

Files

ctags uses the following file:

tags Output tags file

Usage notes

1. It can be difficult to recognize a function definition in C source code. Because **ctags** does not know which C preprocessor symbols are defined, there may be some misplaced function definition information if sections of code within **#if...#endif** are not complete blocks.
2. **ctags** invokes the **sort** internally.
3. **ctags** makes special provision for the **main()** function, which may occur in several C source files. The **tags** file contains an entry for the first **main()** routine found. For all occurrences of **main()**, including the first, the **tags** file contains an entry for M*name*, where name is the name of the input source file, with the **.c** suffix and any leading pathname components removed. For example, a **tags** file created for a C source code file named **foo.c** would contain an entry for **Mfoo**, which represents the **main()** routine in **foo.c**).
4. **ctags** uses **sort** to sort the file by tag name, according to the POSIX locale's collation sequence.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Unknown command-line option
- Cannot create the output file
- Cannot open the output file
- One of the input files was unrecognized

Portability

POSIX.2, X/Open Portability Guide, 4.2BSD and higher.

This utility only understands characters from the POSIX locale.

The **–B**, **–F**, and **–w** options are extensions to the POSIX and XPG standards.

Related information

more, **sort**, **vi**

See the **tags** file format description in "tags — Format of the tags file" on page 1012.

cu — Call up another system (stub only)

Format

cu [**–dehot**] [**–l** *device_name*] [**–s** *speed*] [*system_name* | *phone_num*]
cu –n [**–dehot**] [**–l** *device_name*] [**–s** *speed*]

Note: The **cu** utility is fully supported for compatibility with older UNIX systems. However, because it is no longer supported by POSIX.2 IEEE standard 1003.2-1992, this utility should be avoided for applications intended to be portable to other UNIX-branded systems.

Description

cu connects to remote systems specified in the UUCP configuration file. You can use it for simple terminal connections, or to do simple file transfer with no error checking.

cu is recognized, but its functions are disabled. Traditionally, it is used for simple terminal connections to remote systems specified in the UUCP configuration file. **cu** requires a direct connection (such as with a modem) to the remote system, but this is not supported by z/OS.

cut — Cut out selected fields from each line of a file

Format

cut –b *list* [**-Bn**] [**-W** *option*[,*option*]...] [*file*...]
cut –c *list* [**-B**] [**-W** *option*[,*option*]...] [*file*...]
cut –f *list* [**–d** *char*] [**–Bs**] [**-W** *option*[,*option*]...] [*file*...]

Description

cut reads input from files, each specified with the *file* argument, and selectively copies sections of the input lines to the standard output (stdout). If you do not specify any *file*, or if you specify a file named **–**, **cut** reads from standard input (stdin).

Options

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–b *list* Invokes byte position mode. After this comes a list of the byte positions

you want to display. This list might contain multiple byte positions, separated by commas (**,**) or blanks or ranges of positions separated by dashes (–). Since the list must be a single argument, shell quoting is necessary if you use blanks. You can combine these to allow selection of any byte positions of the input.

Guideline: When using the **–b** option with double-byte characters, you must also specify the **–n** option if you want to ensure that entire characters are displayed. If you do not specify the **–n** option, **cut** assumes that the low byte of a range is the first byte of a character and that the high byte of a range is the last byte of a double-byte character, possibility resulting in the misinterpretation of the characters represented by those byte positions.

–c *list* Invokes character-position mode. After this comes a list of character positions to retain in the output. This list can contain many character positions, separated by commas (**,**) or blanks or ranges of positions separated by a dash (–). Since the list must be a single argument, shell quoting is necessary if you use blanks. You can combine these to allow selection of any character positions of the input.

–d *char*
Specifies *char* as the character that separates fields in the input data; by default, this is the horizontal tab.

–f *list* Invokes field delimiter mode. After this comes a list of the fields you want to display. You specify ranges of fields and multiple field numbers in the same way you specify ranges of character positions and multiple character positions in **–c** mode.

–n Does not split characters. If the low byte in a selected range is not the first byte of a character, **cut** extends the range downward to include the entire character; if the high byte in a selected range is not the last byte of a character, **cut** limits the range to include only the last entire character before the high byte selected. If **–n** is selected, **cut** does not list ranges that do not encompass an entire character, and these ranges do not cause an error.

–s Does not display lines that do not contain a field separator character. Normally, **cut** displays lines that do not contain a field separator character in their entirety.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text

conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

Examples

1. To print a list that contains the dates that the files were created and the file names of files in the working directory:

   ```
   ls –al | cut –c 42–48,54–66
   ```

2. To display the first field of each line of a file containing ASCII characters to the standard output (stdout), assuming that
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are displaying an untagged public text file or a read-only text file)

   then issue:

   ```
   cut -f 1 -W filecodeset=ISO8859-1,pgmcodeset=IBM-1047 myAsciiFile
   ```

3. To display the second byte of each line of a file containing EBCDIC characters to the standard output (stdout), assuming that automatic conversion has been enabled but the text file is incorrectly tagged as UTF-8:

   ```
   cut -b 2 -B myMisTaggedFile
   ```

Localization

cut uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

cut uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 Successful completion

1 Failure due to any of the following reasons:
- Cannot open the input file
- Out of memory
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

2 Failure due to any of the following reasons:
- An incorrect command-line argument
- You did not specify any of **–b**, **–c**, or **–f**
- You omitted the *list* argument
- Badly formed *list* argument

Portability

POSIX.2, X/Open Portability Guide, UNIX System V.

The **–B** and **-W** options are extensions of the POSIX standard.

Related information

paste, **uname**

cxx — Compile C and C++ source code, link-edit and create an executable file

See **c89/xlc** or **man xlc**.

Note:

When working in the shell, to view man page information about **cxx**, type: `man c89` or `man xlc`.

date — Display the date and time

Format

date [**–cu**] [+*format*]

Description

date displays the operating system's concept of the current date and time. The following example shows the default format of the date:

```
Wed Feb 26 14:01:43 EST 1986
```

Options

date accepts the following options:

–c Displays the date and displays the time according to Greenwich Mean Time (Coordinated Universal Time) using CUT as the time zone name.

–u Displays the date and displays the time according to Greenwich Mean Time (Coordinated Universal Time) using GMT as the time zone name.

If the argument to **date** begins with a + character, **date** uses *format* to display the date. **date** writes all characters in *format*, except for the `%` and the character that immediately follows it, directly to the standard output. After **date** exhausts the *format* string, it outputs a newline character. The `%` character introduces a special format field similar to the **printf()** function in the C library. **date** supports the following field descriptors:

%A The full weekday name (for example, `Sunday`).

%a The three-letter abbreviation for the weekday (for example, `Sun`).

%B The full month name (for example, `February`).

%b The three-letter abbreviation for the month name (for example, `Feb`).

%C The first two digits of the year (`00` to `99`).

%c The local representation of the date and time (see `%D` and `%T`).

%D The date in the form *mm*/*dd*/*yy*.

%d The two-digit day of the month as a number (`01` to `31`).

%e The day of the month in a two-character, right-aligned, blank-filled field.

%H The two-digit hour (`00` to `23`).

%h The three-letter abbreviation for the month (for example, `Jun`).

%I The hour in the 12-hour clock representation (`01` to `12`).

%j The numeric day of the year (`001` to `366`).

%M The minute (`00` to `59`).

%m The month number (`01` to `12`).

%n The newline character.

%p The local equivalent of a.m. or p.m.

%r The time in a.m.–p.m. notation (`11:53:29 a.m.`).

%S The seconds (`00` to `61`). There is an allowance for two leap seconds.

%T The time (`14:53:29`).

%t A tab character.

%U The week number in the year, with Sunday being the first day of the week (`00` to `53`).

%W The week number in the year, with Monday being the first day of the week (`00` to `53`).

%w The weekday number, with Sunday being `0`.

%X The local time representation (see `%T`).

%x The local date representation (see `%D`).

%Y The year.

%y The two-digit year.

%Z The time zone name (for example, `EDT`).

%% A percent-sign character.

The **date** command also supports the following modified field descriptors to indicate a different format as specified by the locale indicated by LC_TIME. If the current locale does not support a modified descriptor, **date** uses the unmodified field descriptor value.

%EC The name of the base year (period) in the current locale's alternate representation.

%Ec The current locale's alternate date and time representation.

%Ex The current locale's alternate date representation.

%EY The full alternate year representation.

%Ey The offset from `%EC` (year only) in the current locale's alternate representation.

%Od The day of the month using the current locale's alternate numeric symbols.

%Oe The day of the month using the current locale's alternate numeric symbols.

%OH The hour (24-hour clock) using the current locale's alternate numeric symbols.

%OI The hour (12-hour clock) using the current locale's alternate numeric symbols.

%OM The minutes using the current locale's alternate numeric symbols.

%Om The month using the current locale's alternate numeric symbols.

%OS The seconds using the current locale's alternate numeric symbols.

%OU The week number of the year (`0`–`53`) (with Sunday as the first day of the week) using the current locale's alternate numeric symbols.

%OW The week number of the year (`0`–`53`) (with Monday as the first day of the week) using the current locale's alternate numeric symbols.

%Ow The weekday as a number using the current locale's alternate numeric symbols (Sunday=0).

%Oy The year (offset from %C) using the current locale's alternate numeric symbols.

Examples

The command:

```
date '+%a %b %e %T %Z %Y'
```

produces the date in the default format as shown at the start of this command description.

Environment variables

date uses the following environment variables:

TZ Gives the time zone for **date** to use when displaying the time. This option is ignored if you specify either the **–c** or the **–u** option.

For information about setting the local time zone with the TZ environment variable, see Appendix I, "Format of the TZ environment variable," on page 1021.

Localization

date uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

>0 Failure due to any of the following conditions:

- An incorrect command-line option
- Too many arguments on the command line
- A bad date conversion
- A formatted date that was too long
- You do not have permission to set the date

Messages

Possible error messages include:

Bad format character *x*
A character following "%" in the *format* string was not in the list of field descriptors.

No permission to set date
The system has denied you the right to set the date.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–c** option is an extension of the POSIX standard.

Related information

touch

Appendix I, "Format of the TZ environment variable," on page 1021 also explains how to set the local time zone with the **TZ** environment variable.

---

dbgld — Create a module map for debugging

Format

dbgld
[*option*] ...
file

Description

The compiler creates a `.dbg` file for each compilation unit if the DEBUG compiler option is specified. The path names of all of the `.dbg` files are then stored in the module, which is an executable file or a DLL. The **dbgld** command opens all of the `.dbg` files associated with the module and stores all of the functions, global variables, external types, and source files in a single module map file with a `.mdbg` extension. In addition, the contents of all of the `.dbg` files are packaged together into this same `.mdbg` file. The **dbgld** command only needs to be executed once after binding.

Debuggers that support demand load can use the `.mdbg` file for faster access to debug information. For more information on using the module map to improve debugger performance, see *z/OS Common Debug Architecture User's Guide*.

If the original source files are not available at debugging time (for example, the source files are moved into a different directory or the compilation and debugging are performed on different machines), you can add the source file contents to the `.mdbg` file before the source files are relocated. When invoking the **dbgld** command, you can specify the **-c** option because the source file contents cannot be captured into the `.mdbg` file by the **dbgld** command by default. A debugger that supports captured source can then retrieve the source file contents from the `.mdbg` file.

Options

option

-c Adds captured source file to the module map, which consists of all files that contain executable lines of code.

-v Writes the version information to `stderr`.

file Is the module name, which can be:

- The absolute path name of a z/OS UNIX file
- The relative path name of a z/OS UNIX file
- A fully qualified MVS data set (PDS member)

The output of the **dbgld** command is a file with the name of the module followed by a .mdbg extension. The file will always be written in the current directory. For example, if the module name is /mypath/mymodule, a file called mymodule.mdbg will be created in the current directory. If the file already exists, it will be overwritten.

Restrictions

The following restrictions apply to the use of **dbgld**:

- The source files must be compiled with the DEBUG compiler option.
- The name of a valid module must be passed into the dbgld utility. The module must be bound with the EDIT=YES binder option, which is the default. An error message will be generated if EDIT=NO.
- The .dbg files associated with the module must exist in the directories where they were during compilation. Otherwise, they will not be added to the module map and no debug information will be available to the compilation units via the module map during debugging. An error message will be generated for each .dbg file that is not found.
- Because the **dbgld** command always creates the .mdbg file in the current directory, the command must be run from a directory that has write permission.
- Source files compiled with NOGOFF and NOLONGNAME are not processed by the utility. If the entire module is made up of these compilation units, an error message will be generated to indicate that no debug information was found. Compile your application with LONGNAME or GOFF to mitigate this restriction.

Eample

The following example shows how to compile hello1.c and hello2.c and create a module map in a file called hello.mdbg.

```
xlc -g hello1.c hello2.c -o hello
dbgld hello
```

The following example shows how to compile hello1.c and hello2.c and create a module map in a file called hello.mdbg which contains captured source.

```
xlc -g hello1.c hello2.c -o hello
dbgld -c hello
```

The following example shows how to display the version information for the dbgld utility and the Common Debug Architecture run times when creating the module map.

```
dbgld -v hello
```

The output is:

```
CDA0000I Utility(dbgld ) Level(level name)
CDA0000I Library(elf ) Level(level name)
CDA0000I Library(dwarf ) Level(level name)
CDA0000I Library(ddpi ) Level(level name)
```

If the **-g** option is missing during compilation, hello.mdbg will not be generated and a warning message will be printed, as shown in the following example:

```
xlc hello1.c hello2.c -o hello
dbgld hello
```

The output is a warning message stating that no debug information was found in hello.

Exit values

The exit values for **dbldgd** are:

0 Successful completion

4 Warning

8 Error

12 Severe error

dbx — Use the debugger

Related information

Format

dbx [*options*] [*executable-file* [*program-arguments* ...]]
dbx [*options*] [*attach-type*] *process-id*
dbx [*options*] **-C** *core-file*

Description

dbx is a source-level debugger for z/OS UNIX System Services. It provides an environment to debug and run C and C++ programs, as well as performing machine level debug. You can carry out operations such as the following:
- Examine object files
- Run a program in a controlled environment
- Set breakpoints at selected statements or run the program one line at a time
- Debug using symbolic variables and display them in their correct format
- View an MVS dump
- Attach to a running program, and perform debugging operations.

The *executable-file* argument is an load module produced by a compiler. To perform source-level debugging, you need to compile your executable with symbolic information. This is accomplished by specifying the **–g** or **–Wc,debug** compiler flags on the compiler command line.

Note: If the object file is not compiled with the **–g** or **–Wc,debug** option on the **c89/cc/c++** command, or if the user compiles with optimization, the capabilities of the **dbx** command will be reduced.

The *core-file* argument is an MVS dump that exists as a file in the z/OS UNIX file system or in an MVS data set.

dbx allows the end user to customize its behavior via two files that are processed during initialization. These are **.dbxsetup** . Each file can contain a list of **dbx** subcommands that will be run before the **dbx** prompt is displayed. During startup, **dbx** will first search for these files in the current working directory and then in the user's **$HOME** directory. If a file is found, it is parsed and the search for that specific file terminates. Use a text editor to create a **.dbxsetup** or **.dbxinit** file. and **.dbxinit**

Any subcommand in the **.dbxsetup** file are executed before the debug target program is loaded. This allows the user to tailor **dbx**'s operational behavior during this phase of the **dbx** startup process. Any subcommand in the **.dbxinit** file are executed just before the **dbx** prompt is displayed.

You can use the **man** command to view descriptions of **dbx** subcommands. To do this, you must prefix all subcommands with **dbx**. For example, to view a description of the **dbx alias** subcommand, you would enter the following:

```
man dbxalias
```

dbx supports SVC dumps and SYSMDUMP dumps. It does not process SYSUDUMP dumps or CEEDUMP dumps. (The dump data set must be FB with a record length of 4160.)

Attach-types

–a *ProcessID*
: Attaches the debug program to a running process. The debug program becomes active as soon as the process wakes up. To attach the debug program, you need authority to use the **kill** command on this process.

–A *ProcessID*
: Reattaches the debug program to a running process that is already being debugged by **dbx**. Use this option to reattach a child process that was created when a debugged parent process did a fork while multiprocess debugging mode was active. To reattach to the debug program, you need authority to use the **kill** command on this process.

Options

-b
: Suppresses processing of .dbxsetup and .dbxinit files (bare startup).

–c *script*
: Runs **dbx** subcommands from a specified script file before reading from standard input.

–C *dump–filename*
: Puts **dbx** in dump reading (core file) processing mode.

–d
: Deprecated. This option is ignored and remains only for compatibility purposes.

–f
: Deprecated. This option is ignored and remains only for compatibility purposes.

–F
: Starts debug target in a different address space than the one **dbx** currently resides in; or starts **dbx** in its own address space when attaching to a running target program.

–h
: Prints the **dbx** command syntax.

–I *directory*
: Appends the given directory to the list of directories searched for source and debug files. The default list contains the working directory and the directory containing the object files. The search path can also be set with the **use** subcommand.

–m *dbxmode*
: Instructs **dbx** to start in a specific mode:
  - Specifying **–m4** forces **dbx** to run in 31-bit mode, even on a machine capable of running it in 64-bit mode.
  - Specifying **–m8** forces **dbx** to run in 64-bit mode. If this is impossible, **dbx** will terminate.

-p *ipaddress* | *name***[:***port***]**
: Tells **dbx** to open a socket and connect to the ipAddress:port or

machineName:port which is assumed to be a GUI that supports remote debugging. For example: **dbx -p 9.123.456.78:8001 mypgm**. In this mode, the command-line prompt is not displayed and the user cannot enter **dbx** subcommands through the command-line interface. In addition, the following **dbx** subcommands are not supported when entered via a GUI debug console (command line) interface: **detach**, **edit**, **multproc**, **object**, **quit**, **rerun**, **run**, **sh**.

If **:***port* is not specified, port 8001 is used as the default.

–q Suppresses some of the **dbx** startup messages. Only the **dbx** version information is printed before the prompt is displayed. All other messages are suppressed. This option does not affect the verbosity of normal **dbx** operation.

–r Runs the object file immediately. If it ends successfully, the **dbx** debug program is exited. Otherwise, the debug program is entered and the reason for termination is reported.

Note: Unless **–r** is specified, the **dbx** command prompts the user and waits for a command. However, you can specify program arguments on and **.dbxinit** even when **–r** is not used. For example:

```
dbx myprog arg1 arg2 arg3
```

–u Deprecated. This option is ignored and remains only for compatibility purposes.

Expression handling

Specify expressions in **dbx** with a subset of C and Pascal syntax. A prefix * (asterisk) or a postfix ^ (circumflex) denotes indirection. Specify portions of an array by separating the lower and upper bounds with **..** (two periods).

Use [ ] (square brackets) or ( ) (parentheses) to enclose array subscripts. Use the field reference operator **.** (period) with pointers and records.

Note: The field reference operator **.** (period) makes the C operator **→** unnecessary (although it is supported).

When displaying variables and expressions, the **dbx** command resolves names first using the *static scope* of the current function. The *dynamic scope* is used if the name is not defined in the first scope. If static and dynamic searches do not yield a result, an arbitrary symbol is chosen and the system prints the message (using *Module.Variable*). The *Module.Variable* construction is the name of an identifier qualified with a block name. Override the name resolution procedure by qualifying an identifier with a block name. Source files are treated as modules named by the filename without the language suffix (such as the **.c** suffix on a C language program).

The **dbx** command debug program checks types of expressions. Override types of expressions by using *TypeName (Expression)*. When there is no corresponding named type, use the **&***TypeName* special construct to represent a pointer to the named type. Represent a pointer to **enum**, **struct**, or **union** tag with the **$$***TagName* construct.

A condition can be any **dbx** expression that evaluates to a true or false value. This pertains to four **dbx** subcommands: **stop**, **stopi**, **trace**, and **tracei**.

The following operators are valid in expressions:

Expression	Operators
exp (exponentiation) Algebraic	**+ (addition), - (subtraction), * (multiplication), / (floating point division), div (integral division), mod (modulo division), exp (exponentiation)**
Bitwise	**? (unary minus), ? (bitwise or), & (bitwise and), ? (bitwise xor), ~ (one's complement), << (bitwise left shift), >> (bitwise right shift), bitand (bitwise and), xor (bitwise xor)**
Logical	**?? (logical or), && (logical and), ! (logical not), or, and, not**
Comparison	**< (less than), > (greater than), <= (less than or equal to), >= (greater than or equal to), <> (not equal to), != (not equal to), = (equal to), == (equal to)**
Other	**sizeof**

Files

a.out The object file **a.out** is the default name of an executable file produced by the compiler. If no executable is specified on the dbx command line, then **dbx** will look for an **a.out** file to debug.

.dbxinit
Contains initial commands.

.dbxsetup
Contains initial commands.

.dbxhistory
Contains a listing of recently used **dbx** commands. Used by the history **dbx** subcommand.

Examples

1. This example shows you how to attach **dbx** to a running process. To do this, it is useful to insert a sleep(30) call into the program to be debugged. This will give you enough time to issue the **ps -Aef** shell command to find the process ID of the program. Once you have the process ID, issue the shell command: **dbx -a process-id**.

   Before starting the server, set the following four environment variables:

   `export _BPX_PTRACE_ATTACH=yes` (tells the kernel to always load DLLs and executables into read/write storage)

   `export _CEE_RUNOPTS="test(all)"` (tells Language Environment to load the CEEEVDBG debugger exit and send dbx debug events)

   `export _CEE_DEBUG_FILENAME31=/bin/dbx31vdbg` (the path to the Language Environment debugger exit for 31-bit programs)

   `export _CEE_DEBUG_FILENAME64=/bin/dbx64vdbg` (the path to the Language Environment debugger exit for 64-bit programs)

   Use **dbx** commands to set breakpoints, step through program statements, print variables, work with threads, examine storage, and actions as needed.
2. Example of creating the .dbxinit file in your home directory:

```
alias nsf "use /sandbox3/UNIX_notes/CGOOD/notes/nsf/"
alias asc "set $asciichars ; set $asciistrings"
alias ebc "unset $asciichars ; unset $asciistrings"
set $repeat
set $history_unique
set $hold_next
set $showbases
```

3. Sample **dbx** commands issued after starting server and seeing "sleeping for 30 seconds" message for server process ID 50331876:

```
/sandbox3/UNIX_notes/CGOOD/notes/os>  dbx -a 50331876
FDBX0278: Waiting to attach to process 50331876 ...
FDBX0089: dbx for MVS.
FDBX0399: Compiled: Sep 28 2001 10:22:24 GMT as BFP
FDBX0400: OS level: 12.00 03, LE level: 4.1.2 with CWIs.
FDBX0100: Type 'help' for help.
FDBX0099: reading symbolic information ...
FDBX0900: reading symbols for
/sandbox3/UNIX_notes/CGOOD/usr/lpp/lotus/notes/latest/os390/server ...
FDBX0037: XPLink module found
FDBX0900: reading symbols for
/sandbox3/UNIX_notes/CGOOD/usr/lpp/lotus/notes/latest/os390/libnotes ...

attached in sleep at 0xebcd024 ($t1)
sleep() at 0xebcd024
unnamed block $b64, line 873 in "meminit.c"
MemoryInit1(), line 873 in "meminit.c"
OSInitExt() at 0x1000cdc4
ServerMain() at 0xf80ac38
main() at 0xf80a12e
.() at 0xeeb2f4a
.() at 0x6f8e976
0x0ebcd024 (+0xff3c3024) 47060003     nop    X'3'($r6,)
(dbx) stop at "meminit.c":875
[1] stop at "meminit.c":875
(dbx) c
[1] stopped in unnamed block $b64 at line 875 in file "meminit.c" ($t1)
(dbx) where
unnamed block $b64, line 875 in "meminit.c"
MemoryInit1(), line 875 in "meminit.c"
OSInitExt() at 0x1000cdc4
ServerMain() at 0xf80ac38
main() at 0xf80a12e
.() at 0xeeb2f4a
.() at 0x6f8e976
(dbx) list 872,875
  872           __printf_a("sleeping for 30 seconds time to dbx\n");
  873           sleep(30);
  874           __printf_a("Done sleeping \n");
  875           if (loc_num_of_segs > MAX_NUM_OF_SEGM)
(dbx) print loc_num_of_segs
4
(dbx) &loc_num_of_segs/8x
0fc55af8:  0000 0004 0000 01b0 0400 0000 0f9d 57f8
(dbx) 0xfc55af8/8x
0fc55af8:  0000 0004 0000 01b0 0400 0000 0f9d 57f8
(dbx) n
stopped in unnamed block $b64 at line 971 in file "meminit.c" ($t1)
  971   DoAgain2:
(dbx) n
stopped in unnamed block $b64 at line 972 in file "meminit.c" ($t1)
  972                   hMMShMemId = shmget(ShmemAccessKey,
FirstSegSize, IPC_CREAT|IPC_EXCL|loc_shm390flags|perms);
```

Usage notes

The following list of dbx subcommands can have their output redirected to a file.
- **alias**
- **args**
- **condition**
- **dump**
- **examine**
- **list**
- **listfiles**
- **listfuncs**
- **listi**
- **map**
- **mutex**
- **onload**
- **readwritelock**
- **rerun**
- **registers**
- **run**
- **sh**
- **status**
- **thread**
- **whatis**
- **where**
- **whereis**
- **which**

The following **dbx** subcommands will return an error message in GUI mode (**-p**).
- **detach**
- **edit**
- **multproc**
- **object**
- **quit**
- **rerun**
- **run**
- **sh**

Related information

c89/cc/c++

? subcommand for dbx: Search backward for a pattern

Format

? [*RegularExpression*]

Description

The **?** subcommand searches backward in the current source file for the pattern specified by the *RegularExpression* argument. Entering the **?** subcommand with no arguments causes **dbx** to search backward for the previous regular expression.

Usage notes

The **?** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To search backward in the current source file for the letter z, enter:
   ```
   ?z
   ```
2. To repeat the previous search, enter:
   ```
   ?
   ```

Related information

The / (search) subcommand.

/ subcommand for dbx: Search forward for a pattern

Format

/ [*RegularExpression*]

Description

The **/** subcommand searches forward in the current source file for the pattern specified by the *RegularExpression* argument. Entering the **/** subcommand with no arguments causes **dbx** to search forward for the previous regular expression.

Usage notes

The **/** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To search forward in the current source file for the number 12, enter:
   ```
   / 12
   ```
2. To repeat the previous search, enter:
   ```
   /
   ```

Related information

The **?** (search) subcommand.

alias subcommand for dbx: Display and assign subcommand aliases

Format

alias [*name*] [*string*]

Description

The **alias** subcommand creates aliases for **dbx** subcommands. The *name* argument is the alias being created. The *string* argument is a series of **dbx** subcommands that, after the execution of this subcommand, can be referred to by *name*. If the **alias** subcommand is used without aliases, it displays all current aliases.

Usage notes

The **alias** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To set **tracef1** to be an alias for **trace** in **f1**, enter:
   ```
   alias tracef1 "trace in f1"
   ```
2. To define a **stopf** alias with *file* and *line* arguments to allow shorthand for setting a breakpoint within a file, enter:
   ```
   alias stopf(file, line) "stop at \"file\":line"
   ```

args subcommand for dbx: Display program arguments

Format

args

Description

The **args** subcommand displays the argument count and a list of arguments that are passed to the user's program when **dbx** starts debugging the program.

Usage notes

The **args** subcommand can be run only while the **dbx** debug program is running.

Examples

To display the current arguments, enter:

```
args
```

Related information

The **rerun** and **run** subcommands.

assign subcommand for dbx: Assign a value to a variable

Format

assign [*variable=expression*]

Description

The **assign** subcommand assigns the value specified by the *expression* argument to the variable specified by the *variable* argument.

Usage notes

1. The **assign** subcommand can be run only while the **dbx** debug program is running.
2. Functions cannot be specified with the *expression* argument.

Examples

1. To assign the value 5 to a variable *x*, enter:
   ```
   assign x = 5
   ```
2. To assign the value of a variable *y* to a variable *x*, enter:
   ```
   assign x = y
   ```
3. To assign a value to a storage location, enter:

```
assign 0x02e0f7f0 = 0xff
```

4. To assign a value to a register, enter:
```
assign $r7 = 123
```
5. To change the exit_status of a specific thread, enter:
```
assign $t1.exit_status=&$void(0x2d95840);
```

case subcommand for dbx: Change how dbx interprets symbols

Format

case [**default** | **mixed** | **lower** | **upper**]

Description

The **case** subcommand changes how the **dbx** debug program interprets symbols. Use **case** if a symbol needs to be interpreted in a way not consistent with the default behavior.

Entering **case** with no parameters displays the current case mode.

Options

default
Varies with the current language.

mixed Causes symbols to be interpreted as they actually appear.

lower Causes symbols to be interpreted as lowercase.

upper Causes symbols to be interpreted as uppercase.

Usage notes

The **case** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To instruct **dbx** to interpret symbols as they actually appear, enter:
```
case mixed
```
2. To instruct **dbx** to interpret symbols as uppercase, enter:
```
case upper
```

catch subcommand for dbx: Start trapping a signal

Format

catch [*signalnumber* | *signalname*]

Description

The **catch** subcommand starts the trapping of a specified signal before that signal is sent to the application program. This subcommand is useful when the application program being debugged handles such signals as interrupts. The signal to be trapped can be specified by number or by name using either the *signalnumber* or the *signalname* argument, respectively. Signal names are case-insensitive, and the SIG prefix is optional. All signals are caught by default except the SIGDUMP,SIGHUP, SIGCHLD, SIGALRM, and SIGKILL signals. If no arguments

are specified, the current list of signals to be caught is displayed.

Usage notes

The **catch** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To display a current list of signals to be caught by **dbx**, enter:
   ```
   catch
   ```
2. To trap signal SIGALRM, enter:
   ```
   catch SIGALRM
   ```

   or:
   ```
   catch ALRM
   ```

   or:
   ```
   catch 14
   ```

Related information

The **ignore** subcommand.

clear subcommand for dbx: Remove all stops at a specified source line

Format

clear *sourceline*

Description

The **clear** subcommand removes all stops at a specified source line. The *sourceline* argument can be specified in two formats:
- As an integer
- As a file name string followed by a **:** (colon) and an integer

Usage notes

The **clear** subcommand can be run only while the **dbx** debug program is running.

Examples

To remove breakpoints set at line 19, enter:
```
clear 19
```

Related information

The **cleari** and **delete** subcommands.

cleari subcommand for dbx: Remove all breakpoints at an address

Format

cleari *address*

Description

The **cleari** subcommand clears all the breakpoints at the address specified by the *address* argument.

Usage notes

The **cleari** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To remove a breakpoint set at address 0X100001B4, enter:
   ```
   cleari 0x100001b4
   ```
2. To remove a breakpoint set at the address of the **main()** procedure, enter:
   ```
   cleari &main
   ```

Related information

The **clear** and **delete** subcommands.

---

condition subcommand for dbx: Display a list of active condition variables

Format

condition &lbrk;*number &ellip;*&rbrk;
condition wait
condition nowait

Description

The **condition** subcommand displays a list of active condition variables for the application program. All active condition variables are listed unless you use the *number* parameter to specify the condition variables you want listed. You can also select condition variables with or without waiters by using the **wait** or **nowait** options.

In order to capture the condition variables, **dbx** must be debugging your program before the condition variable is created. You must have coded your application in one of the following ways:

- Add the following line at the top of the C program:
  ```
  &numsign;pragma runopts(TEST(ALL))
  ```
  Or:
- Code an assembler program, CEEUOPT, to invoke the CEEXOPT macro, which specifies TEST(ALL). For examples of how to code this program, see *z/OS Language Environment Programming Guide*.

Usage notes

The **condition** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To display all condition variables, enter:
   ```
   condition
   ```

2. To display condition variables number 1 and number 4, enter:
   ```
   condition 1 4
   ```
3. To display all condition variables with waiters, enter:
   ```
   condition wait
   ```
4. To display all condition variables without waiters, enter:
   ```
   condition nowait
   ```

cont subcommand for dbx: Continue program execution

Format

cont [*signalnumber* | *signalname*]

Description

The **cont** subcommand continues the execution of the program from the current stopping point until either the program finishes, another breakpoint is reached, a signal is received that is trapped by the **dbx** command, or an event occurs (such as a fork, an exec, or a program abend).

If a signal is specified, either by the number specified in the *signalnumber* argument or by the name specified in the *signalname* argument, the program continues as if that signal had been received by the focus thread.

If a signal is not specified, the **dbx** debug program variable **$sigblock** is set, and a signal caused the debugged program to stop, then the program resumes execution. If a signal is not specified, the **dbx** debug program variable **$sigblock** is not set, and a signal caused the debugged program to stop, then typing in the **cont** command with no signal causes the program to continue as if it had received the original signal.

Signal names are not case-sensitive, and the **SIG** prefix is optional. If no signal is specified, the program continues as if it had not been stopped.

Usage notes

The **cont** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To continue program execution from the current stopping point, enter:
   ```
   cont
   ```
2. To continue program execution as though it had received the signal **SIGQUIT**, enter:
   ```
   cont SIGQUIT
   ```

Related information

The **step**, **next**, **goto**, and **skip** subcommands.

delete subcommand for dbx: Remove traces and stops

Format

delete [**all** | *number...*]

Description

The **delete** subcommand removes traces and stops from the program. You can specify the traces and stops to be removed through the *number* arguments, or you can remove all traces and stops by using the **all** option. To display the numbers associated by the **dbx** debug program with a trace or stop, use the **status** subcommand.

Options

all Removes all traces and stops.

Usage notes

The **delete** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To remove all traces and stops from the program, enter:
   ```
   delete all
   ```
2. To remove traces and stops for event number 4, enter:
   ```
   delete 4
   ```

Related information

The **status**, **clear**, and **cleari** subcommands.

detach subcommand for dbx: Continue program execution without dbx control

Format

detach [*signalnumber* | *signalname*]

Description

The **detach** subcommand continues the execution of a program from the current stopping point without control of **dbx**.

If a signal is specified, either by the number specified in the *signalnumber* argument or by the name specified in the *signalname* argument, the program continues without **dbx** control as if that signal had been received by the focus thread. If the signal is not specified, the program continues with no signal and without **dbx** control.

Signal names are not case-sensitive, and the SIG prefix is optional. If no signal is specified, the program continues without **dbx** control as if it had not been stopped.

Usage notes

- The **detach** subcommand can be run only while the **dbx** debug program is running.
- The **detach** subcommand is not supported in GUI (socket) mode (**-p**).

Examples

1. To continue program execution from the current stopping point without **dbx** in control, enter:

   ```
   detach
   ```

2. To continue program execution without **dbx** control as though it had received the signal SIGQUIT, enter:

   ```
   detach SIGQUIT
   ```

Related information

The **cont** subcommand.

---

display memory subcommand for dbx: Display the contents of memory

Format

address, address/[mode]

address/[count][mode]

[b | Bd | Bf | Bq | c | d | D | f | g | h | i | I | ld | lo | lx | o | O | q | s | S | o | W | X] [>file]

Description

The **display memory** subcommand displays the contents of memory. The display starts at the first address, and terminates at either the second address or until count items are printed. If the address is ".", the address following the one most recently printed is used. The mode specifies how memory is to be printed; if it is omitted the previous mode specified is used. The initial mode is "X".

- The range of memory displayed is controlled by specifying:

  — Two *address* arguments, in which case all lines between those two addresses are displayed (**address/address**), or

  — One **address** argument, where the display starts, and **count**, which determines the number of lines displayed from **address** (**address/count**).

  . Used in place of the first *address* argument, this displays from the point where you left off (see example 3 on page 220).

- Symbolic addresses are specified by preceding the name with an **&** (ampersand).
- Registers are denoted by "$rN", "$frN" or "$drN", where N is the number of the register.
- Addresses may be expressions made up of other addresses and the operators **+**, **-**, and * indirection.
- Any expression enclosed in parentheses is interpreted as an address.
- The format in which the memory is displayed is controlled by the *mode* argument. The default for the *mode* argument is the current mode. The initial value of *mode* is **X**. The possible modes include:

  b Print a byte in octal format

Bf Print single precision real number in binary floating point

Bg Print a double precision real number in binary floating point

Bq Print a long double precision real number in binary floating point

c Print a byte as a character

C Print a wchar_t character

d Print a short word in decimal

D Print a long word in decimal

Df Print single precision real number in decimal floating point

Dg Print a double precision real number in decimal floating point

Dq Print a long double precision real number in decimal floating point

f Print a single precision real number in hexadecimal floating point

g Print a double precision real number in hexadecimal floating point

h Print a byte in hexadecimal format

ha Print a byte in hexadecimal format and ASCII

he Print a byte in hexadecimal format and EBCDIC

i Print the machine instruction

I Print a wint_t character

ld Print a long long in signed decimal

lo Print a long long in octal format

lu Print a long long in unsigned decimal

lx Print a long long in hexadecimal format

o Print a short word in octal format

O Print a long word in octal format

q Print a long double precision real number in hexadecimal floating point

s Print a string (terminated by a null byte)

S Print a wchar_t string

W Print a wint_t string

x Print a short word in hexadecimal format

X Print a long word in hexadecimal format

Options

>file Redirects output to the specified file.

Usage notes

The **display memory** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To display one long word of memory content in hexadecimal format starting at the address 0X3FFFE460, enter:

   ```
   0x3fffe460 / x
   ```

2. To display 2 bytes of memory content as characters starting at the address of variable *y*, enter:

   ```
   &y/2c
   ```

3. To display from the point where you left off, when using **.** (period) in place of one of the addresses, enter:

   ```
   0x100 / 2             which displays 2 words starting at x'100'
   ```

   followed by:

   ```
   . / 3                 which displays 3 words starting at x'108'
   ```

Related information

See also: **cleari**, **gotoi**, **registers**, **stepi**, **nexti**, **tracei**, and **stopi** commands.

down subcommand for dbx: Move the current function down the stack

Format

down [*count*]

Description

The **down** subcommand moves the current function down the stack *count* number of levels. The current function is used for resolving names. The default for the *count* argument is 1.

Usage notes

The **down** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To move one level down the stack, enter:

   ```
   down
   ```

2. To move three levels down the stack, enter:

   ```
   down 3
   ```

Related information

The **up** and **where** subcommands.

dump subcommand for dbx: Display the names and values of variables in a procedure

Format

dump [*procedure*] [>*file*]

Description

The **dump** subcommand displays the names and values of all variables in the specified procedure. If the *procedure* argument is **.** (dot), all active variables are displayed. If the *procedure* argument is not specified, the current procedure is used. If the >*file* option is used, the output is redirected to the specified file.

Options

>*file* **dump** output to the specified file.

Usage notes

The **dump** subcommand can be run only while the **dbx** debug program is running. **dump** redirects output to the specified file.

Examples

1. To display names and values of variables in the current procedure, enter:
   ```
   dump
   ```
2. To display names and values of variables in the **add_count** procedure, enter:
   ```
   dump add_count
   ```
3. To redirect names and values of variables in the current procedure to the **var.list** file, enter:
   ```
   dump > var.list
   ```

edit subcommand for dbx: Invoke an editor

Format

edit [*procedure* | *file*]

Description

The **edit** subcommand invokes an editor on the specified file. The file can be specified through the *file* argument or through the *procedure* argument (in which case the editor is invoked on the file containing that procedure). If no file is specified, the editor is invoked on the current source file. The default editor is the **ed** editor. Override the default by resetting the EDITOR environment variable to the name of the desired editor.

Usage notes

- The **edit** subcommand can be run only while the **dbx** debug program is running.
- The **edit** subcommand is not supported in GUI (socket) mode (**-p**).

Examples

1. To invoke an editor on the current source file, enter:
   ```
   edit
   ```
2. To invoke an editor on the **main.c** file, enter:
   ```
   edit main.c
   ```
3. To invoke an editor on the file containing the **do_count** procedure, enter:
   ```
   edit do_count
   ```

Related information

The **ed** editor.

The **list** subcommand for the **dbx** command.

file subcommand for dbx: Change the current source file

Format

file [*file*]

Description

The **file** subcommand changes the current source file to the file specified by the *file* argument; it does not write to that file. If the *file* argument is not specified, the **file** subcommand displays the name of the current source file.

Usage notes

The **file** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To change the current source file to the **main.c** file, enter:
   ```
   file main.c
   ```
2. To display the name of the current source file, enter:
   ```
   file
   ```

func subcommand for dbx: Change the current function

Format

func [*procedure*]

Description

The **func** subcommand changes the current function to the procedure or function specified by the *procedure* argument. If the *procedure* argument is not specified, the default current function is displayed. Changing the current function implicitly changes the current source file to the file containing the new function; the current scope used for name resolution is also changed.

Usage notes

The **func** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To change the current function to the **do_count** procedure, enter:
   ```
   func do_count
   ```
2. To display the name of the current function, enter:
   ```
   func
   ```

goto subcommand for dbx: Run a specified source line

Format

goto *sourceline*

Description

The **goto** subcommand causes the specified source line to be run next. Typically, the source line must be in the same function as the current source line. To override this restriction, use the **set** subcommand with the **$unsafegoto** variable.

Usage notes

- The **goto** subcommand can be run only while the **dbx** debug program is running.
- While **dbx** allows the changing of the next instruction to be run, unpredictable results might occur in the program being debugged. Whether the unpredictable results occur depends on where the program is currently stopped, the current state of the program, and where the program is to resume running.

Examples

To change the next line to be executed to line 6, enter:

```
goto 6
```

Related information

The **cont**, **gotoi**, and **set** subcommands.

gotoi subcommand for dbx: Change the program counter address

Format

gotoi *address*

Description

The **gotoi** subcommand changes the program counter address to the address specified by the *address* argument.

Usage notes

- The **gotoi** subcommand can be run only while the **dbx** debug program is running.
- While **dbx** allows the changing of the next instruction to be run, unpredictable results might occur in the program being debugged. Whether the unpredictable results occur depends on where the program is currently stopped, the current state of the program, and where the program is to resume running.

Examples

To change the program counter address to address 0X100002B4, enter:

```
gotoi 0x100002b4
```

Related information

The **goto** subcommand.

help subcommand for dbx: Display a subcommand synopsis

Format

help [*subcommand*] [*topic*]

Description

The **help** subcommand displays a synopsis of common **dbx** subcommands.

Usage notes

The **help** subcommand can be run only while the **dbx** debug program is running.

Examples

To obtain a synopsis of common **dbx** subcommands, enter one of the following:

```
help
help subcommand
help topic
```

The **help** subcommand with no arguments lists available **dbx** subcommands and topics.

help *subcommand*, where *subcommand* is one of the **dbx** subcommands, displays a synopsis and brief description of the subcommand. **help** *topic* (where *topic* is execution, expression, files, machine, scope, usage, or variables) displays a synopsis and brief description of the topic.

history subcommand for dbx: Display commands in a history list

Format

history

Usage notes

The **history** subcommand displays the commands in the history list. As each command is entered, it is appended to the history list. A mechanism for history substitution is provided through the exclamation (**!**) operator. The allowable forms are **!!** for a previous command, *!n* for the *n*th command, and **!***string* for the previous command that starts with *string*. The number of commands retained and displayed is controlled by the **dbx** internal variable **$historywindow**.

ignore subcommand for dbx: Stop trapping a signal

Format

ignore [*signalnumber* | *signalname*]

Description

The **ignore** subcommand stops the trapping of a specified signal before that signal is sent to the program. This subcommand is useful when the program being debugged handles such signals as interrupts.

The signal to be trapped can be specified by:
- Number, with the *signalnumber* argument
- Name, with the *signalname* argument

Signal names are not case-sensitive. The **SIG** prefix is optional.

If neither the *signalnumber* nor the *signalname* argument is specified, all signals except the SIGDUMP, SIGHUP, SIGCHLD, SIGALRM, and SIGKILL signals are ignored by default. The **dbx** debug program cannot catch SIGKILL or SIGDUMP. If no arguments are specified, the list of currently ignored signals is displayed.

Usage notes

The **ignore** subcommand can be run only while the **dbx** debug program is running.

Examples

To cause **dbx** to ignore alarm clock timeout signals sent to the program, enter:

```
ignore sigalrm
```

or:

```
ignore alrm
```

or:

```
ignore 14
```

Related information

The **catch** subcommand.

list subcommand for dbx: Display lines of the current source file

Format

list [*procedure* | *SourcelineExpression*] [,*SourcelineExpression*]

Description

The **list** subcommand displays a specified number of lines in the source file. The number of lines displayed are specified in one of two ways:

- By specifying a procedure using the *procedure* argument. In this case, the **list** subcommand displays lines before the first executable line of source in the specified procedure and until the list window is filled.
- By specifying a starting and ending source line number using the *SourcelineExpression* argument. Use the current filename or source filename if specified.

  The *SourcelineExpression* argument should consist of a valid line number followed by an optional + or - and an integer. In addition, a *SourcelineExpression*

of **$** can be used to denote the current line number, and a *SourcelineExpression* of **@** can be used to denote the next line number to be listed.

All lines from the first line number specified to the second line number specified, inclusive, are then displayed, provided these lines fit in the list window.

If the second source line is omitted, ten lines are printed, beginning with the line number specified in the *SourcelineExpression* argument.

If the **list** subcommand is used without arguments, the default number of lines are printed, beginning with the current source line. The default is `10`.

To change the number of lines to list by default, set the special debug program variable, **$listwindow**, to the number of lines you want. Initially, **$listwindow** is set to `10`.

Usage notes

The **list** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To list the lines 1 through 10 in the current file, enter:
   ```
   list 1,10
   ```
2. To list 10, or **$listwindow**, lines around the first executable line in the **main** procedure, enter:
   ```
   list main
   ```
3. To list 11 lines around the current line, enter:
   ```
   list $-5,$+5
   ```

Related information

The **edit**, **listi**, **move**, and **set** subcommands.

listfiles subcommand for dbx: Display the list of source files

Format

listfiles [*loadmap-index*]

Description

The **listfiles** subcommand displays the list of files associated with each module in the load map.

If the **listfiles** subcommand is used without arguments, the files for every module in the load map will be listed.

Usage notes

The **listfiles** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To list all files in all modules, enter:
   ```
   listfiles
   ```

2. To list the files only for module with index 0 in the loadmap, enter:
   ```
   listfiles 0
   ```

Related information

The **listfuncs** and **map** subcommands.

listfuncs subcommand for dbx: Display the list of functions

Format

listfuncs [*filename*]

Description

The **listfuncs** subcommand displays a list of functions associated with each file in the program.

If the listfuncs subcommand is used without arguments, the function for every file in the program will be listed.

Usage notes

The **listfuncs** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To list all functions in all files, enter:
   ```
   listfuncs
   ```
2. To list the function only for file **mypgm.c**, enter:
   ```
   listfuncs mypgm.c
   ```

Related information

The **func** subcommand.

listi subcommand for dbx: List instructions from the program

Format

listi [*procedure* | **at** | *sourceline* | *address*] [,*address*]

Description

The **listi** subcommand displays a specified set of instructions from the source file. The instructions displayed are specified by:

- Providing the *procedure* argument, in which case the **listi** subcommand lists instructions from the beginning of *procedure* until the list window is filled.
- Using the **at***sourceline* option, in which case the **listi** subcommand displays instructions beginning at the specified source line and continuing until the list window is filled.
- Specifying a beginning and ending address using the *address* arguments, in which case all instructions between the two addresses, inclusive, are displayed.

If the **listi** subcommand is used without options or arguments, the next **$listwindow** instructions are displayed. To change the current size of the list window, use the **set $listwindow**=*value* subcommand.

Options

at *sourceline*
Specifies a starting source line for the listing.

Usage notes

The **listi** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To list the next 10, or **$listwindow**, instructions, enter:
   ```
   listi
   ```
2. To list the machine instructions beginning at source line 10, enter:
   ```
   listi at 10
   ```
3. To list the instructions between addresses 0X10000400 and 0X10000420, enter:
   ```
   listi 0x10000400, 0x10000420
   ```

Related information

The **list** and **set** subcommands.

map subcommand for dbx: Display load characteristics

Format

map [>*file*]

Description

The **map** subcommand displays characteristics for each loaded portion of the program. This information includes the name, text origin, text length, text end, text subpool, data origin, data length, data subpool, and file descriptor for each loaded module. The data origin, data length, data subpool, and file descriptor do not contain meaningful information.

Options

>*file* Redirects output to the specified file.

Usage notes

The **map** subcommand can be run only while the **dbx** debug program is running.

Examples

To examine the characteristics of the loaded portions of the application, enter:

```
map
```

move subcommand for dbx: Display or change the next line to be shown with the list command

Format

move

move *sourceline*

move *function*

Description

The **move** subcommand changes the next line to be displayed to the line specified by the *sourceline* argument. This subcommand changes the value of the @ variable. The *sourceline* argument can either be a line number in the current file, or a function name. Omitting the *sourceline* argument will display the current line number.

Usage notes

The **move** subcommand can be run only while the **dbx** debug program is running.

Examples

To change the next line to be listed to line 12, enter:

```
move 12
```

To change the next line to be listed to be the function main, enter:

```
move main
```

To display the current line number, enter :

```
move
```

Related information

The **list** subcommand.

multproc subcommand for dbx: Enable or disable multiprocess debugging

Format

multproc
multproc [on]
multproc [off]
multproc [parent]
multproc [child]

Description

The **multproc** subcommand alters the way **dbx** behaves when the process that is being debugged issues a **fork()** runtime call. By default, multiprocess debugging is disabled when **dbx** is started.If no options are specified, the **multproc** subcommand returns the current status of multiprocess debugging.

Options

on **dbx** will notify the user that a fork has occurred, provide the PID of the new child process, and follow the parent process.

off **dbx** will ignore any forks that occur.

parent **dbx** will notify the user that a fork has occurred and follow the parent process.

child **dbx** will notify the user that a fork has occurred and follow the child process.

Usage notes

- The **multproc** subcommand can be run only while the **dbx** debug program is running.
- The **multproc** subcommand is not supported in GUI (socket) mode (**-p**).

Examples

1. To check the current status of multiprocess debugging, enter:
   ```
   multproc
   ```
2. To have **dbx** notify the user that the process being debugged has forked, enter:
   ```
   multproc on
   ```
3. To have **dbx** ignore all forks by the process being debugged, enter:
   ```
   multproc off
   ```

Related information

The **fork()** function.

---

mutex subcommand for dbx: Display a list of active mutex objects

Format

mutex [*number ...*]
mutex lock
mutex unlock
mutex wait
mutex nowait

Description

The **mutex** subcommand displays a list of active mutex objects for the application program. All active mutex objects are listed unless you use the *number* parameter to specify the mutex objects you want listed. You can also select only locked or unlocked mutexes, or mutexes with or without waiters, by using the **lock**, **unlock**, **wait**, or **nowait** options.

In order to capture the mutex variables, **dbx** must be debugging your program before the mutex variable is created. You must have coded your application in one of the following ways:

- Add the following line at the top of the C program:
  ```
  #pragma runopts(TEST(ALL))
  ```
  Or:

- Code an assembler program, CEEUOPT, to invoke the CEEXOPT macro, which specifies TEST(ALL). For examples of how to code this program, see *z/OS Language Environment Programming Guide*.

Usage notes

The **mutex** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To display all mutex objects, enter:
   ```
   mutex
   ```
2. To display mutex objects number 1 and number 4, enter:
   ```
   mutex 1 4
   ```
3. To display all locked mutex objects, enter:
   ```
   mutex lock
   ```
4. To display all unlocked mutex objects, enter:
   ```
   mutex unlock
   ```
5. To display all mutex objects with waiters, enter:
   ```
   mutex wait
   ```
6. To display all mutex objects without waiters, enter:
   ```
   mutex nowait
   ```

---

next subcommand for dbx: Run the program up to the next source line

Format

next [*number*]

Description

The **next** subcommand runs the application program up to the next source line. The *number* argument specifies the number of times the **next** subcommand runs. If the *number* argument is not specified, **next** runs once only.

Usage notes

1. The **next** subcommand can be run only while the **dbx** debug program is running.
2. If the *$hold_next* variable is defined, **dbx** holds all threads except the focus thread during a **next** subcommand. Then **dbx** unholds the threads after the **next** subcommand finishes.

Examples

1. To continue execution up to the next source line, enter:
   ```
   next
   ```
2. To continue execution up to the third source line following the current source line, enter:
   ```
   next 3
   ```

Related information

The **cont**, **goto**, **nexti**, and **step** subcommands.

nexti subcommand for dbx: Run the program up to the next machine instruction

Format

nexti [*number*]

Description

The **nexti** subcommand runs the application program up to the next instruction. The *number* argument specifies the number of times the **nexti** subcommand is to be run. If the *number* argument is not specified, **nexti** runs only once.

Usage notes

1. The **nexti** subcommand can be run only while the **dbx** debug program is running.
2. If the *$hold_next* variable is defined, **dbx** holds all threads except the focus thread during a **nexti** subcommand. Then **dbx** unholds the threads after the **nexti** subcommand finishes.

Examples

1. To continue execution up to the next machine instruction, enter:

   ```
   nexti
   ```

2. To continue execution up to the third machine instruction following the current machine instruction, enter:

   ```
   nexti 3
   ```

Related information

The **gotoi**, **next**, and **stepi** subcommands.

object subcommand for dbx: Load an object file

Format

object *filename*

Description

The **object** subcommand loads the specified object file for execution, without the overhead of reloading **dbx**.

Usage notes

- The **object** subcommand can be run only while the **dbx** debug program is running.
- The **object** subcommand is not supported in GUI (socket) mode (**-p**).

Examples

To complete debugging of the current program, and to start debugging a new program without reloading **dbx**, enter:

```
object myprog
```

onload subcommand for dbx: Evaluate stop/trace after DLL load

Format

onload delete [all | *number ...***]**
onload list
onload stop at *sourceline*
onload stop in *procedure*
onload trace at *sourceline*
onload trace in *procedure*

Description

The **onload** subcommand defers building of stop or trace events until the *procedure* or *sourceline* is defined in the program **dbx** is debugging. **dbx** will evaluate the **onload** list after a DLL is loaded and generate stop/trace events if the *procedure* or *sourcefile* is now known to **dbx** after symbolics for the DLL are processed. If the *procedure* or *sourceline* is already known to **dbx**, then a normal stop or trace event will be generated and no event will be added to the **onload** list.

Usage notes

The **onload** subcommand can be run only while the **dbx** debug program is running.

Examples

To defer the building of a stop or trace event, enter:

```
onload stop in myfunc
onload stop in myclass::memfunc
onload stop in myclassvar.memfunc
onload stop at "mypgm.c":52
onload trace in myfunc
onload trace in myclass::memfunc
onload trace in myclassvar.memfunc
onload trace in "mypgm.c":52
```

Related information

The **stop** and **trace** subcommands.

plugin subcommand for dbx: Pass the specified command to the plug-in parameter

Format

plugin[*name*[*command*]]

Description

The **plugin** subcommand passes the command specified by the *command* parameter to the plug-in specified by the *name* parameter. If no parameters are specified, the names of all available plug-ins are displayed.

Usage notes

The **plugin** subcommand can be run only while the dbx debug program is running.

Examples

1. To list all available plug-ins, enter:
   ```
   plugin
   ```
2. To invoke the subcommand **help** of a plug-in named **sample**, enter:
   ```
   plugin sample help
   ```
3. To invoke the subcommand **interpret 0x12345678**of a plug-in named **xyz**, enter:
   ```
   plugin xyz interpret 0x12345678
   ```

See the **pluginload** subcommand and also the topic on Developing for dbx Plug-in Framework in *z/OS UNIX System Services Programming Tools*.

pluginload subcommand for dbx: Load the specified plug-in

Format

pluginload *file*

Description

The **pluginload** subcommand loads the plug-in specified by the *file* parameter. The *file* parameter should specify a path to the plug-in.

Usage notes

The **pluginload** subcommand can be run only while the dbx debug program is running.

Examples

1. To load the plug-in named **sample** located at /home/user/dbx_plugins/libdbx_sample.dll, enter:
   ```
   pluginload /home/user/dbx_plugins/libdbx_sample.dll
   ```

See the **pluginload** subcommand and also the topic on developing for the dbx plug-in framework in *z/OS UNIX System Services Programming Tools*.

pluginunload subcommand for dbx: Unload the specified plug-in

Format

pluginunload *name*

Description

The **pluginunload** subcommand unloads the plug-in specified by the *name* parameter. The *name* parameter should specify a name of plug-in that is currently loaded.

Usage notes

The **pluginunload** subcommand can be run only while the **dbx** program is running.

Examples

1. To unload the plug-in named **sample**, enter:
   ```
   pluginunload sample
   ```

See the **plugin** subcommand and the **pluginload** subcommand. Also see the topic on developing for the **dbx** plug-in framework in *z/OS UNIX System Services Programming Tools*.

print subcommand for dbx: Print the value of an expression

Format

print [*expression,...*] [*(parameters)*]

Description

The **print** subcommand prints the value of a list of expressions, specified by the *expression* arguments.

Usage notes

The **print** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To display the value of *x* and the value of *y* shifted left 2 bits, enter:
   ```
   print x, y << 2
   ```
2. To display a specific condition variable, enter:
   ```
   print $c1
   ```
3. To display the number of waiters for a specific mutex object, enter:
   ```
   print $m1.num_wait
   ```
4. To display the exit value of a specific thread, enter:
   ```
   print $t1.exit_status
   ```

Related information

The **assign** and **set** subcommands.

prompt subcommand for dbx: Change the dbx command prompt

Format

prompt [*"string"*]

Description

The **prompt** subcommand changes the **dbx** command prompt to the string specified by the *string* argument.

Usage notes

The **prompt** subcommand can be run only while the **dbx** debug program is running.

Examples

To change the prompt to dbx>, enter:

```
prompt "dbx>"
```

quit subcommand for dbx: End the dbx debugging session

Format

quit

Description

The **quit** subcommand ends the **dbx** debugging session.

Usage notes

- The **quit** subcommand can be run only while the **dbx** debug program is running.
- The **quit** subcommand is not supported in GUI (socket) mode (**-p**).

Examples

To exit the **dbx** debug program, enter:

```
quit
```

readwritelock subcommand for dbx: Display a list of active read/write lock objects

Format

readwritelock [*number ...*]
readwritelock lock
readwritelock unlock
readwritelock holder
readwrite noholder

Description

The **readwritelock** subcommand displays a list of active read/write lock objects for the application program. All active read/write lock objects are listed unless you use the *number* parameter to specify the read/write lock objects you want listed. You can also select only locked or unlocked read/write locks, or read/write locks with or without holders, by using the **lock**, **unlock**, **holder**, or **noholder** options.

In order to capture the read/write lock variables, **dbx** must be debugging your program before the read/write lock variable is created. You must have coded your application in one of the following ways:

- Add the following line at the top of the C program:

  ```
  #pragma runopts(TEST(ALL))
  ```

  Or:

- Code an assembler program, CEEUOPT, to invoke the CEEXOPT macro, which specifies TEST(ALL). For examples of how to code this program, see *z/OS Language Environment Programming Guide*.

  Or:

- Specify test(all) in the _CEE_RUNOPTS environment variable:

  ```
  export _CEE_RUNOPTS="test(all)"
  ```

Usage notes

The **readwritelock** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To display all read/write lock objects, enter:

   ```
   readwritelock
   ```

2. To display read/write lock objects number 1 and number 4, enter:

   ```
   readwritelock 1 4
   ```

3. To display all locked read/write lock objects, enter:

   ```
   readwritelock lock
   ```

4. To display all unlocked read/write lock objects, enter:

   ```
   readwritelock unlock
   ```

5. To display all read/write lock objects with holders, enter:

   ```
   readwritelock holder
   ```

6. To display all read/write lock objects without holders, enter:

   ```
   mutex noholders
   ```

record subcommand for dbx: Append user's commands to a file

Format

record *filename*

Description

The **record** subcommand appends the user's command lines to the specified file until a **record** command is entered with no parameters.

The **record** subcommand is started by specifying a file name on the **record** command. A second **record** command with no parameters will stop the current **record** process and close the file.

Usage notes

The **record** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To start recording the **dbx** commands to file **/tmp/mycmds**, enter:

   ```
   record /tmp/mycmds
   ```

2. To stop the previous recording to file **/tmp/mycmds**, enter:

   ```
   record
   ```

Related information

The **source** subcommand.

registers subcommand for dbx: Display the value of registers

Format

registers [>*file*]

Description

The **registers** subcommand displays the values of general-purpose registers, system control registers, floating-point registers, and the current instruction register, such as the program status word (PSW) for z/OS.

- General-purpose registers are denoted by the **$r***number* variable, where the *number* argument indicates the number of the register.
- Floating-point registers are denoted by the **$fr***number* variable. By default, the floating-point registers are not displayed. To display the floating-point registers, use the **unset $noflregs dbx** subcommand.

Options

>*file*
Redirects output to the specified file.

Usage notes for the registers subcommand of dbx

1. The **registers** subcommand can be run only while the **dbx** debug program is running.
2. Vector registers can be displayed or assigned individually by vector element type using the following predefined register names:
   - $vr0 through $vr31, for vector registers of type vector int
   - $vr0c through $vr31c, for vector char
   - $vr0s through $vr31s, for vector short

   Assigning a vector register can either be done a whole register at a time, for example, `assign $vr0 = $vr31`, or must be done an individual element at a time, using array subscripts. For example, to assign the third short element of vr15, `assign $vr15s[2] = <expression>`.

Examples

To display the registers, enter:

```
registers
```

Related information

The **set** and **unset** subcommands.

rerun subcommand for dbx: Begin running a program with the previous arguments

Format

rerun [*arguments*] [**<***file* | **>***file* | **2>***file* | **>>***file* | **2>***file* | **>&***file* | **>>&***file*]

Description

The **rerun** subcommand begins execution of the object file. The values specified with the *arguments* argument are passed as command-line arguments. If the *arguments* argument is not specified, the arguments from the last **run** or **rerun** subcommand are reused.

Options

<*file* Redirects input so that input is received from *file*.

>*file* Redirects output to *file*.

2>*file* Redirects standard error to *file*.

>>*file* Appends redirected output to *file*.

2>>*file* Appends redirected standard error to *file*.

>&*file* Redirects output and standard error to *file*.

>>&*file*
Appends output and standard error to *file*.

Usage notes

- The **rerun** subcommand can be run only while the **dbx** debug program is running.
- The **rerun** subcommand is not supported in GUI (socket) mode (**-p**).

Examples

To rerun the program with the previously entered arguments, enter:

```
rerun
```

Related information

The **run** subcommand.

return subcommand for dbx: Continue running a program until a return is reached

Format

return [*procedure*]

Description

The **return** subcommand causes the program to run until a return to the procedure specified by the *procedure* argument is reached. If the *procedure* argument is not specified, execution ceases when the current procedure returns.

Usage notes

The **return** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To continue execution to the calling routine, enter:

   ```
   return
   ```

2. To continue execution to the **main** routine, enter.

```
return main
```

run subcommand for dbx: Run a program

Format

run [*arguments*] [**<***file* | **>***file* | **2>***file* | **>>***file* | **2>***file* | **>&***file* | **>>&***file*]

Description

The **run** subcommand begins execution of the object file. The values specified with the *arguments* argument are passed as command-line arguments.

Options

<*file* Redirects input so that input is received from *file*.

>*file* Redirects output to *file*.

2>*file* Redirects standard error to *file*.

>>*file* Appends redirected output to *file*.

2>>*file* Appends redirected standard error to *file*.

>&*file* Redirects output and standard error to *file*.

>>&*file*
Appends output and standard error to *file*.

Usage notes

- The **run** subcommand can be run only while the **dbx** debug program is running.
- The **run** subcommand is not supported in GUI (socket) mode (**-p**).

Examples

To run the application with the arguments *blue* and *12*, enter:

```
run blue 12
```

Related information

The **rerun** subcommand.

set subcommand for dbx: Define a value for a dbx variable

Format

set [*variable=expression*]

Description

The **set** subcommand defines a value, which is specified by the *expression* argument, for the **dbx** debug program variable, which is specified by the *variable* argument. The name of the variable must not conflict with names in the program being debugged. A variable is expanded to the corresponding expression within other commands. If the **set** subcommand is used without arguments, the variables currently set are displayed.

Variables

The following variables are set with the **set** subcommand:

$asciichars
Any **dbx** operation that displays the value of a character will interpret the binary representation of the character as ASCII.

$asciistrings
Any **dbx** operation that displays the value of a string will interpret the binary representation of the string as ASCII.

$c<n> Condition variables

$catchbp
Catches breakpoints during the execution of the next command.

$charset
Converts character strings before displaying them. The character strings are converted from the code page srcCodePage to destCodePage. The destCodePage must be IBM-1047. The default setting is not to convert the character strings.

$commandedit
Enables the command line facility.

$current
Defined as a constant with the value of the focus thread.

$cv_events
Notifies the user but does not stop when a condition variable event is processed. The following trace information is sent to the user for the different events:

```
(dbx) cont
.
.
cv initialize, object=0x2e04567
cv wait, object=0x2e04567, mutex=0x2d04567, thid=0x0102030405060708
cv unwait, object=0x2e04567, mutex=0x2d04567, thid=0x0102030405060708
cv destroy, object=0x2e04567
.
.
```

$dll_loads
Set by default. When set, **dbx** processes symbolics for DLLs as they are loaded.

$dll_loadstop
Set by default. When set, **dbx** stops the function call that caused the DLL to be loaded. If the DLL was loaded due to a variable reference or an explicit load, **dbx** stops at the source line that caused the DLL to be loaded.

$expandunions
Displays values of each part of variant records or unions.

$expressionexhaustivesearch
Searches all scopes in a user's program to determine and verify the scope for an expression. Selecting this option might degrade performance.

$flprecision
Determines the precision in bytes of floating-point registers when the values of the register are displayed; for example, in expressions or during assignment. Valid values are 4, 8 or 16.

$fr<n>
Hexadecimal floating-point register.

$frb<n>
Binary floating-point register

$frd<n>
Decimal floating-point register

$hexchars
Prints characters in hexadecimal format.

$hexin
Input is interpreted in hexadecimal format.

Restriction: The **$hexin** variable is only supported in **dbx** command-line mode and does not affect the interpretation of GUI input. If the user of the GUI debugger wants input to be interpreted in hexadecimal format, the input must be prefixed with "0x".

$hexints
Prints integers in decimal format instead of hexadecimal format.

$historypage
Specifies the number of history items to be traversed when using the page up and page down keys.

$history_unique
Prevents consecutive duplicate commands from being saved to the history list.

$historywindow
Specifies the number of commands to display and retain in the history list.

$hold_next
Automatically holds all threads except the focus thread during the **next**, **nexti**, **step**, or **stepi** command execution. If not set, all threads resume execution and may reach the breakpoint set by the **next**, **nexti**, **step**, or **stepi** command execution.

$l<n> Read/write locks variables.

$listwindow
Specifies the number of lines to list around a function and to list when the **list** subcommand is used without parameters.

$lv_events
When set, **dbx** notifies the user but does not stop when a read/write lock object event is processed. The following trace information is sent to the user for the different events:

```
(dbx) cont
.
.
lv initialize, object=0x2d04567
lv wait, object=0x2d04567, thid=0x0102030405060708
lv unwait, object=0x2d04567, thid=0x0102030405060708
lv lock, object=0x2d04567, thid=0x0102030405060708
lv unlock, object=0x2d04567, thid=0x0102030405060708
lv relock, object=0x2d04567, thid=0x0102030405060708
lv unrelock, object=0x2d04567, thid=0x0102030405060708
lv destroy, object=0x2d04567
.
.
```

$m<n>
Specifies mutex variables.

$maxstring
Specifies the maximum number of characters to be displayed when printing a string. String printing stops when $maxstring characters are printed. Set to zero to completely display strings. The default value is zero.

$mv_events
When set, **dbx** notifies the user but does not stop when a mutex object event is processed. The following trace information is sent to the user for the different events:

```
(dbx) cont
.
.
mv initialize, object=0x2d04567
mv wait, object=0x2d04567, thid=0x0102030405060708
mv unwait, object=0x2d04567, thid=0x0102030405060708
mv lock, object=0x2d04567, thid=0x0102030405060708
mv unlock, object=0x2d04567, thid=0x0102030405060708
mv relock, object=0x2d04567, thid=0x0102030405060708
mv unrelock, object=0x2d04567, thid=0x0102030405060708
mv destroy, object=0x2d04567
.
.
```

$noargs
Omits arguments from subcommands, such as **where**, **up**, **down**, and **dump**.

$noflbregs
Does not display the binary floating point representation of the floating point registers with the **registers** subcommand.

$nofldregs
Does not display the decimal floating point representation of the floating point registers with the **registers** subcommand.

$noflregs
Does not display the hexadecimal floating point representation of the floating point registers with the **registers** subcommand.

$novregs
When set, omits the display of vector registers from the registers subcommand.

$octin Interprets input in octal format. The **$octin** variable is only supported in **dbx** command-line mode and does not affect the interpretation of GUI input. If the user of the GUI debugger wants input to be interpreted in octal format, the input must be prefixed with "0".

$octints
Prints integers in octal format.

$pc Program counter register.

$psw First word of the program status word register.

$psw0 First word of the program status word register.

$psw1 Second word of the program status word register.

$r<n> General register.

$r_precision
Sets the amount of precision, in bytes, to use when displaying an integer value. Possible values are 4 and 8.

$repeat
Repeats the previous command if no command was entered.

$showbases
Displays the base class data when a derived class is printed.

$showcodelines
Indicates the lines where the debugger can stop and where breakpoints can be set.

$sigblock
Blocks all signals from reaching the program being debugged.

$sticky_debug
When set, **dbx** will recognize sticky bit programs and DLLs in the loadmap.

$t<n> Thread variables

$tv_events
Notifies the user but does not stop when a thread object event is processed. Trace information similar to the following example is sent to the user for the different events:

```
(dbx) cont
.
.
IPT create, thid=0x1234567890123456, stack=5200
IPT exit, thid=0x1234567890123456
tv create, thid=0x1234567890123456,  created thid=0x1234567890123422,
           stack=5200
tv created, thid=0x1234567890123456, stack=5200
tv exit, thid=0x1234567890123456
tv wait, thid=0x1234567890123456, joining thid=0x1234567890123422
tv unwait, thid=0x1234567890123456, joined thid=0x1234567890123422
```

$unsafeassign
Turns off strict type checking between the two sides of an **assign** subcommand.

$unsafebounds
Turns off subscript checking on arrays.

$unsafegoto
Turns off the **goto** subcommand destination checking.

Usage notes

1. The **$unsafe** variables limit the usefulness of the **dbx** debug program in detecting errors.
2. The **set** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To change the default number of lines to be listed to 20, enter:
   ```
   set $listwindow=20
   ```
2. To disable type checking on the **assign** subcommand, enter:
   ```
   set $unsafeassign
   ```

Related information

The **unset** subcommand.

sh subcommand for dbx: Pass a command to the shell for execution

Format

sh [*command*]

Description

The **sh** subcommand passes the command specified by the *command* parameter to the shell for execution. The SHELL environment variable determines which shell is used. The default is the **sh** shell. If no argument is specified, control is transferred to the shell.

Usage notes

- The **sh** subcommand can be run only while the **dbx** debug program is running.
- The **sh** subcommand is not supported in GUI (socket) mode (**-p**).

Examples

1. To run the **ls** command, enter:
   ```
   sh ls
   ```
2. To escape to a shell, enter:
   ```
   sh
   ```

skip subcommand for dbx: Continue from the current stopping point

Format

skip [*number*]

Description

The **skip** subcommand continues execution of the application program from the current stopping point. A number of breakpoints equal to the value of the *number* argument are skipped, and execution then ceases when the next breakpoint is reached or when the program finishes. If the *number* argument is not specified, it defaults to a value of 1.

Usage notes

The **skip** subcommand can be run only while the **dbx** debug program is running.

Examples

To continue execution until the second breakpoint is encountered, enter:

```
skip 1
```

Related information

The **cont** subcommand.

source subcommand for dbx: Read subcommands from a file

Format

source *file*

Description

The **source** subcommand reads **dbx** subcommands from the file specified by the *file* argument.

Usage notes

The **source** subcommand can be run only while the **dbx** debug program is running.

Examples

To read the **dbx** subcommands in the **cmdfile** file, enter:

```
source cmdfile
```

status subcommand for dbx: Display the active trace and stop subcommands

Format

status [>*file*]

Description

The **status** subcommand displays the **trace** and **stop** subcommands currently active. The **>** option sends the output of the **status** subcommand to a file specified in the *file* argument.

Options

>*file* Redirects output to *file*.

Usage notes

The **status** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To display the currently active **trace** and **stop** subcommands, enter:

   ```
   status
   ```

2. To stop at line 52 only when thread $t2 reaches that line, enter:

   ```
   stop at 52 if $t2==$current
   ```

Related information

The **clear**, **delete**, **stop**, and **trace** subcommands.

step subcommand for dbx: Run one or more source lines

Format

step [*number*]

Description

The **step** subcommand runs source lines of the program. Specify the number of lines to be run with the *number* argument. If the *number* argument is omitted, it defaults to a value of 1.

Usage notes

1. The **step** subcommand can be run only while the **dbx** debug program is running.
2. If the *$hold_next* variable is defined, **dbx** holds all threads except the focus thread during a **step** subcommand. Then **dbx** unholds the threads after the **step** subcommand finishes.

Examples

1. To continue execution for one source line, enter:

   ```
   step
   ```

2. To continue execution for five source lines, enter:

   ```
   step 5
   ```

Related information

The **cont**, **goto**, **next**, and **stepi** subcommands.

stepi subcommand for dbx: Run one or more machine instructions

Format

stepi [*number*]

Description

The **stepi** subcommand runs instructions of the program. Specify the number of instructions to be run in the *number* argument. If the *number* argument is omitted, it defaults to 1.

Usage notes

1. The **stepi** subcommand can be run only while the **dbx** debug program is running.
2. If the *$hold_next* variable is defined, **dbx** holds all threads except the focus thread during a **stepi** subcommand. Then **dbx** unholds the threads after the **stepi** subcommand finishes.

Examples

1. To continue execution for one machine instruction, enter:

   ```
   stepi
   ```

2. To continue execution for five machine instructions, enter:

   ```
   stepi 5
   ```

Related information

The **gotoi**, **nexti**, and **step** subcommands.

---

stop subcommand for dbx: Stop execution of a program

Format

stop if *condition*
stop [*variable*] **at** ["*filename*":]*sourceline* [**if** *condition*]
stop [*variable*] **in** *procedure* [**if** *condition*]
stop *variable* [**if** *condition*]

Description

The **stop** subcommand stops execution of the program when certain conditions are fulfilled. The program is stopped when:

- The *condition* is true, if the **if** *condition* option is used.
- The *sourceline* line number is reached, if the **at** *sourceline* option is used.
- The *procedure* is called, if the **in** *procedure* option is used.
- The *variable* is changed, if the *variable* argument is specified.

The **dbx** debug program associates event numbers with each **stop** subcommand. To view these numbers, use the **status** subcommand. To turn **stop** off, use the **delete** or **clear** subcommand.

Options

at ["*filename***":]***sourceline*
Specifies the source line number in either the specified *filename* or the file that is currently being debugged. If a specific file name is specified, the *filename* must be enclosed with quotation marks and a colon must separate the "*filename*" from the *sourceline*. For example:

```
stop at "myfile":1234
```

if *condition*
Specifies the condition, such as true.

in *procedure*
Specifies the procedure to be called.

Usage notes

The **stop** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To stop execution at the first executable statement in the **main** procedure, enter:

   ```
   stop in main
   ```

2. To stop execution when the value of the *x* variable is changed on line 12 of the execution, enter:

   ```
   stop x at 12
   ```

3. To stop execution at a specified line (line 23), when the value of the variable (*myvar*) is greater than 2, enter:

   ```
   stop at 23 if myvar > 2
   ```

4. To stop at line 52 only when thread $t2 reaches that line, enter:

   ```
   stop at 42 if $t2==$current
   ```

Related information

The **stopi**, **delete**, **clear**, and **trace** subcommands.

stopi subcommand for dbx: Stop at a specified location

Format

stopi *address* [**if** *condition*]
stopi [*address*] **at** *address* [**if** *condition*]
stopi [*address*] **in** *procedure* [**if** *condition*]

Description

The **stopi** subcommand sets a stop at the specified location.

- With the **if***condition* option, the program stops when the condition is true.
- With the *address* argument, the program stops when the contents of *address* change.
- With the **at***address* option, a stop is set at the specified address.
- With the **in***procedure* option, the program stops when the procedure specified with the *procedure* argument is called.

Options

if*condition*
Specifies the condition, such as true.

in*procedure*
Specifies the procedure to be called.

at*address*
Specifies the machine instruction address.

Usage notes

The **stopi** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To stop execution at address 0X100020F0, enter:
   ```
   stopi at 0x100020f0
   ```
2. To stop execution when the contents of address 0X100020F0 change, enter:
   ```
   stopi 0x100020f0
   ```
3. To stop at address 0x2d04567 only when thread $t2 reaches that address, enter:
   ```
   stopi at 0x2d04567 if $t2=$current
   ```

Related information

The **stop** subcommand.

thread subcommand for dbx: Display a list of active threads

Format

thread [*number ...*]
thread hold [*number ...*]
thread unhold [*number ...*]
thread info [*number ...*]

thread current [*number ...*]
thread activ
thread async
thread dead
thread pcanc

Description

The **thread** subcommand displays a list of active threads for the application program. All active threads are listed unless you use the **number** parameter to specify the threads you want listed. You can also select threads by their states using the **activ**, **async**, **dead**, or **pcanc** options.

You can use the **info** option to display full information about a thread, and threads can be held or unheld with the **hold** or **unhold** options. The focus thread is defaulted to the running thread; **dbx** uses it as the context for normal **dbx** subcommands such as **register**. You can use the current option to switch the **dbx** focus thread.

Examples

1. To display all thread objects, enter:
   ```
   thread
   ```
2. To display thread objects number 1 and 2, enter:
   ```
   thread 1 2
   ```
3. To display all active threads, enter:
   ```
   thread activ
   ```
4. To display all threads in dead state, enter:
   ```
   thread dead
   ```
5. To display all threads in async state (that is, threads with a cancelability type of PTHREAD_INTR_ASYNCHRONOUS) that are waiting to be scheduled), enter:
   ```
   thread async
   ```
   Because this thread was created with the PTATASYNCHRONOUS attribute and the limit was reached, this thread was queued for execution. For example, if the thread limit is set to ten and there are 12 threads, two of them will be shown as async for the dbx thread command.
6. To display all threads in pcanc state (that is, threads that have been requested to be canceled by **pthread_cancel()**, enter:
   ```
   thread pcanc
   ```
7. To hold all threads, enter:
   ```
   thread hold
   ```
8. To hold thread number 1 and 4, enter:
   ```
   thread hold 1 4
   ```
9. To unhold thread number 1 and 4, enter:
   ```
   thread unhold 1 4
   ```
10. To display the focus thread, enter:
    ```
    thread current
    ```
11. To set the focus thread to thread number 1, enter:
    ```
    thread current 1
    ```
12. To get information about thread number 3, enter:
    ```
    thread info 3
    ```

trace subcommand for dbx: Print tracing information

Format

trace [**if** *condition*]
trace *procedure* [**if** *condition*]
trace [*variable*] **at** *sourceline* [**if** *condition*]
trace [*variable*] **in** *procedure* [**if** *condition*]
trace *sourceline* [**if** *condition*]
trace *expression* **at** *sourceline* [**if** *condition*]

Description

The **trace** subcommand prints tracing information for the specified procedure, function, source line, expression, or variable when the program runs. A condition can be specified. The **dbx** debug program associates a number with each **trace** subcommand. To view these numbers, use the **status** subcommand. To turn tracing off, use the **delete** subcommand.

Options

at*sourceline*
Specifies the source line at which to find the expression being traced.

if*condition*
Specifies a condition for the beginning of the trace. The trace begins only **if***condition* is true.

in*procedure*
Specifies the procedure in which to find the procedure or variable being traced.

Usage notes

The **trace** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To trace each call to the **printf()** procedure, enter:
   ```
   trace printf
   ```
2. To trace each execution of line 22 in the **hello.c** file, enter:
   ```
   trace "hello.c":22
   ```
3. To trace changes to the **x** variable within the **main** procedure, enter:
   ```
   trace x in main
   ```
4. To trace at line 52 only when mutex $m1 is not held, enter:
   ```
   trace at 52 if $m2.lock == 0
   ```

Related information

The **tracei** subcommand.

tracei subcommand for dbx: Turn on tracing

Format

tracei [**if** *condition*]
tracei *address* [**at** *address*] [**if** *condition*]
tracei *address* [**in** *procedure*] [**if** *condition*]
tracei *expression* **at** *address* [**if** *condition*]

Description

The **tracei** subcommand turns on tracing when:

- The contents of the storage at the address change, if the *address* argument is specified.
- The instruction at the specified address is executed, if the **at***address* option is specified.
- The procedure specified by *procedure* is active, if the **in***procedure* option is included.
- The condition specified by the *condition* argument is true, if the **if***condition* option is included.

Options

at*address*
: Specifies an address. Tracing is enabled when the contents of this address change.

if*condition*
: Specifies a condition, the meeting of which causes tracing to be enabled.

in*procedure*
: Specifies a procedure. Tracing is enabled when this procedure is active.

Usage notes

The **tracei** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To trace each instruction run, enter:
   ```
   tracei
   ```
2. To trace each time the instruction at address 0X100020F0 is run, enter:
   ```
   tracei at 0x100020f0
   ```
3. To trace each time the contents of memory location 0X20004020 change while the **main** procedure is active, enter:
   ```
   tracei 0x20004020 in main
   ```
4. To trace at address 0x2d04567 only when thread $t2 reaches that address, enter:
   ```
   tracei at 0x2d04567 if $t2=$current
   ```

Related information

The **trace** subcommand.

unalias subcommand for dbx: Remove an alias

Format

unalias *name*

Description

The **unalias** subcommand removes the alias specified by the *name* argument.

Usage notes

The **unalias** subcommand can be run only while the **dbx** debug program is running.

Examples

To remove an alias named **printx**, enter:

```
unalias printx
```

Related information

The **alias** subcommand.

unset subcommand for dbx: Delete a variable

Format

unset *name*

Description

The **unset** subcommand deletes the debug program variable associated with the name specified by the *name* argument.

Usage notes

The **unset** subcommand can be run only while the **dbx** debug program is running.

Examples

To delete the variable inhibiting the display of floating-point registers, enter:

```
unset $noflregs
```

Related information

The **set** subcommand.

up subcommand for dbx: Move the current function up the stack

Format

up [*count*]

Description

The **up** subcommand moves the current function up the stack *count* number of levels. The current function is used for resolving names. The default for the *count* argument is 1.

Usage notes

The **up** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To move the current function up the stack two levels, enter:

   ```
   up 2
   ```

2. To display the current function on the stack, enter:

   ```
   up 0
   ```

Related information

The **down** subcommand.

use subcommand for dbx: Set the list of directories to be searched

Format

use [*directory...*]

Description

The **use** subcommand sets the list of directories to be searched when the **dbx** debug program looks for source files. If the **use** subcommand is specified without arguments, the current list of directories to be searched is displayed.

If the C primary source is in an MVS data set, the **use** subcommand can be specified with a double-slash (//) argument to indicate that the source file be sought outside the file system.

Usage notes

The **use** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To change the list of directories to be searched to the working directory, the parent directory, and **/tmp**, enter:

   ```
   use . .. /tmp
   ```

2. To change the list of directories to be searched to look for the C source as an MVS data set, enter:

   ```
   use //
   ```

Related information

The **edit** and **list** subcommands.

whatis subcommand for dbx: Display the type of program components

Format

whatis *name*

Description

The **whatis** subcommand displays the declaration of *name*, where the *name* argument designates a variable, procedure, or function name, optionally qualified with a block name.

Usage notes

1. Variables declared with the **const** attribute (in C programs) are displayed without the **const** attribute.
2. The **whatis** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To display the declaration of the *x* variable, enter:
   ```
   whatis x
   ```
2. To display the declaration of the **main** function, enter:
   ```
   whatis main
   ```
3. To display the declaration of the *x* variable within the **main** function, enter:
   ```
   whatis main.x
   ```
4. To display the declaration of a specific condition variable, $c1, enter:
   ```
   whatis $c1
   ```
5. To display the declaration of a specific mutex object, $m1, enter:
   ```
   whatis $m1
   ```
6. To display the declaration of a specific thread, $t1, enter:
   ```
   whatis $t1
   ```

where subcommand for dbx: List active procedures and functions

Format

where [>*file*]

Description

The **where** subcommand displays a list of active procedures and functions. By using the >*file* option, you can redirect the output of this subcommand to the specified file.

Options

>*flag* Redirects output to the specified file.

Usage notes

The **where** subcommand can be run only while the **dbx** debug program is running.

Examples

To display the list of active routines, enter:

```
where
```

Related information

The **up** and **down** subcommands.

whereis subcommand for dbx: Display the full qualifications of symbols

Format

whereis [-exhaustive] *identifier*

Description

The **whereis** subcommand displays the full qualifications of all the symbols whose names match the specified identifier. The order in which the symbols print is not significant.

Options

-exhaustive
Specifies that **whereis** is to search for symbols in all compile units. This option only applies when a module map is being used. If one is being used, then the default is to use quick mode, which searches for symbols only in the current compile unit and global lists. In that case, using this option might degrade performance. If a module map is not being used, then this subcommand always searches for symbols in all compile units.

Usage notes

1. The **whereis** subcommand can be run only while the **dbx** debug program is running.

Examples

1. To display the qualified names of all symbols named *x*, enter:

   ```
   whereis x
   ```

   An example of a possible output is:

   ```
   "x1.c".x

   FDBX9998: whereis quick mode will only search symbol x in current CU
   and global lists.  To list all symbol x, please use whereis -exhaustive x,
   but that will cause all debug data files to be loaded and performance
   will be degraded.
   ```

2. To display the qualified names of all symbols named x in exhaustive mode, enter:

   ```
   whereis -exhaustive x
   ```

   An example of a possible output is:

   ```
   ."x1.c".x
   ."x2.c".x
   ```

Related information

The **which** subcommand.

which subcommand for dbx: Display the full qualification of an identifier

Format

which *identifier*

Description

The **which** subcommand displays the full qualification of the given identifier. The full qualification consists of a list of the outer blocks with which the identifier is associated.

Usage notes

The **which** subcommand can be run only while the **dbx** debug program is running.

Examples

To display the full qualification of the *x* symbol, enter:

```
which x
```

Related information

The **whereis** subcommand.

dd — Convert and copy a file

Format

dd [**bs=***size*] [**cbs=***size*] [**conv=***conversion*] [**count=***n*] [**ibs=***size*] [**if=***file*] [**imsg=***string*] [**iseek=***n*] [**obs=***s*] [**of=***file*] [**omsg=***string*] [**seek=***n*] [**skip=***n*]>

Description

dd reads and writes data by blocks. It can convert data between formats. It is frequently used for such devices as tapes that have discrete block sizes, or for fast multisector reads from disks. **dd** performs conversions to accommodate nonprogrammable terminals, which require deblocking, conversion to and from EBCDIC, and fixed-length records.

dd processes the input data as follows:

1. **dd** reads an input block.
2. If this input block is smaller than the specified input block size, **dd** pads it to the specified size with null bytes. When you also specify a **block** or **unblock** conversion, **dd** uses spaces instead of null bytes.
3. If you specified **bs=***s* and requested no conversion other than **sync** or **noerror**, **dd** writes the padded (if necessary) input block to the output as a single block and omits the remaining steps.
4. If you specified the *swab* conversion, **dd** swaps each pair of input bytes. If there is an odd number of input bytes, **dd** does not attempt to swap the last byte.
5. **dd** performs all remaining conversions on the input data independently of the input block boundaries. A fixed-length input or output record may span these boundaries.

6. **dd** gathers the converted data into output blocks of the specified size. When **dd** reaches the end of the input, it writes the remaining output as a block (without padding if **conv=***sync* is not specified). As a result, the final output block might be shorter than the output block size.

Options

bs=*size*

Sets both input and output block sizes to *size* bytes. You can suffix this decimal number with **w**, **b**, **k**, or **x** *number*, to multiply it by 2, 512, 1024, or *number,* respectively. You can also specify *size* as two decimal numbers (with or without suffixes) separated by **x** to indicate the product of the two values. Processing is faster when **ibs** and **obs** are equal, since this avoids buffer copying. The default block size is 1B. **bs=***size* supersedes any settings of **ibs=***size* or **obs=***size*.

If you specify **bs=***size* and you request no other conversions than **noerror**, **notrunc**, or **sync**, **dd** writes the data from each input block as a separate output block; if the input data is less than a full block and you did not request **sync** conversion, the output block is the same size as the input block.

cbs=*size*

Sets the size of the conversion buffer used by various **conv** options.

conv=*conversion***[,** *conversion, ...***]**

conversion can be any one of the following:

ascii Converts EBCDIC input to ASCII for output; it is provided for compatibility purposes only.

To copy a file and convert between a shell code page and ASCII, use **iconv**, not **dd**.

block Converts variable-length records to fixed-length records. **dd** treats the input data as a sequence of variable-length records (each terminated by a newline or an EOF character) independent of the block boundaries. **dd** converts each input record by first removing any newline characters and then padding (with spaces) or truncating the record to the size of the conversion buffer. **dd** reports the number of truncated records on standard error (**stderr**). You must specify **cbs=***size* with this conversion.

Note: When working with double-byte characters, **dd** truncates the record after the last complete double-byte character that will fit in the conversion buffer. **dd** then pads the record with spaces if it is shorter than the conversion buffer size.

convfile

Uses **convfile** as a translation table if it is not one of the conversion formats listed here and it is the name of a file of exactly 256 bytes.

You can perform multiple conversions at the same time by separating arguments to **conv** with commas; however, some conversions are mutually exclusive (for example, **ucase** and **lcase**).

Note:

1. When you specify one or more of the character set conversions (**ascii**, **ebcdic**, **ibm**, or **convfile**), **dd** assumes that all characters

are single-byte characters, regardless of the locale. Do not use these conversions with double-byte character sets.

2. When working with DBCS text, **dd** treats the input and output files as character strings and handles DBCS characters correctly (no splitting and retaining of proper shift states). This happens only if any of the conversion options (**block**, **unblock**, **ucase**, or **lcase**) are specified. Otherwise, DBCS strings can be corrupted with the **seek**, **count**, or **iseek** processing.

ebcdic Converts ASCII input to EBCDIC for output; it is provided for compatibility purposes only.

To copy a file and convert between a shell code page and ASCII, use **iconv**, not **dd**.

ibm Like **ebcdic**, converts ASCII to EBCDIC; it is provided for compatibility purposes only.

To copy a file and convert between code page 01047 (used in the z/OS shell) and ASCII, use **iconv**, not **dd**.

lcase Converts uppercase input to lowercase.

noerror
Ignores errors on input.

notrunc
Does not truncate the output file. **dd** preserves blocks in the output file that it does not explicitly write to.

swab Swaps the order of every pair of input bytes. If the current input record has an odd number of bytes, this conversion does not attempt to swap the last byte of the record.

sync Specifies that **dd** is to pad any input block shorter than **ibs** to that size with NUL bytes before conversion and output. If you also specified *block* or *unblock*, **dd** uses spaces instead of null bytes for padding.

ucase Converts lowercase input to uppercase.

unblock
Converts fixed-length records to variable-length records by reading a number of bytes equal to the size of the conversion buffer, deleting all trailing spaces, and appending a newline character. You must specify **cbs=***size* with this conversion.

count=*n*
Copies only *n* input blocks to the output.

ibs=*size*
Sets the input block *size* in bytes. You specify it in the same way as with the **bs** option.

if=*file* Reads input data from *file*. If you don't specify this option, **dd** reads data from standard input (**stdin**).

imsg=*string*
Displays *string* when all data has been read from the current volume, replacing all occurrences of `%d` in *string* with the number of the next volume to be read. **dd** then reads and discards a line from the controlling terminal.

iseek=*n*
seeks to the *n*th block of the input file. The distinction between this and the **skip** option is that **iseek** does not read the discarded data. There are some devices, however, such as tape drives and communication lines, on which seeking is not possible, so only **skip** is appropriate.

obs=*size*
Sets the output block *size* in bytes. You specify it in the same way as the **bs** value. The size of the destination should be a multiple of the value chosen for *size*. For example, if you choose **obs=**`10K`, the destination's size should be a multiple of 10K.

of=*file* Writes output data to *file*. If you don't specify this option, **dd** writes data to standard output (**stdout**). **dd** truncates the output file before writing to it, unless you specified the **seek=***n* operand. If you specify **seek=***n*, but do not specify **conv=***notrunc*, **dd** preserves only those blocks in the output file over which it seeks. If the size of the seek plus the size of the input file is less than the size of the output file, this can result in a shortened output file.

omsg=*string*
Displays *string* when **dd** runs out of room while writing to the current volume. Any occurrences of `%d` in *string* are replaced with the number of the next volume to be written. **dd** then reads and discards a line from the controlling terminal.

seek=*n*
Initially seeks to the *n*th block of the output file.

Note: Use caution when working with DBCS characters and the **seek** option. Seeking into the output file that contains DBCS characters can cause the DBCS string in the output file to be corrupted. Be sure that the seek count is not aligned with an existing DBCS string in the output file. Otherwise, part of the existing DBCS string either is written over with single-byte data or has extra shift codes from the input file's DBCS data.

skip=*n*
Reads and discards the first *n* blocks of input.

Examples

Entering:

```
dd if=in of=out conv=ascii cbs=80 ibs=6400 obs=512
```

converts 80-byte fixed-length EBCDIC card images in 6400-byte input blocks to variable-length ASCII lines, 512 bytes to the output block.

Localization

dd uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- I/O errors on read/write
- Incorrect command-line option
- Incorrect arguments to a conversion

2 Failure resulting in a usage message such as:
- An option that should contain **=** does not
- Unknown or incorrect command-line option

Messages

Possible error messages include:

badly formed number *number*
A value specified as a number (for example, a block size) does not have the form of a number as recognized by **dd**. For example, you may have followed the number with a letter that **dd** does not recognize as a block-size unit (**w**, **b**, **k**).

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **conv=convfile**, **iseek**, **imsg**, and **omsg** options plus the **w** suffix described in the **bs=** option are all extensions of the POSIX standard.

Related information

cp, **cpio**, **iconv**, **mv**, **tr**

df — Display the amount of free space in the file system

Format

df [–kPStv][*file ...*]

Description

df shows the amount of free space left on a file system. Space can have the following values:

Space Used
Total amount of space allocated to existing files in the file system.

Space Free
Total amount of space available in file system for the creation of new files by unprivileged users.

Space Reserved
Space reserved by the system which is not normally available to a user.

Total Space
Includes space used, space free, and space reserved.

df measures space in units of 512-byte disk sectors. You can specify a particular file system by naming any file name on that file system. If you do not give an argument, **df** reports space for all mounted file systems known to the system, in the following format:

- File system root
- File system name
- Space available and total space

  The total space reported is the space in the already allocated extents (primary and any already allocated secondary extents) of the data set that holds this file system. Therefore, the total space might increase as new extents are allocated.
- Number of free files (inodes)

  This number is only meaningful for file systems created using DFSMS 1.3.0 and later. For file systems created with earlier versions of DFSMS, this number is always 4 294 967 295.
- File system status

Tip: For zFS file systems, the **df** command might not provide sufficient information to indicate whether a file system is running out of space. For complete information about zFS space usage, use the **zfsadm aggrinfo -long** command. See *z/OS Distributed File Service zFS Administration* for more information.

Options

–k Uses 1024-byte (1KB) units instead of the default 512-byte units when reporting space information.

–P Lists complete information about space used, in the following order:
- File system name
- Total space
- Space used
- Space free
- Percentage of space used
- File system root

–S Display SMF accounting fields.

–t Display total allocated file slots, in addition to the total number of free files that are already displayed.

–v Lists more detailed information about the file system status.
- File system root
- File system name
- Space available and total space
- Number of free files (inodes)
- File system status
- File system type, mode bits and device number
- File system mount parm data
- File system mount tag value
- Whether ACLs are supported by the security product and file system.
- Aggregate name, if one exists
- File system ID issuing a quiesce request
- User name and effective UID of the user who mounted the file system, if it was a nonprivileged user mount.

For systems in a shared file system environment, the following additional fields are displayed:
- File system ID (owner/mounted file system server)

- File system automove status (yes-Y, no-N, include-I, exclude-E or unmount-U)
- File system client status
- System list and include/exclude indicator, if the system list exists
- PFS normal status, if one exists
- PFS exception status, if one exists

Examples

If you issue a **df –v** on a file system whose owner is participating in shared file system, status information such as the following is displayed:

```
Mounted on     Filesystem         Avail/Total     Files       Status
/u/billyjc    (OMVS.ZFS.BILLYJC)  365824/3165120  4294924769  Available
ZFS, Read/Write, Device: 17,ACLS=Y, No SUID, Exported, No Security
FSFULL(90,1)
File System owner: AQFT  Automove=E  Client=N
System List (Exclude):  sysname1   sysname2   ....  sysnameN
Quiesce Owner    : AQTS    Quiesce Jobname : MEGA    Quiesce PID: 16777321
Filetag : T=on    codeset=ISO8859-1
Aggregate Name:  POSIX.ZFS.ETC
```

Localization

df uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to access *filename*
- Inability to access *device*
- *device* is not a device

2 Incorrect command-line option

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

Related information

du, **ls**

diff — Compare two text files and show the differences

Format

diff [**–BbefHhimNnrsw**] [**–C** *n*] [**–c**[*n*]] [**–D***ifname*] [**-M** mark] [**-W** *option*[,*option*]...] *path1 path2*

Description

The **diff** command attempts to determine the minimal set of changes needed to convert a file whose name is specified by the *path1* argument into the file specified by the *path2* argument.

Input files must be text files. If either (but only one) file name is **–**, **diff** uses a copy of the standard input (stdin) for that file. If exactly one of *path1* or *path2* is a directory, **diff** uses a file in that directory with the same name as the other file name. If both are directories, **diff** compares files with the same file names under the two directories; however, it does not compare files in subdirectories unless you specify the **–r** option. When comparing two directories, **diff** does not compare character special files, or FIFO special files with any other files.

By default, output consists of descriptions of the changes in a style like that of the **ed** text editor. A line indicating the type of change is given. The three types are `a` (append), `d` (delete), and `c` (change). The output is symmetric: A delete in *path1* is the counterpart of an append in *path2*. **diff** prefixes each operation with a line number (or range) in *path1* and suffixes each with a line number (or range) in *path2*. After the line giving the type of change, **diff** displays the deleted or added lines, prefixing lines from *path1* with < and lines from *path2* with >.

Options

Options that control the output or style of file comparison are:

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–b Ignores trailing blanks and tabs and considers adjacent groups of blanks and tabs elsewhere in input lines to be equivalent.

For example, if one file contained a string of three spaces and a tab at a given location while the other file contained a string of two spaces at the same location, **diff** would not report this as a difference.

–C *n* Shows *n* lines of context before and after each change. **diff** marks lines removed from *path1* with **–**, lines added to *path2* with +, and lines changed in both files with !.

–c[*n***]** Is equivalent to **–C***n*, but *n* is optional. The default value for *n* is 3. **diff** marks lines removed from *path1* with **–**, lines added to *path2* with **+**, and lines changed in both files with !.

–D*ifname*
Displays output that is the appropriate input to the C preprocessor to generate the contents of *path2* when *ifname* is defined, and the contents of *path1* when *ifname* is not defined.

–e Writes out a script of commands for the **ed** text editor, which converts *path1* to *path2*. **diff** sends the output to the standard output (stdout).

–f Writes a script to stdout that shows modifications necessary to convert *path1* to *path2* in the reverse order of that produced by the **–e** option. However, the script is not in a form that is suitable for use with the **ed** editor. The commands produced is reversed from that produced by **–e**, and the line number ranges are separated by spaces, rather than commas. This option conflicts with the **–m** option.

–H Uses the half-hearted (**–h**) algorithm only if the normal algorithm runs out of system resources.

–h Uses a fast, half-hearted algorithm instead of the normal **diff** algorithm. This algorithm can handle arbitrarily large files; however, it is not good at finding a minimal set of differences in files with many differences.

–i Ignores the case of letters when doing the comparison.

–m Produces the contents of *path2* with extra formatter request lines interspersed to show which lines were added (those with vertical bars in the right margin) and deleted (indicated by a * in the right margin).

–M Is an IBM internal option and is not supported.

–n Is an IBM internal option and is not supported.

–N Is an IBM internal option and is not supported.

–r Compares corresponding files under the directories, and recursively compares corresponding files under corresponding subdirectories under the directories. You can use this option when you specify two directory names on the command line.

–s Compares two directories, file by file, and prints messages for identical files between the two directories.

–w Ignores white space during the comparison process.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program

(command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

Examples

1. To compare two text files containing UTF-8 characters and show the differences, assuming that:
   - The text files are untagged and you do not want to tag them or enable automatic conversion, and
   - You cannot alter the tag (for example, you are comparing untagged public text files or read-only text files):

   ```
   diff -W filecodeset=UTF-8,pgmcodeset=IBM-1047 myUtf8File01 myUtf8File02
   ```

2. To compare two text files containing EBCDIC characters and show the differences, assuming that automatic conversion has been enabled but the text files are incorrectly tagged as ASCII:

   ```
   diff -B myMisTaggedFile01 myMisTaggedFile02
   ```

3. The following example illustrates the effect of the **–c** option on the output of the **diff** command. The following two files, `price1` and `price2`, are compared with and without the use of the **–c** option.

   The contents of `price1` are as follows:

   ```
   Company X Price List:
   $  0.39  -- Package of Groat Clusters
   $  5.00  -- Candy Apple Sampler Pack
   $ 12.00  -- Box of Crunchy Frog Chocolates
   $ 15.99  -- Instant Rain (Just Add Water)
   $ 20.00  -- Asparagus Firmness Meter
   $ 25.00  -- Package of Seeds for 35 Herbs
   $ 30.00  -- Child's Riding Hood (Red)
   $ 35.00  -- Genuine Placebos
   $ 45.00  -- Case of Simulated Soy Bean Oil
   $ 75.88  -- No-Name Contact Lenses
   $ 99.99  -- Kiddie Destructo-Bot
   $125.00  -- Emperor's New Clothes
   ```

   The contents of `price2` are as follows:

   ```
   Company X Price List:
   $  0.39  -- Package of Groat Clusters
   $  5.49  -- Candy Apple Sampler Pack
   $ 12.00  -- Box of Crunchy Frog Chocolates
   $ 15.99  -- Instant Rain (Just Add Water)
   $ 17.00  -- Simulated Naugahyde cleaner
   ```

```
$ 20.00  -- Asparagus Firmness Meter
$ 25.00  -- Package of Seeds for 35 Herbs
$ 30.00  -- Child's Riding Hood (Red)
$ 35.00  -- Genuine Placebos
$ 45.00  -- Case of Simulated Soy Bean Oil
$ 75.88  -- No-Name Contact Lenses
$ 99.99  -- Kiddie Destructo-Bot
```

The command:

```
diff price1 price2
```

results in the following display:

```
3c3
< $  5.00  -- Candy Apple Sampler Pack
--->
 $  5.49  -- Candy Apple Sampler Pack
5a6
> $ 17.00  -- Simulated Naugahyde cleaner
13d13
< $125.00  -- Emperor's New Clothes
```

The addition of the **–c** option, as in:

```
diff -c price1 price2
```

results in the following display:

```
*** price1 Wed Oct 1 13:59:18 1997
--- price2 Wed Oct 1 14:03:36 1997
***************
*** 1,8 ****
Company X Price List:

  $  0.39  -- Package of Groat Clusters
! $  5.00  -- Candy Apple Sampler Pack
  $ 12.00  -- Box of Crunchy Frog Chocolates
  $ 15.99  -- Instant Rain (Just Add Water)
  $ 20.00  -- Asparagus Firmness Meter
  $ 25.00  -- Package of Seeds for 35 Herbs
  $ 30.00  -- Child's Riding Hood (Red)
--- 1,9 ----
  Company X Price List:

  $  0.39  -- Package of Groat Clusters
! $  5.49  -- Candy Apple Sampler Pack
  $ 12.00  -- Box of Crunchy Frog Chocolates
  $ 15.99  -- Instant Rain (Just Add Water)
+ $ 17.00  -- Simulated Naugahyde cleaner
  $ 20.00  -- Asparagus Firmness Meter
  $ 25.00  -- Package of Seeds for 35 Herbs
  $ 30.00  -- Child's Riding Hood (Red)
***************
*** 10,13 ****
  $ 45.00  -- Case of Simulated Soy Bean Oil
  $ 75.88  -- No-Name Contact Lenses
  $ 99.99  -- Kiddie Destructo-Bot
- $125.00  -- Emperor's New Clothes
--- 11,13 ----
```

diff –c marks lines removed from `price1` with **–**, lines added to `price1` with **+** and lines changed in both files with `!`. In the example, **diff** shows the default three lines of context around each changed line. One line was changed in both files (marked with `!`), one line was added to `price1` (marked with **+**), and one line was removed from `price1` (marked with –).

Note: If there are no marks to be shown in the corresponding lines of the file being compared, the lines are not displayed. Lines 11 to 13 of `price2` are suppressed for this reason.

Localization

diff uses the following localization environment variables:
- LANG
- LC_ALL
- LC_CTYPE
- LC_MESSAGES
- LC_TIME
- LC_SYNTAX
- NLSPATH

See Appendix F, "Localization," on page 997 for more information.

Environment variables

diff uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 No differences between the files compared.

1 **diff** compared the files and found them to be different.

2 Failure due to any of the following:
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion
- Incorrect command-line argument
- Inability to find one of the input files
- Out of memory
- Read error on one of the input files

4 At least one of the files is a binary file containing embedded NUL (\0) bytes or newlines that are more than LINE_MAX bytes apart.

Messages

Possible error messages include:

file *filename***: no such file or directory**
The specified *filename* does not exist. *filename* was either typed explicitly, or generated by **diff** from the directory of one file argument and the basename of the other.

Files *file1* **and** *file2* **are identical**
The **–s** option was specified and the two named files are identical.

Common subdirectories: *name* **and** *name*
This message appears when **diff** is comparing the contents of directories,

but you have not specified **–r**. When **diff** discovers two subdirectories with the same name, it reports that the directories exist, but it does not try to compare the contents of the two directories.

Insufficient memory (try diff –h)
diff ran out of memory for generating the data structures used in the file differencing algorithm. (See "Limits.") The **–h** option of **diff** can handle any size file without running out of memory.

Internal error—cannot create temporary file
diff was unable to create a working file that it needed. Ensure that you either have a directory `/tmp` or that the environment contains the TMPDIR environment variable that names a directory where **diff** can store temporary files. Also, ensure that there is sufficient file space in this directory.

Missing *ifdef* **symbol after -D**
You did not specify a conditional label on the command line after the **–D** option.

Only one file may be –
Of the two input files typically found on the command line of **diff**, only one can be the standard input (stdin).

Too many lines in *filename*
A file of more than the maximum number of lines (see "Limits") was given to **diff**.

Limits

The longest input line is 1024 bytes. Except under **–h**, files are limited to INT_MAX lines. INT_MAX is defined in `limits.h`.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–B**, **–D**, **–H**, **–h**, **–i**, **–m**, **–s**, **–W**, and **–w** options, and the *n* argument to the **–c** option, are extensions of the POSIX standard.

Related information

cmp, **comm**, **patch**

J. W. Hunt and M. D. McIlroy, *An Algorithm for Differential File Comparison*, Report 41, from Computing Science, Bell Laboratories, Murray Hill, NJ 07974, (June 1976), 9 pages.

dircmp — Compare directories

Format

dircmp [**-Bds**] [**-W** *option*[,*option*]...] *dir1 dir2*

Guideline: The **dircmp** utility is fully supported for compatibility with older UNIX systems. However, use **diff –r** instead because it may provide greater functionality and is considered the standard for portable UNIX applications as defined by POSIX.2 IEEE standard 1003.2-1992.

Description

dircmp examines *dir1* and *dir2* and generates listings about the contents of the directories. Listings of files that are unique to each directory are generated for all the options. If no option is entered, a list is output indicating whether the filenames common to both directories have the same contents.

Options

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–d Compares the contents of files with the same name in both directories and creates a list telling what must be changed in the two files to bring them into agreement. The list format is described in **diff**.

–s Suppress messages about identical files.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless

automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

Examples

1. To compare the contents of two directories, showing files that are identical, files that differ, and files or directories that are unique to a directory:

   ```
   dircmp MyDir01 MyDir02
   ```

2. To compare the contents of two directories and only show files that differ, along with a listing of those differences, and files or directories that are unique to a directory:

   ```
   dircmp -ds MyDir01 MyDir02
   ```

3. To compare the contents of two directories consisting of text files containing ASCII characters, showing files that are identical, files that differ, along with a listing of those differences, and files or directories that are unique to a directory, assuming that:
   - The text files are untagged and you do not want to tag them or enable automatic conversion, and
   - You cannot alter the tag (for example, you are comparing untagged public text files or read-only text files):

   ```
   dircmp -d -W filecodeset=ISO8859-1,pgmcodeset=IBM-1047 MyAsciiDir01 MyAsciiDir02
   ```

4. To compare the contents of two directories consisting of text files containing EBCDIC characters and only show files that differ, along with a listing of those differences, and files or directories that are unique to a directory, assuming that automatic conversion has been enabled but the text files are incorrectly tagged as UTF-8:

   ```
   dircmp -Bds MyMisTaggedDir01 MyMisTaggedDir02
   ```

Localization

dircmp uses the following localization environment variables:
- LANG
- LC_ALL
- LC_MESSAGES
- NLSPATH

See Appendix F, "Localization," on page 997 for more information.

Environment variables

dircmp uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more

information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 Successful completion

>0

- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

Related information

cmp, **diff**

---

dirname — Return the directory components of a path name

Format

dirname *pathname*

Description

dirname deletes the trailing part of a file name. The result is the path name of the directory that contains the file. This is useful in shell scripts. **dirname** does not try to validate the path name. For validation, use **pathchk**.

dirname follows these rules:

1. If *pathname* is `//`, return it.
2. Otherwise, if it is all slashes, return one slash.
3. Otherwise, remove all trailing slashes.
4. If there are no slashes remaining in *pathname*, return period (`.`).
5. Otherwise, remove trailing nonslash characters.
6. If the remaining string is `//`, return it.
7. Otherwise, remove any trailing slashes.
8. If the resulting string is empty, return period (`.`).
9. Otherwise, return the resulting string.

Examples

The command:

```
dirname src/lib/printf.c
```

produces:

```
src/lib
```

Localization

dirname uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion
1 Failed
2 Unknown command-line option

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

basename, **pathchk**

. (dot) — Run a shell file in the current environment

Format

. *file* [*argument* **...**]

Description

. (**dot**) runs a shell script in the current environment and then returns. Normally, the shell runs a command file in a child shell so that changes to the environment by such commands as **cd**, **set**, and **trap** are local to the command file. The **.** (**dot**) command circumvents this feature.

If there are slashes in the file name, **.** (**dot**) looks for the named *file*. If there are no slashes **.** (**dot**) searches for *file* in the directories specified in the PATH variable. This may surprise some people when they use dot to run a file in the working directory, but their search rules are not set up to look at the working directory. As a result, the shell does not find the shell file. If you have this problem, you can use:

```
. ./file
```

This indicates that the shell file you want to run is in the working directory. Also, the file need not be executable, even if it is looked for on the **PATH**. If you specify an argument list *argument ...*, **.** (**dot**) sets the positional parameters to the arguments while running the shell script, then restores the invoker's positional parameters. If no argument list is specified, the shell script has the same positional parameters as the invoker. Any changes made to the positional parameters (for example, by the **set** command) in the shell script remain in effect when the **.** (**dot**) command ends.

Usage notes

1. **.** (**dot**) is a special built-in shell command.
2. The file specified is treated as a shell script containing shell commands. Files that are not shell scripts (such as REXX execs, executable programs) should not be specified as *file*.

Localization

. (**dot**) uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

1 The path search failed
2 Failure because of an incorrect command-line option

Otherwise, the exit status is the exit status of the last command run from the script.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

cd, **set**, **sh**, **trap**

---

dspcat — Display all or part of a message catalog

Format

dspcat [**–gt**] **CatalogName** [**SetNumber** [**MessageNumber**]]

Description

dspcat displays a particular message, all of the messages in a set, or all of the messages in a catalog. Messages are displayed as they are specified in the message catalog; no substitution of variables takes place.

It directs the messages to standard output (**stdout**).

It has the following parameters:

- The **CatalogName** parameter specifies a message catalog.
- The **SetNumber** parameter specifies a set in the catalog specified by the **CatalogName** parameter. If you specify a nonexistent **SetNumber** value, all messages in the catalog are displayed.
- The **MessageNumber** parameter specifies a particular message in the set specified by the **SetNumber** parameter.

If you include all three parameters, **dspcat** displays a particular message. If you do not include the **MessageNumber** parameter, or if the **MessageNumber** value is in error, all the messages in the set are displayed. If you specify only the **CatalogName** parameter, all the messages in the catalog are displayed. You must include the **SetNumber** parameter if you include the **MessageNumber** parameter.

Use the **NLSPATH** environment variable to find the specified message catalog if slash (/) characters are not used in the value of the **CatalogName** parameter.

Options

–g Formats the output so it can be used as input to the **gencat** command. The **MessageNumber** parameter is not valid when **–g** is specified.

–t Displays the timestamp of the message catalog.

Examples

To display message number 2 in set number 1 of **test.cat,** enter:

```
dspcat test.cat 1 2
```

dspmsg — Display selected messages from message catalogs

Format

dspmsg [–d] [–s SetNumber] CatalogName MessageNumber ['DefaultMessage'[Arguments]]

Description

dspmsg displays either the text of a particular message from a message catalog generated with the **gencat** command or, if the message cannot be retrieved, a default message supplied as a parameter to the command. **dspmsg** directs the message to standard output. This command is intended for use in shell scripts as a replacement for the **echo** command.

The **NLSPATH** environment variable and the **LANG** category are used to find the specified message catalog if / (slash) characters are not used in the value of the **CatalogName** parameter. If the catalog named by the **CatalogName** parameter is not found or if the message named by the **MessageNumber** parameter (and optional **SetNumber** value) is not found, then the supplied **DefaultMessage** value is displayed. If a **DefaultMessage** value is not specified, a system-generated error message is displayed.

dspmsg allows up to ten string arguments to be substituted into the message if it contains the **%s** or **%n$s**, fprintf() conversion specification. Only string variables are allowed. If arguments are specified, then a **DefaultMessage** must also be specified.

Missing arguments for conversion specifications result in a **dspmsg** error message. Normal **fprintf()** subroutine control character escape codes (for example, **–n**) are recognized.

Options

–d If you are receiving the default message, use this option to request debugging information about why **dspmsg** cannot get the message from the message catalog.

–s SetNumber
Specifies an optional set number. The default value for the **SetNumber** variable is 1.

Examples

To display set number 1, message number 2 of the **test.cat** catalog, enter:

```
dspmsg –s 1 test.cat 2 'message %s not found' 2
```

If the message is not found, `message 2 not found` is displayed.

du — Summarize usage of file space

Format

du [**–a** | **–s**[**–krtx**] [*pathname ...*]

Description

du reports the amount of file space used by the files indicated by the given path name. If the path name is a directory, **du** reports the total amount of file space used by all files in that directory and in each subdirectory in its hierarchy. If you do not specify a path name, **du** assumes the current directory. Files with multiple links are only counted once. On systems supporting symbolic links, only the disk space used by the symbolic link is counted.

du measures file space in 512-byte units.

Options

–a Generates a report for all files in *pathname*.

–k Displays file sizes in 1024-byte (1KB) units.

–r Reports files that cannot be opened and directories that cannot be read; this is the default.

–s Does not display file size totals for subdirectories.

–t Displays the total amount of space used by all path names examined.

–x Displays file sizes for only those files contained on the same device as *pathname*.

Usage notes

du computes file space in units of 512 bytes. The actual disk space used by files and directories may be more, since some systems allocate space in units of some multiple of a sector. On UNIX System V, it is usually two sectors; on UNIX Version 7, it is one sector.

The allocation unit is file system specific.

Localization

du uses the following localization variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Incorrect command-line option
- Cannot access a directory

- Cannot read a directory
- Cannot access file information

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

The **–t** option is an extension to the POSIX standard.

Related information

df, **find**, **ls**

---

echo — Write arguments to standard output

Format

echo *argument ...*

tcsh shell: **echo** [**-n**] *word ...*

Description

echo writes its arguments, specified with the *argument* argument, to standard output. **echo** accepts these C-style escape sequences:

\a Bell
\b Backspace
\c Removes any following characters, including **\n** and **\r**.
\f Form feed
\n Newline
\r Carriage return
\t Horizontal tab
\v Vertical tab
\0*num* The byte with the numeric value specified by the zero to three-digit octal *num*.
\– Backslash

echo follows the final argument with a newline unless it finds \c in the arguments. Arguments are subject to standard argument manipulation.

In the tcsh shell, **echo** writes each word to the shell's standard output, separated by spaces and terminated with a newline.

tcsh **echo** accepts these C-style escape sequences:

\a Bell
\b Backspace
\e Escape
\f Form feed
\n Newline
\r Carriage return
\t Horizontal tab
\v Vertical tab
nnn The EBCDIC character corresponding to the octal number *nnn*

For more information, see “tcsh — Invoke a C shell” on page 689.

Examples

1. One important use of **echo** is to expand filenames on the command line, as in:

   ```
   echo *.[ch]
   ```

   This displays the names of all files with names ending in **.c** or **.h**—typically C source and include (header) files. **echo** displays the names on a single line. If there are no filenames in the working directory that end in **.c** or **.h**, **echo** simply displays the string ***.[ch]**.
2. **echo** is also convenient for passing small amounts of input to a filter or a file:

   ```
   echo 'this is\nreal handy' > testfile
   ```

Usage notes

echo is a built-in shell command.

Localization

echo uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit value

echo always returns the following exit status value:

0 Successful completion

Portability

POSIX.2, UNIX System V.

The POSIX standard does not include escape sequences, so a strictly conforming application cannot use them. **printf** is suggested as a replacement.

Related information

sh, **tcsh**

ed — Use the ed line-oriented text editor

Format

ed [**–Bbs**] [**–p** *prompt*] [**-W** *option*[,*option*]...] [*file*]

Description

ed is a line-oriented text editor that lets you manipulate text files interactively. It reads the text of a file into memory and stores it in an area called a *buffer*. Various subcommands let you edit the text in the buffer. You can also write the contents of the buffer back out to the file, thereby overwriting the old contents of the file.

Options

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–b Enables you to edit larger files by restricting the amount of memory dedicated to paging. Using a large amount of memory may make **ed** run more slowly.

–p *prompt*
Displays the given *prompt* string prompting you to input a subcommand. By default, **ed** does not typically prompt for subcommand input. See "Subcommands" on page 281 for more information about subcommand prompting.

–s Puts **ed** into a quiet mode, in which **e**, **E**, **r**, and **w**, subcommands do not display file size counts; the **q** and **e** subcommands do not check buffer modification; and ! is not displayed after calling the shell to run a subcommand. This mode is particularly useful when you invoke **ed** from within a shell script.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name that is known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

If the optional *file* argument is present on the command line, **ed** reads the specified *file* into the editor by simulating an **e***file* subcommand.

Addresses

You can prefix subcommands in **ed** with zero, one, or two addresses. These addresses let you refer to single lines or ranges of lines in the buffer. You do not need to specify addresses for certain subcommands that use default addresses. Consult the description for a particular subcommand. You can construct each address out of the following components:

. The single *dot* character represents the *current line* in the buffer. Many subcommands set the *current line*; for example the **e** command sets it to the last line of the new file being edited.

$ The dollar sign refers to the last line in the buffer.

n The number *n* refers to the *n*th line in the buffer.

/regexp/
This searches for a line containing a string that matches the regular expression, **regexp**. The search begins at the line immediately following the current line. It proceeds *forward* through the buffer; if **ed** reaches the end of the buffer without finding a match, it wraps around to the first line of the buffer and continues the search. If **ed** does not find a match, the search ends when it reaches the original current line. If it does find a match, the address */regexp/* refers to the first matching line. If you omit *regexp*, the last used regular expression becomes the object of the search. You can omit the trailing /. Within *regexp*, \/ represents a literal slash and not the *regexp* delimiter.

?regexp?
This is similar to the previous address form, except that the search goes *backward* through the buffer. If the search reaches the first line in the buffer without finding a match, **ed** wraps around and continues searching backward from the last line in the buffer. If you omit *regexp*, the last used regular expression becomes the object of the search. You can omit the trailing ?. Within *regexp*, \? represents a literal question mark and not the *regexp* delimiter.

'l The address is the line marked with the mark name *l*. The name *l* must be a lowercase letter that is set by the **k** subcommand.

You can combine these basic addresses with numbers using the **+** and **–** operators, with the usual interpretation. Missing left operands default to . (dot); missing right operands default to 1. Missing right operands also have a cumulative effect; so an address of – – refers to the current line number less two.

You can specify address ranges in the following ways:

a1,*a2* Specifies a range of addresses from address *a1* to address *a2*, inclusive. If you omit *a1* and *a2* (that is, the comma alone is specified), this is equivalent to the range `1,$`.

a1;*a2* Is similar to the previous form except that **ed** resets the current line after calculating the first address, *a1*, so that the second address, *a2*, is relative to *a1*. If you omit *a1* and *a2* (that is, the semicolon alone is specified), this is equivalent to `.;$`. If you specify only *a1* and the command requires both *a1* and *a2*, the command operates as though you specified a range of:

a1`;.` *command*

> Is equivalent to `.,.+22` (that is, page forward), except that it never attempts to address any line beyond $.

< Is equivalent to `.–22,.` (that is, page backward), except that it never addresses any line before line 1.

Subcommands

An **ed** command has the form `[address]` *command*

All commands end with a newline; you must press <Enter>. Most commands allow only one command on a line, although you can modify commands by appending the **l**, **n**, and **p** commands.

Subcommands generally take a maximum of zero, one, or two addresses, depending upon the particular subcommand. In the following descriptions, we show commands with their default addresses (that is the addresses used when you don't specify any addresses) in a form that shows the maximum number of permitted addresses for the command. In any of the subcommands that take a *file* argument, *file* can be a pathname or:

`!`*command-line*

If you use the **!** form, **ed** runs the given command line, reading its standard output (**stdout**) or writing its standard input (**stdin**), depending on whether the **ed** command does reading or writing.

If a terminal disconnect is detected:

- If the buffer is not empty and has changed since the last write, the **ed** utility will attempt to write a copy of the buffer to a file named **ed.hup** in the current directory. If this write fails, **ed** will attempt to write a copy of the buffer to a filename **ed.hup** in the directory named by the HOME environment variable. If both these attempts fail, **ed** will exit without saving the buffer.
- The **ed** utility will not write the file to the currently remembered pathname or return to command mode, and will terminate with the exit status of 1.

If an end-of-file is detected on standard input:

- If the **ed** utility is in input mode, **ed** will terminate input mode and return to command mode. Any partially entered lines (that is, input text without a terminating newline) will be saved.

- If the **ed** utility is in command mode, it will act as if a **q** command had been entered.

ed accepts the following subcommands:

.a Appends text *after* the specified line. Valid addresses range from 0 (text is placed at the beginning of the buffer, before the first line) to $ (text is placed after the last line of the buffer). **ed** reads lines of text from the workstation until a line consisting solely of an unescaped **.** (dot) is entered. **ed** sets the current-line indicator to the last line appended.

.,.c Changes the addressed range of lines by deleting the lines and then reading new text in the manner of the **a** or **i** subcommands. If the variable _UNIX03 is set to YES, address 0 is valid for this subcommand and it will be interpreted as if address 1 were specified.

.,.d Deletes the addressed range of lines. The line after the last line deleted becomes the new current line. If you delete the last line of the buffer, **ed** sets the current line to the new last line. If no lines remain in the buffer, it sets the current line to 0.

E[*file***]** Is similar to the **e** command, but **ed** gives no warning if you have changed the buffer.

e [*file***]** Replaces the contents of the current buffer with the contents of *file*. The text conversion that is specified on the **ed** command (for example, the **-B** or **-W** option) is used. If you did not specify *file*, **ed** uses the remembered file name, if any. In all cases, the **e** subcommand sets the remembered file name to the file that it has just read into the buffer. **ed** displays a count of the bytes in the file unless it is in *quiet* mode. If you have changed the current buffer since the last time its contents were written, **ed** warns you if you try to run an **e** subcommand, and does not run the subcommand. If you enter the **e** subcommand a second time, **ed** goes ahead and runs the command.

f [*file***]** Changes the remembered filename to *file*. **ed** displays the new remembered filename. If you do not specify *file*, **ed** displays the current remembered filename.

1,$G/*regexp/*
Is similar to the **g** command except that when **ed** finds a line that matches *regexp*, it prints the line and waits for you to type in the subcommand to be run. You cannot use the **a**, **c**, **i**, **g**, **G**, **v**, and **V** subcommands. If you enter &, the **G** subcommand reruns the last subcommand you typed in. If you just press <Enter>, **G** does not run any subcommand for that line. Note that the subcommands input as part of the execution of the G subcommand can address and affect any lines in the buffer. If the variable _UNIX03 is set to YES, any line modified by the subcommand will be unmarked.

1,$g/*regexp/command*
Performs *command* on all lines that contain strings matching the regular expression *regexp*. This subcommand works in two passes. In the first pass, **ed** searches the given range of lines and marks all those that contain strings matching the regular expression *regexp*. The second pass performs *command* on those lines. If the variable _UNIX03 is set to YES, any line modified by the command will be unmarked. You cannot use **!**, **g**, **G**, **V**, or **v** as *command*. *command* consists of one or more **ed** subcommands, the first of which must appear on the same line as the **g** subcommand. All lines of a multiline command list, except the last, must end with a backslash (\). If

command is empty, **ed** assumes it to be the **p** subcommand. If no lines match *regexp*, **ed** does not change the current line number; otherwise, the current line number is the one set by the last subcommand in *command*. Instead of the slash (/) to delimit *regexp*, you can use any character other than space or newline.

H Tells **ed** to display more descriptive messages when errors occur. If **ed** is already printing descriptive messages, **H** returns to terse error messages. Normally, **ed** indicates error messages by displaying a **?**. When you turn on descriptive error messages with this subcommand, **ed** also displays the descriptive message for the most recent **?** message.

h Provides a brief explanation of the last error that occurred. This does not change the current line number.

.i Works similarly to the **a** subcommand, except that **ed** places the text *before* the addressed line. Valid addresses range from line 1 to $ (the last line). **ed** sets the current line number to the last inserted line. If the variable _UNIX03 is set to YES, address 0 is valid for this subcommand and it will be interpreted as if address 1 were specified.

.,.+1j Joins a range of lines into one line. To be precise, the **j** command removes all newline characters from the addressed range of lines, except for the last one. **ed** sets the current line number to the resulting combined line.

.kx Marks the addressed line with the mark name *x*, which is any single lowercase letter of the alphabet. This lets you refer to a marked line with the construct **'x**. This is called an absolute address, because it always refers to the same line, regardless of changes to the buffer.

.,.l Displays the addressed range of lines, representing nonprintable (control) characters in a visible manner. The end of each line will be marked with a '$' character. The characters listed in the Base Definitions volume of IEEE Std 1003.1-2001, Table 5-1, Escape Sequences and Associated Actions ('\\', '\a', '\b', '\f', '\r', '\t', '\v') shall be written as the corresponding escape sequence; the '\n' in that table is not applicable. If the variable _UNIX03 is set to YES,'$' characters within the text will be written with a preceding backslash. **ed** sets the current line to the last line so displayed. You can append this subcommand to most other commands, to check on the effect of those subcommands.

.,.m*a* Moves the addressed lines to the point immediately following the line given by the address *a*. The address *a* must not be in the range of addressed lines. If address *a* is `0`, **ed** moves the lines to the beginning of the buffer. The last line moved becomes the new current line.

.,.n Displays the addressed lines in a way similar to the **p** command, but **ed** puts the line number and a tab character at the beginning of each line. The last line displayed becomes the new current line. You can append **n** to any subcommand (except for **E**, **e**, **f**, **Q**, **r**, **w**, or **!**) so that you can check on the effect that the subcommands had.

P Turns on subcommand prompting if it is not already on. If you specified the **–p** *prompt* option on the **ed** command line, **ed** displays the *prompt* string whenever it is ready for you to type in another subcommand. If you did not include the **–p** option, **ed** uses the * character as a prompt. If subcommand prompting is currently turned on, issuing the **P** subcommand turns it off.

.,.p Displays (prints) the addressed lines. The last line displayed becomes the

new current line. You can append **p** to most subcommands, so that you can check on the effect that the subcommands had.

You can append **p** to any subcommand (except for **E**, **e**, **f**, **Q**, **r**, **w**, or **!**) so that you can check on the effect that the subcommands had.

Q Quits unconditionally, without checking for buffer changes.

q Causes the editor to exit. If you have made changes to the buffer since the last save and you try to quit, **ed** issues a warning. Entering the **q** subcommand again lets you quit, regardless of unsaved changes.

$r [*file***]**
Reads the contents of the *file* into the buffer after the addressed line. The text conversion that is specified on the **ed** command (for example, the **-B** or **-W** option) is used. If the address is `0`, **ed** places the text before the first line in the buffer. If you do not specify *file*, **ed** uses the remembered filename; if no remembered filename exists, *file* becomes the new remembered name. If *file* contains bytes that are not valid in the current character set, they are replaced by the rubout character.

The **r** subcommand displays the number of bytes read from *file* unless you specified the **–s** option. The last line read from the file becomes the new current line. If *file* is replaced by **!**, the rest of the line is considered a shell command line, the output of which is to be read.

.,.s/*regexp/new/[flags]*
Searches the specified range of lines for strings matching the regular expression *regexp*. Normally the **s** subcommand replaces the first such matching string in each line with the string *new*. The **s** subcommand sets the current line to the last line on which a substitution occurred. If **ed** makes no such replacements, **ed** considers it an error.

flags can be one of the following:

n	Replaces the *n*th matching string in the line instead of the first one.
g	Replaces *every* matching string in each line, not just the first one.
l	Displays the new current line in the format of the **l** subcommand.
n	Displays the new current line in the format of the **n** subcommand.
p	Displays the new current line in the format of the **p** subcommand.

You can use any single printable character other than space or newline instead of / to separate parts of the subcommand provided that you use the same character to delimit all parts of the subcommand. You can omit the trailing delimiter.

You can include a newline in the *new* string by putting a \ immediately in front of the newline. This is a good way to split a line into two lines. If *new* consists only of the `%` character, **s** uses the *new* string from the previous **s** command. If the variable _UNIX03=YES is set and there was no previous s command, the use of `%` in this manner is an error. If `&` appears anywhere in *new*, **ed** replaces it with the text matching the *regexp*. If you want *new* to contain a literal ampersand, or percent sign, put a backslash (\) in front of the `&` or `%` character.

.,.t*a* Copies the addressed lines to the point *after* the line given by the address *a*. The address *a* must not fall in the range of addressed lines. If address *a* is `0`, **ed** copies the lines to the beginning of the buffer. This sets the current line to the last line copied.

u Rolls back the effect of the last subcommand that changed the buffer. For the purposes of **u**, subcommands that change the buffer are: **a**, **c**, **d**, **g**, **G**, **i**,

j, **m**, **r**, **s**, **t**, **v**, **V**, and (of course) **u**. This means that typing **u** repeatedly switches the most recent change back and forth. This subcommand sets the current line number to the value it had immediately before the subcommand being undone started.

1,$V/*regexp/*
Is similar to the **G** subcommand, except that this subcommand gives you the chance to edit only those lines that do *not* match the given regular expression.

1,$v/*regexp/commands*
Is similar to the **g** (global) command, except that **ed** applies the given *commands* only to lines that do *not* match the given regular expression.

1,$W [file]
Is similar to the **w** subcommand, except that this command appends data to the given *file* if the file already exists.

1,$w [*file***]**
Writes the addressed lines of the buffer to the named *file*. The text conversion that is specified on the **ed** command (for example, the **-B** or **-W** option) is used. This does not change the current line. If you do not provide *file*, **ed** uses the remembered filename; if there is no remembered filename, *file* becomes the remembered name. If the output file does not exist, **ed** creates it. **ed** displays the number of characters written unless you had specified the **–s** option.

X Prompts you to enter an encryption key. All subsequent **e**, **r**, and **w** subcommands use this key to decrypt or encrypt text read from or written to files. To turn encryption off, issue an **X** subcommand and press <Return> in response to the prompt for an encryption key.

!*command*
Runs *command* as if you typed it to your chosen command interpreter. If *command* contains the % character, **ed** replaces it with the current remembered filename. If you want a subcommand to contain a literal %, put a backslash (\) in front of the character. As a special case, typing **!!** reruns the previous *command*.

$= Displays the line number of the addressed line. This does not change the current line.

.= Displays the current line number.

.+1.,.+1
If you supply zero, one, or two addresses without an explicit subcommand, **ed** displays the addressed lines in the mode of the last print subcommand: **p**, **l**, or **n**. This sets the current line number to the last line displayed.

Examples

1. To edit or browse a file using the **ed** line-oriented text editor:
   ```
   ed myFile
   ```
2. To edit or browse a file containing UTF-8 characters using the **ed** line-oriented text editor, assuming that
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are browsing an untagged public text file or a read-only text file)

   then issue:

```
ed -W filecodeset=UTF-8,pgmcodeset=IBM-1047 myUtf8File
```

3. To edit or browse a file containing EBCDIC characters using the **ed** line-oriented text editor, assuming that automatic conversion has been enabled but the text file is incorrectly tagged as ASCII:

```
ed -B myMisTaggedFile
```

Environment variables

ed uses the following environment variables:

COLUMNS
Contains the terminal width in columns. **ed** folds lines at that point. If it is not set, **ed** uses the appropriate value from the terminfo database or if that is not available, it uses a default of 80.

HOME
Contains the path name of your home directory.

SHELL
Contains the full path name of the current shell.

TMPDIR
The path name of the directory being used for temporary files. If it is not set, **ed** uses **/tmp**.

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

_UNIX03
For more information about the effect of _UNIX03 on this command, see Appendix N, “Shell commands changed for UNIX03,” on page 1039.

Files

ed uses the following files:

/tmp/e*
This is the *paging file*. It holds a copy of the file being edited. You can change the directory for temporary files using the environment variable **TMPDIR**.

ed.hup
When **ed** receives a hang up signal (or detects a terminal disconnect) and the current buffer has changed since the last write, **ed** will attempt to write the current buffer to **ed.hup** in the current directory. If this write fails, **ed** will attempt to write the current buffer to **ed.hup** in the $HOME directory.

Localization

ed uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**

- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Addressed line out of range
- Only one filename is allowed
- No space for the line table
- Temporary file error
- Badly constructed regular expression
- No remembered regular expression
- File read error
- Out of memory
- Unknown command
- Command suffix not permitted
- No match found for regular expression
- Wrong number of addresses for the subcommand
- Not enough space after the subcommand
- The name is too long
- Badly formed name
- Subcommand redirection is not permitted
- Restricted shell
- No remembered filename
- The mark name must be lowercase
- The mark name is not defined
- **m** and **t** subcommands require a destination address
- The destination cannot straddle source in **m** and **t**
- A subcommand not allowed inside **g**, **v**, **G**, or **V**
- The **x** subcommand has become `X` (uppercase)
- The global command is too long
- Write error (no disk space)
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

2 Usage error

Messages

Some error messages are issued only if **h** or **H** subcommands are used after **ed** displays `?`. Possible error messages include:

Destination cannot straddle source in m and t
The range of lines being moved or copied by **m** or **t** cannot include the destination address.

Global command too long
There is a limit on the length of a global instruction (**g** or **v**). See "Limits" on page 288 for this limit.

m and t require destination address
You must follow the **m** or **t** subcommands with an address indicating where you want to move or copy text. You omitted this address.

No remembered filename
You tried to run a subcommand that used a remembered filename (for example, you used **w** to write without specifying an output filename).

However, there is no remembered filename at present. Run the subcommand again, but specify a filename this time.

Restricted shell
The command line invoked the restricted form of **ed**, but you tried an action that was not allowed in the restricted editor (the **!** subcommand).

Temporary file error
You ran out of space on disk or encountered other errors involving the page file stored in the temporary file.

Warning: file not saved
You entered a subcommand to quit editing the current file, for example, **q** or **e** to edit a new file; however, you have changed the file since the last time you saved it. **ed** is suggesting that you save the file before you exit it; otherwise, your recent changes will be lost. To save the file, use the **w** command. If you really do not want to save the recent changes, use **q** to quit or **e** to edit a new file.

?file An error occurred during an attempt to open or create *file*. This is applicable to the **e**, **r**, and **w** subcommands.

? An unspecified error occurred. Use the **h** or **H** subcommand for more information. If the input to **ed** comes from a script rather than from a workstation, **ed** exits when any error occurs.

Limits

ed allows a limit of 1024 bytes per line and 28 000 lines per file. It does not allow the NUL ('\0') character. The maximum length of a global command is 256 characters, including newlines.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The addresses **<** and **>**, the **–B** , **–b**, and **–W** options, and the **W** and **X** subcommands are extensions of the POSIX standard.

Related information

awk, **diff**, **env**, **ex**, **grep**, **sed**, **vi**

See Appendix C, “Regular expressions (regexp),” on page 971 for more information about **regexp**.

edcmtext — Display errnojr reason code text

Format

edcmtext *errnojr_value*

Description

edcmtext displays the description and action text for C/C++ run-time library errnojr (errno2) values. No other values are supported by this command. This command is intended as an aid for problem determination.

errnojr_value is specified as 8 hexadecimal characters.

You can specify one of the following in place of a errnojr value to view a help dialog: *-h*, *help*, *?*.

To display the output in uppercase, specify the **-U** option.

Usage notes

errnojr_values are also accepted in mixed case and with hexadecimal digits prefixed with the "0x".

Message returns

If the user specifies a *-h*, *help* or *?* in place of the *errnojr_value*, the following message is displayed:

```
Usage: edcmtext errnojr_value
```

If no text is available for the *errnojr_value* the following message is displayed:

```
errnojr_value: No information is currently available for this errnojr_value.
```

If the *errnojr_value* is not comprised of 1-8 hexadecimal digits the following message is displayed:

```
Usage: edcmtext errnojr_value
```

If the errnojr_value is not in the C/C++ run-time library range, the following message is displayed:

```
Notice: The errnjr_value is not in the C/C++ run-time library range.
```

If the environment that **edcmtext** is being run in is not TSO/E or z/OS UNIX, the following message is displayed:

```
Error: The environment is not TSO/E or z/OS UNIX.
```

errnojr (errno2) values will be found in *z/OS Language Environment Runtime Messages*.

Examples

The command:

```
edcmtext C00B0021
```

produces data displayed in the following format:

```
JrEdc1opsEinval01: The mode argument passed to fopen() or freopen() did not begin
with r, w, or a.

Action: Correct the mode argument.  The first keyword of the mode argument must be
the open mode.  Ensure the open mode is specified first and begins with r, w, or a.

Source: edc1opst.c
```

Exit values

0 Successful completion

2 Failure due to an argument that is not 1–8 hexadecimal digits

8 Bad input due to an *errnojr_value* out of the C/C++ run-time range.

14 Environment not TSO/E or z/OS UNIX

>20 Internal error. Contact IBM.

egrep — Search a file for a specified pattern

Format

egrep [–**Bbcilnqsvx**] [**-W** *option*[,*option*]...] [**–e** *pattern*] ... [**–f** *patternfile*] ... [*pattern*] [*file ...*]

Guideline: The **egrep** utility is fully supported for compatibility with older UNIX systems. However, use **grep –E** instead because it may provide greater functionality and is considered the standard for portable UNIX applications as defined by POSIX.2 IEEE standard 1003.2-1992.

Description

See **grep**.

env — Display or set environment variables for a process

Format

env [**–i**] [*variable=value ...*] [*command argument ...*]
env [**–**] [*variable=value ...*] [*command argument ...*]

Description

If you enter **env** with no arguments, it displays the environment variable that it received from its parent (presumably the shell).

Arguments of the form *variable=value* let you add new environment variables or change the value of existing environment variables.

If you specify *command*, **env** calls *command* with the arguments specified with the *argument* argument that appear on the command line, passing the accumulated environment variable to this command. The *command* is run directly as a program found in the search path, and is not interpreted by a shell.

In a double-byte locale, environment variable values can contain double-byte characters. The equal sign (=) must be single byte.

Options

env supports the following two options, both of which have the same effect.

–i Specifies that the environment variable inherited by **env** not be used.

– Specifies that the environment variable inherited by **env** not be used.

Examples

1. Compare the output of the following two examples:

```
env foo=bar env
env –i foo=bar env
```

2. Compare the output of the following example:

```
env - echo $PATH
 .:/usr/lpp/Printsrv/bin:/bin:/usr/sbin
```

The variable $PATH appears to still be valid but is resolved first by the shell before the initial **env** command is run to clear the environment variables with the **-** or **-i** option. For more information, see the section on using substitutions in commands in *z/OS UNIX System Services User's Guide*.

Localization

env uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion.

1 Failure due to any of the following situations:
- Not enough memory
- Name is too long

2 Incorrect command-line argument.

126 **env** found *command* but could not invoke it.

127 **env** could not find *command*.

Portability

POSIX.2, X/Open Portability Guide, UNIX System V.

printenv on Berkeley UNIX systems works like **env**.

Related information

env, **sh**

eval — Construct a command by concatenating arguments

Format

eval [*argument ...*]

tcsh shell: **eval** *argument ...*

Description

The shell evaluates each argument as it would for any command. **eval** then concatenates the resulting strings, separated by spaces, and evaluates and executes this string in the current shell environment.

In the tcsh shell, **eval** treats the arguments as input to the shell and executes the resulting commands in the context of the current shell. This action is typically used to execute commands generated as the result of command or variable substitution, since parsing occurs before these substitutions. See "tcsh — Invoke a C shell" on page 689.

Examples

The command:

```
for a in 1 2 3
do
        eval x$a=fred
done
```

sets variables *x1*, *x2*, and *x3* to `fred`. Then:

```
echo $x1 $x2 $x3
```

produces:

```
fred fred fred
```

Usage notes

eval is a special built-in shell command.

Localization

eval uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

The only possible exit status value is:

0 No arguments were specified, or the specified arguments were empty strings

Otherwise, the exit status of **eval** is the exit status of the command that **eval** runs.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

exec, **sh**, **tcsh**

ex — Use the ex text editor

Format

ex [**–BelRrsv**] [+*command*] [**–c** *command*] [**–t** *tag*] [**–w** *size*] [**-W** *option*[,*option*]...] [*file ...file ...*]

Description

ex is the line-editor mode of the **vi** text editor.

Options

The **ex** internal commands are described in **vi**. It supports the following options:

+*command*
Begins the editing session by running the specified editor *command*. To specify multiple commands, separate them with a vertical bar (|).

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–c *command*
Begins editing by executing the specified editor command. To specify multiple commands, separate them with an "or" bar (|). *command* can be any **ex** command except those that enter input mode, such as **insert** or **append**.

–e Invokes **ex**. This option is intended for use with **vi**.

–l Sets LISP mode. The (and) commands use blocks of LISP code as their context rather than sentences.

–r Recovers named files after an editor or system fails. If you do not specify a file argument, **ex** lists all recoverable files and then exits.

When using **ex -r** to recover a file that was being edited with automatic conversion, the file must also be recovered with automatic conversion enabled when writing the data back to the original tagged text file. Likewise, if explicit conversion was being used when editing the file (by using the **-W filecodeset** or **-W pgmcodeset** options), the same options must be specified when writing the recovered data back to the original file. Failure to do either of these might result in incorrectly coded character data being written to the file when you save the recovered version.

–R Sets read-only mode.

–s Suppresses all interactive feedback (quiet mode). This option is for batch mode operation; **ex** assumes that the terminal cannot display text and ignores the value of TERM. **ex** also ignores all startup files and ignores the value of EXINIT.

–t *tag* Edits the file containing the specified *tag* and sets the virtual position in the edit buffer to point of definition for the tag.

–v Invokes **vi**.

–w *size*
Sets the option variable `window` equal to *size.*

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*

Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

Examples

1. To edit or browse a file containing UTF-8 characters using the **ex** editor, assuming that:
   - The file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are browsing an untagged public file or a read-only file)

   issue:

   ```
   ex -W filecodeset=UTF-8,pgmcodeset=IBM-1047 myUtf8File
   ```
2. To edit or browse a file containing EBCDIC characters using the **ex** editor, assuming that automatic conversion has been enabled but the file is incorrectly tagged as ASCII, issue:

   ```
   ex -B myMisTaggedFile
   ```

Localization

ex uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

ex uses the following environment variable:

_TEXT_CONV
: Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 Successful completion

1 Failure due to any of the following:
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

2 Failure due to any of the following:
- Unknown command-line option
- Missing or incorrect *num* in an **–n** option

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

The **–B**, **–e**, **–W**, and **–x** options are extensions of the POSIX standard.

Related information

ed, **vi**

exec — Run a command and open, close, or copy the file descriptors

Format

exec [**–a** *name*] [*command_line*]

tcsh shell: **exec** *command*

Description

The *command_line* argument for **exec** specifies a command line for another command. **exec** runs this command without creating a new process. Some people picture this action as *overlaying* the command on top of the currently running shell. Thus, when the command exits, control returns to the parent of the shell.

Input and output redirections are valid in *command_line*. You can change the input and output descriptors of the shell by giving only input and output redirections in the command. For example:

```
exec 2>errors
```

redirects the standard error stream to **errors** in all subsequent commands ran by the shell.

If you do not specify *command_line*, **exec** returns a successful exit status.

In the tcsh shell, **exec** executes the specified command in place of the current shell. See "tcsh — Invoke a C shell" on page 689.

Options

–a *name*
: The shell passes name as the zero'th argument (argv[0]) to command_line. **–a** *name* can be used to replace the current shell with a new login shell, by specifying name as a shell with a prefix of a dash (–).

Examples

To replace the current shell process with a new login shell (which will run the login profiles), specify:

```
exec -a -sh /bin/sh
```

Usage notes

exec is a special built-in shell command.

Localization

exec uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

If you specify *command_line*, **exec** does not return to the shell. Instead, the shell exits with the exit status of *command_line* or one of the following exit status values:

1–125 A redirection error occurred.

126 The command in *command_line* was found, but it was not an executable utility.

127 The given *command_line* could not be run because the command could not be found in the current **PATH** environment.

If you did not specify *command_line*, **exec** returns with an exit value of zero.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

sh, **tcsh**

---

exit — Return to the shell's parent process or to TSO/E

Format

exit [*expression*]

tcsh shell: **exit** [*expr*]

Description

exit ends the shell. If there is an *expression*, the value of the *expression* is the exit status of the shell.

The value of expression should be between `0` and `255`. For values outside this range, the exit status will be the least significant 8 bits of the value of the expression. The **EXIT** trap is raised by the **exit** command, unless **exit** is being called from inside an **EXIT** trap.

If you have a shell background job running, you cannot exit from the shell until it completes. However, you can switch to subcommand mode and exit.

In the tcsh shell, the shell exits either with the value of the specified expression or, without expression, with the value of the **status** variable. The value of expression should be between `0` and `255`. See "tcsh — Invoke a C shell" on page 689.

Usage notes

exit is a special built-in shell command.

Localization

exit uses the following localization environment variables:
- LANG
- LC_ALL
- LC_MESSAGES
- NLSPATH

See Appendix F, "Localization," on page 997 for more information.

Exit values

exit returns the value of the arithmetic expression specified by the *expression* argument to the parent process as the exit status of the shell. If you omit *expression*, **exit** returns the exit status of the last command run.

Related information

return, **sh**, **tcsh**

The **exit()** ANSI C function, the **_exit** callable service, and the **_exit()** POSIX C function are unrelated to the **exit** shell command.

expand — Expand tabs to spaces

Format

expand [**–B**] [**–t** *tablist*] [**-W** *option*[,*option*]...] [*file ...file ...*]
expand [*–tabstop*] [*–tab1,tab2,...,tabn*] [**–B**] [**-W** *option*[,*option*]...] [*file ...file ...*]

Description

expand reads text input from the files that are specified on the command line, converts tabs into spaces, and writes the result to the standard output (stdout). If you do not specify any files on the command line, **expand** reads from the standard input (stdin).

expand preserves backspace characters. By default, tab stops are set every eight columns. A tab after the last tabstop is replaced by a space.

Options

The first syntax of **expand** supports the following options:

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–t *tablist*
Sets tab stops at positions that are indicated by *tablist*. Numbers in *tablist* must be in ascending order (origin 0) and separated by commas or blanks; however, the list must be one argument so you need shell quoting if you are using blanks. The list can consist of a single number, in which case tabs are set every *tablist* positions apart.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name that is known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **filecodeset** are ISO8859-1 and 819.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name that is known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

The second syntax of **expand** (which the POSIX standard considers obsolete) supports the following options:

–tabstop
Sets tab stops every *tabstop* columns.

—tab1,tab2,...,tabn
Sets tab stops at each column *tab1*,*tab2* and so on (origin 0).

Examples

1. To convert tabs in a text file to spaces that are 10 positions apart:
   ```
   expand -t 10 myTextFile
   ```
2. To convert tabs in a text file containing ASCII characters to spaces, assuming that
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are displaying an untagged public text file or a read-only text file)

   then issue:
   ```
   expand -W filecodeset=ISO8859-1,pgmcodeset=IBM-1047 myAsciiFile
   ```
3. To convert tabs in a text file containing EBCDIC characters to spaces, assuming that automatic conversion has been enabled but the text file is incorrectly tagged as UTF-8:
   ```
   expand -B myTextFile
   ```

Localization

expand uses the following localization environment variables:
- LANG
- LC_ALL
- LC_CTYPE

- LC_MESSAGES
- NLSPATH

See Appendix F, "Localization," on page 997 for more information.

Environment variables

expand uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Cannot open the input file
- Insufficient memory
- Incorrect tab stop specification
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, 4.2BSD and higher.

The **–B** and **-W** options are extensions of the POSIX standard.

Related information

pr, **unexpand**

export — Set a variable for export

Format

export [*name* [=*value*] ...]
export –p

Description

export marks each variable *name* so that the current shell makes it automatically available to the environment of all commands run from that shell. Exported variables are thus available in the environment to all subsequent commands. Several commands (for example, **cd**, **date** and **vi**) look at environment variables for configuration or option information.

Variable assignments of the form *name=value* assign *value* to *name* as well as marking *name* for export. The *name* can contain only the underscore and alphanumeric characters from the portable character set.

Calling **export** without arguments lists, with appropriate quoting, the names and values of all variables in the format *Variable="value"*. If you reinput this format to another shell, variables are assigned appropriately but not exported. The **–p** option lists variables in a format suitable for reinput to the shell (see the description of the **–p** option).

Options

–p Lists variables in a form that is suitable for reinput to the shell:

```
export name="value"
```

Usage notes

export is a special built-in shell command.

Localization

export uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to incorrect command-line argument

2 Failure, usually due to incorrect an incorrect command-line argument, that results in a usage message

Portability

POSIX.2, X/Open Portability Guide.

Assigning a value to *name*, and the behavior given for calling **export** with arguments are extensions of the POSIX standard.

Related information

cd, **date**, **set**, **sh**, **typeset**, **vi**

expr — Evaluate arguments as an expression

Format

expr –W *expression*

Description

The set of arguments passed to **expr** constitutes an expression to be evaluated. Each command argument is a separate token of the expression. **expr** writes the result of the expression on the standard output. This command is primarily intended for arithmetic and string manipulation on shell variables.

expr supports the following operators. Operators explained together have equal precedence; otherwise, they are in increasing order of precedence. **expr** stores an expression as a string and converts it to a number during the operation. If the context requires a Boolean value, a numeric value of `0` (zero) or a null string ("") is *false*, and any other value is *true*. Numbers have an optional leading sign. If the **-W** option is not specified, numbers are decimal. If the **-W** option is specified, expressions may contain octal, hexadecimal, or decimal numbers. **expr** determines the base of the number as follows:

- Any number that starts with 0x is hexadecimal.
- Any number that starts with 0 is octal.
- Any number that does not start with 0x or 0 is decimal.

Numbers are manipulated as long integers.

expr1 **|** *expr2*
: Results in the value *expr1* if *expr1* is true; otherwise, it results in the value of *expr2*.

expr1 **&** *expr2*
: Results in the value of *expr1* if both expressions are true; otherwise, it results in `0`.

expr1 **<=** *expr2* **|** *expr1* **<** *expr2* **|** *expr1* **=** *expr2* **|** *expr1* **!=** *expr2* **|** *expr1* **>=** *expr2* **|** *expr1* **>** *expr2*
: If both *expr1* and *expr2* are numeric, **expr** compares them as numbers; otherwise, it compares them as strings. If the comparison is true, the expression results in `1`; otherwise, it results in `0`.

expr1 **+** *expr2* **|** *expr1* **–** *expr2*
: Performs addition or subtraction on the two expressions. If either expression is not a number, **expr** exits with an error.

expr1 ***** *expr2* **|** *expr1* **/** *expr2* **|** *expr1* **%** *expr2*
: Performs multiplication, division, or modulus on the two expressions. If either expression is not a number, **expr** exits with an error.

expr1 **:** *re* **|** **match** *expr1 re*
: matches the regular expression *re* against *expr1* treated as a string. The regular expression is the same as that accepted by **ed**, except that the match is always anchored—that is, there is an implied leading ^. Therefore, **expr** does not consider ^ to be a metacharacter. If the regular expression contains \(**...**\), **\)** and it matches at least part of *expr1*, **expr** results in only that part; if there is no match, **expr** results in `0`. If the regular expression doesn't contain this construct, the result is the number of characters matched. The function **match** performs the same operation as the colon operator.

substr *expr1 expr2 expr3*
: Results in the substring of *expr1* starting at position *expr2* (origin 1) for the length of *expr3*.

index *expr1 expr2*
: Searches for any of the characters in *expr2* in *expr1* and results in the offset of any such character (origin 1), or `0` if no such characters are found.

length *expr1*
: Results in the length of *expr1*.

(*expr***)** Groups expressions.

Options

–W Allows the *expression* to use hexadecimal and octal numbers.

Usage notes

The parser stack depth is limited to 150 levels. Attempting to process extremely complicated expressions may result in an overflow of this stack, causing an error.

Examples

1. The example

   ```
   fname=src/fn_abs.c
   expr $fname : '*_\(.*\)\.c'
   ```

   returns `abs`.

2. The example

   ```
   a='expr $a + 1'
   ```

   adds 1 to the value of the shell variable *a*.

Localization

expr uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 The result of *expression* is true.

1 The result of *expression* is false.

2 Failure due to any of following:
- Not enough memory.
- Command-line syntax error.
- Too few arguments on the command line.
- Incorrect regular expression.
- Regular expression is too complicated.
- Nonnumeric value found where a number was expected.

Messages

Possible error messages include:

internal tree error
Syntax errors or unusual expression complexity make it impossible for **expr** to evaluate an expression. If an expression has syntax errors, correct them; if not, simplify the expression (perhaps by breaking it into parts).

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

In the shell, **let** largely supersedes this command.

match, **substr**, **length**, and **index** are not documented on all UNIX systems, though they do appear to exist. They are extensions of the POSIX standard.

Related information

ed, **let**, **sh**, **test**

See Appendix C, "Regular expressions (regexp)," on page 971 for more information about **regexp**.

exrecover daemon — Retrieve vi and ex files

Format

exrecover [**–s**] [*name_file* ...]
exrecover [**–v**]

Description

The **exrecover** daemon recovers text files from working files created by **vi** and **ex**. (These working files are in one or more temporary directories.) It is normally invoked from a system startup file before these working files are purged.

Options

–s Suppresses error messages.

–v Displays the version number of **exrecover**.

Environment variables

exrecover uses the following environment variables:

TMP_VI
Contains a directory path name that can be specified by an administrator as a location for **vi** temporary files. This is useful if the current default directory for these files (usually `/tmp`) is implemented as a TFS. In this case, all **vi** temporary files that the **exrecover** daemon uses for recovery would be gone after a system crash.

IBM recommends that this environment variable be set by a system administrator as opposed to a user setting it for their environment. If the latter occurs and the user sets the TMP_VI directory to something different than what **exrecover** recognizes as TMP_VI, the user will need to run the **exrecover** daemon manually to allow the temporary files to be converted to the recoverable files used by **vi** (located in `/etc/recover/$LOGNAME`).

Restrictions: The system administrator should not do the following:

- Set TMP_VI to `/etc/recover/$LOGNAME`.
- Set TMP_VI to any directory where a path name component is an environment variable with a user's value different than the initialization process's value (for example, $HOME). **vi** temporary files are converted into a form recoverable by **vi** when **exrecover** is run during IPL. Because

exrecover is issued during IPL, it is owned by the initialization process and will therefore contain different values for certain environment variables, if those environment variables are set. Throughout the file system, there may exist some temporary files that can only be converted by **exrecover**. This conversion can be done manually by a system administrator (to recover files owned by all users) or by a single user (to recover only their own files).

TMPDIR
The default directory. When this environment variable is set, **exrecover** looks in this directory for the **ex** and **vi** working files.

TMP If TMPDIR is not set, TMP specifies the directory to be searched when looking for the **ex** and **vi** working files.

If both TMPDIR and TMP are not set, **exrecover** uses the directory that the XL C/C++ runtime library function tempnam() would use.

Localization

exrecover uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Files

exrecover uses the following files:

/tmp/VIl*
Line table files.

/tmp/VIn*
Name files.

/tmp/VIt*
Paged text files.

/etc/recover
The directory containing subdirectories of user names whose files have been recovered. Only users with the appropriate privileges, such as the system administrator, can create the `/etc/recover` directory.

/etc/recover/$LOGNAME/VIn*
Contains the name of the file that was being edited.

/etc/recover/$LOGNAME/VIt*
Contains the recovered text of the file that corresponds to the VIn* file

Rule: Using a TFS for **vi** temporary files will make it impossible to recover **vi** files after a system crash. **vi** writes temporary files to TMP_VI or TMPDIR (or `/tmp` by default), and if the system crashes, those files can be recovered by the **exrecover** command, which automatically runs from `/etc/rc`. If the files are written to a TFS, then they will be wiped out when the system is IPLed. See the TMP_VI description under Environment Variables section of this command.

Usage notes

1. To recover all the files in the temporary directory, this command must be run with appropriate permissions (for example, superuser privileges) so the recovered files can be stored in the **/etc/recover** directory with the appropriate ownerships and permissions.

   For example, the following is a shell script to recover the files from TMPDIR, where TMPDIR is the default directory:

   ```
   export TMPDIR=/tmp
   exrecover
   ```

2. If it is invoked by a nonprivileged user (for example, a user who is not a root user), then only those files owned by that user are recovered. Because **vi** and **ex** create their working files in directories specified by the TMPDIR or TMP environment variables, one of these environment variables must be set before **exrecover** can be issued.

   For example, the following is a shell script that recovers files from $HOME/tmp:

   ```
   export TMPDIR=$HOME/tmp
   exrecover
   ```

3. **exrecover** is also invoked by **vi** or **ex** when you issue the **ex preserve** command or when **exrecover** receives a SIGHUP signal. The working files created by **vi** and **ex** are found in a default temporary directory (such as `/tmp`) or in the directory specified by the TMPDIR or in the directory specified by the TMP_VI,, TMPDIR, or TMP environment variable. Three working files are created:

   name_file
   : Contains the actual name of the **vi** file. The names of all *name_files* begin with **VIn**.

   line_table_file
   : Contains a dummy page followed by data that gives, in line number order, the offset for each line of text in the corresponding *paged_text_file*. The page size is typically 1K, but may vary on some systems. The names of all line table files begin with **VII**.

   paged_text_file
   : Contains lines of text that are at most LINE_MAX bytes in length. Lines shorter than LINE_MAX byte are ended by a newline. The names of all paged text files begin with VIt.

4. You can also run the program by specifying *name_file* on the command line. For example:

   ```
   exrecover /tmp/VInaaaa.111 /tmp/VInbbbb.222 ...
   ```

   exrecover searches for a *name_file* and tries to open the associated line table and paged text files. If all these files are found, **exrecover** builds, from the line table and paged text files, a text file and stores it in the directory `/etc/recover/$LOGNAME`.

   It also stores a corresponding *name_file* to identify the file that was recovered and sends mail, using the **mailx** utility, to the owner of the file indicating the date, time, and name of the file recovered. You can retrieve recovered files in one of the following ways:

   ```
   vi –r file [issued from a shell command line]
   ex –r file [issued from a shell command line]
   :recover file [issued from within a vi session]
   ```

Each command loads the most recent occurrence of the file recovered from a system failure or the **ex preserve** command. If **vi** successfully loads the file, it removes the preserved file.

Exit values

0 Successful completion

1 Failure due to any of the following:

- Memory allocation error
- No working files were found
- No `/etc/recover` directory errors that affect the overall operation of the **exrecover** command
- An incomplete set of working files were found

2 Usage error

3 An error occurred while recovering a specific file. Some, but not all, files were recovered.

Related information

ex, **vi**

extattr — Set, reset, and display extended attributes for files

Format

extattr [**+alps**] [**-alps**] [**-F***format*] *file ...*

Note: **l** is a lower case L, not an upper case i.

Description

extattr sets, resets, and displays extended attributes for files.

Extended attributes

The following extended attributes are defined:

a When this attribute is set (**+a**) on an executable program file (load module), it behaves as if loaded from an APF-authorized library. For example, if this program is exec()ed at the job step level and the program is linked with the AC=1 attribute, the program will be executed as APF-authorized.

To be able to use the **extattr** command for the **+a** option, you must have at least read access to the BPX.FILEATTR.APF resource in the FACILITY class profile. For more information about BPX.FILEATTR.APF, see *z/OS UNIX System Services Planning*.

l When this attribute is set (**+l**) on an executable program file (load module), it will be loaded from the shared library region.

To be able to use the **extattr** command for the **+l** option, you must have at least read access to the BPX.FILEATTR.SHARELIB resource in the FACILITY class. For more information about BPX.FILEATTR.SHARELIB, see *z/OS UNIX System Services Planning*.

Note: **l** is a lower case L, not an upper case i.

p When this attribute is set (**+p**) on an executable program file (load module), it causes the program to behave as if an RDEFINE had been done for the load module to the PROGRAM class. When this program is brought into storage, it does not cause the environment to be marked dirty.

To be able to use the **extattr** command for the **+p** option, you must have at least read access to the BPX.FILEATTR.PROGCTL resource in the FACILITY class. For more information about BPX.FILEATTR.PROGCTL , see *z/OS UNIX System Services Planning*.

s When this attribute is not set (**–s**), the _BPX_SHAREAS=YES and _BPX_SHAREAS=REUSE environment variable settings are ignored when the file is spawn()ed. Use of the _BPX_SHAREAS=MUST setting and the **–s** option will result in a spawn() failure. By default, this attribute is set (**+s**) for all executable files.

Note: To specify any of these attributes, the user must be the owner of the file or have superuser authority.

Options

-F *format file ...*

extattr command will accept the **-F** option flag with values consistent with the **cp** command to indicate the format of the file. The command will set the file format accordingly.

Setting the file format flag on a file does not modify the data in the file. Use the **ls -H** to display the file format.

For *format*, you can specify:

BIN Binary data
CR Carriage return
CRLF Carriage return followed by line feed
CRNL Carriage return followed by a newline character
LF Line feed
LFCR Line feed followed by carriage return
NA Not specified
NL Newline character
REC File data consists of records with prefixes. The record prefix contains the length of the record that follows.

The format option can be specified in lowercase, uppercase or in mixed cases. The format option can also be specified with a space or no space after the file format flag (**-F**). For example: **extattr -FLFcr** *file*

The file format flag (**-F**) can be used with other **extattr** flags (+alps/-alps), but it must be separated by a space or tab. For example:

extattr +aps -F BIN *file* is a valid entry.

extattr -apsF NA *file* is not a valid entry.

Usage notes

The APF-authorized (a), shared library (l) and program-control (p) attributes are reset by the system if the file is opened for write, an external link to the file is created, or the file is renamed.

Examples

Following are valid examples of the use of **extattr**:

```
extattr +ap -F BIN -sl <filename>
extattr -F NA -aps +l <filename>
extattr -FCRnl <filename>
```

To have the **c89** and **tso** utilities not run in an address space shared with other processes, issue:

```
extattr -s /bin/c89 /bin/tso
```

Related information

ls, **ISHELL**

false — Return a nonzero exit code

Format

false [*argument ...*]

Description

false returns an exit status value of 1 (failure). It ignores any arguments given on the command line. This option can be useful in shell scripts.

Usage notes

false is a built-in shell command.

Localization

false uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

false always returns an exit status value of 1.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

sh

fc — Process a command history list

Format

fc [–r] [**–e** *editor*] [*first*[*last*]]
fc –l [**–nr**] [*first*[*last*]]
fc –s [*old=new*] [*specifier*]

Description

fc displays, edits, and reenters commands that have been input to an interactive shell. **fc** stands for "fix commands." If the variable **HISTSIZE** is not defined, 128 commands are accessible. The number of commands that are accessible is determined by the **HISTSIZE** variable.

The shell stores these commands in a history file. When the **HISTFILE** environment variable is defined as the name of a writable file, the shell uses this as the history file. Otherwise, the history file is **$HOME /.sh_history**, if **HOME** is defined and the file is writable. If the **HOME** variable is not defined, or the file is not writable, the shell attempts to create a temporary file for the history. If a temporary file cannot be created, the shell does not keep a history file.

Note: A shell shares history (commands) with all shells that have the same history file. A login shell truncates the history file if it is more than **HISTSIZE** lines long.

Normally, the shell does not keep a history of commands run from a profile file or the **ENV** file. By default, however, it begins recording commands in the history file when it encounters a function definition in either of these setup files. This means that the **HISTSIZE** and **HISTFILE** variables must be set up appropriately before the first function definition. If you do not want the history file to begin at this time, use:

```
set -o nolog
```

For further information, see **sh** and **set**. Any variable assignment or redirection that appears on the **fc** command line affects both the **fc** command itself and the commands that **fc** produces.

The first form of **fc** in "Format" puts you into an editor with a range of commands to edit. When you leave the editor, **fc** inputs the edited commands to the shell.

The first and last command in the range are specified with *first* and *last*. There are three ways to specify a command.

- If the command specifier is an unsigned or positive number, **fc** edits the command with that number.
- If the command specifier is a negative number *–n*, **fc** edits the command that came *n* commands before the current command.
- If the command specifier is a string, **fc** edits the most recent command beginning with that string.

The default value of *last* is *first*. If you specify neither *first* nor *last*, the default command range is the previous command entered to the shell.

Options

–e *editor*
Invokes *editor* to edit the commands. If you do not specify the **–e** option, **fc**

assumes that the environment variable **FCEDIT**, if defined, contains the name of the editor for **fc** to use. If **FCEDIT** is not defined, **fc** invokes **ed** to edit the commands.

–l Displays the command list. This option does not edit or reenter the commands. If you omit *last* with this option, **fc** displays all commands from the one indicated by *first* through to the previous command entered. If you omit both *first* and *last* with this option, the default command range is the 16 most recently entered commands.

–n Suppresses command numbers when displaying commands.

–r Reverses the order of the commands in the command range.

–s Reenters exactly one command without going through an editor. If a command *specifier* is given, **fc** selects the command to reenter as described earlier; otherwise, **fc** uses the last command entered. To perform a simple substitution on the command before reentry, use a parameter of the form *old=new*. The string *new* replaces the first occurrence of string *old*. **fc** displays the (possibly modified) command before reentering it.

Environment variables

FCEDIT
Contains the default editor to be used if none is specified with the **–e** option.

HISTFILE
Contains the path name of the history file.

HISTSIZE
Gives the maximum number of previous commands that are accessible.

Files

/tmp Used to store temporary files. You can use the TMPDIR environment variable to dictate a different directory to store temporary files.

$HOME/.sh_history
This default history file is created.

Localization

fc uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Usage notes

1. **fc** is a built-in shell command.
2. **r** is a built-in alias for **fc –s**. **history** is a built-in alias for **fc –l**.

Exit values

0 If you specified **–l**, this indicates successful completion.

1 Failure due to any of the following:
- Missing history file

- Inability to find the desired line in the history file
- Inability to create temporary file

2 An incorrect command-line option or argument

If **fc** runs one or more commands, the exit status of **fc** is the exit status of the last run command.

Messages

Possible error messages include:

Cannot create temporary file
fc must create a temporary file to do some operations, such as editing. It prints this message when it cannot create its temporary file—for example, because the disk is full.

No command matches *string*
You asked to edit a command beginning with a particular *string*, but there was no such command in the history file.

Portability

POSIX.2.

Related information

alias, **ed**, **print**, **read**, **sh**, **vi**

---

fg — Bring a job into the foreground

Format

fg [**%***job-identifier*]

tcsh shell: **fg** [*%job ...*]

Description

fg restarts a suspended job or moves a job from the background to the foreground. To identify the job, you give a *job-identifier* (preceded by **%**) as given by the **jobs** command.

If you do not specify *job-identifier*, **fg** uses the most recent job to be suspended (with the **kill** command) or placed in the background (with the **bg** command). **fg** is available only if you have enabled job control. See the **–m** option of **set** for more information.

In the tcsh shell, **fg** brings the specified jobs (or, without arguments, the current job) into the foreground, continuing each if it is stopped. *job* can be '', %, +, –, a number, or a string. See also the **run-fg-editor** editor command described in “tcsh — Invoke a C shell” on page 689.

Localization

fg uses the following localization environment variables:
- **LANG**
- **LC_ALL**

- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion
>0 No current job

Messages

Possible error messages include:

Not a stopped job
Job was not stopped.

Portability

POSIX.2 User Portability Extension.

Related information

bg, **jobs**, **kill**, **ps**, **tcsh**

fgrep — Search a file for a specified pattern

Format

fgrep [**Bbcilnqsvx**]] [**-W** *option*[,*option*]...] [**–e** *pattern*] ... [**–f** *patternfile*] ... [*pattern*] [*file ...file ...*]

Guideline: The **fgrep** utility is fully supported for compatibility with older UNIX systems. However, use **grep –F** instead because it may provide greater functionality and is considered the standard for portable UNIX applications as defined by POSIX.2 IEEE standard 1003.2-1992.

Note:

Description

See **grep**.

file — Determine file type

Format

file [**–BcdEh**] [**–f** *filelist*] [**-M** *magic*] [**–m** *magic*] [**-W** *option*[,*option*]...] *file ...file ...*

file -i [**-h**] [**–f** *filelist*] *file ...file ...*

Description

file determines the format of each *file* by inspecting the attributes and (for a regular file) reading the contents of the *file*. If the *file* is an executable, its addressing mode is determined for output. If *file* is not an executable, **file**

compares each *file* to entries found in one or more **magic** files to determine their file type. If you specify - as a file name, **file** reads from the standard input (stdin).

file then divides files that do not match a template in the **magic** file into text files and binary data. Then, by reading the text files and making an informed guess based on the contents, **file** further divides text files into various types such as C programs, assembler programs, files of commands to the shell, and **yacc** or **lex** programs.

file displays the name of each file along with the file type.

- If the variable _UNIX03=YES is set, a space is used to separate the file name and the type.
- If the variable _UNIX03 is unset or is not set to YES, a tab is used to separate the file name and the file type.

The **file** utility uses three types of tests to determine the file type: the file attribute tests, the position-sensitive tests and the context-sensitive tests.

- The "file attribute tests" determine file types such as directory, character special, FIFO, socket, symbolic link, and external link.
- The "position-sensitive tests" determine file types by looking for certain string or binary values at specific offsets in the file being examined. The "default position-sensitive tests" are defined by:
  - The`/etc/magic` file
  - The AMODE test built into the **file** utility

  If a magic file test succeeds, the message field of the line will be printed and no further tests will be applied, except for tests on immediately following lines beginning with a single '>' character.
- The "default context-sensitive tests" are built into the **file** utility. These tests look for language constructs in text files trying to identify shell scripts, C, FORTRAN, and other computer language source files, and even plain text files. The "default context-sensitive tests" will never be applied before any "position-sensitive tests" even if the **-d** option is specified before an **-m magic** option or **-M magic** option.

Options

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–c Only checks the file *magic* (specified by **-m** or **-M**) and `/etc/magic`. If the semantics imply it, see the usage notes for the validity of the format.

-d Apply any default position-sensitive tests and default context-sensitive tests to the file. This option is the default if no **-M** or **-m** option is specified. See the usage notes for more information.

-E Uses the **magic** file and bypasses the checking of regular files for executables.

–f *filelist*
Examines the files listed in the file *filelist*.

-h When a symbolic link is encountered, identify *file* as a symbolic link instead of following the link.

If **-h** is not specified and

- *file* is an external link or *file* is a symbolic link referring to a nonexistent file:

If the variable _UNIX03=YES is set
The type will be reported as if **-h** was specified.

If the variable _UNIX03 is unset or is not set to YES
The type will be reported as if **-h** was not specified.

-i If *file* is a regular file, does not attempt to classify the type of the file further. This option can only be used with **-h** and **-f** options. "Usage Note" for the file types that **file** command does not attempt to classify.

–M *magic*
Uses the file *magic* to classify the file type. No default position-sensitive tests, default context-sensitive tests, nor AMODE tests shall be applied, unless the **-d** option is also specified. See the usage notes for more information.

–m *magic*
Alters the classification of regular files when examining the file content.

If the variable _UNIX03=YES is set
Then *file* attempts to classify the file type using the following tests, in order:

1. Using the file *magic*.
2. Using the default position-sensitive tests (`/etc/magic`).
3. Using the default context-sensitive tests built into the **file** command.

If the variable _UNIX03 is unset or is not set to YES
Then *file* attempts to classify the file type using the following tests, in order:

1. Using the file *magic* rather than `/etc/magic`.
2. Using the default context-sensitive built into the **file** command.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

Examples

1. To display the type of a file:
   ```
   file myFile
   ```
2. To display the type of a file, without attempting to classify regular files:
   ```
   file -i myFile
   ```
3. To display the type of a text file containing UTF-8 characters, assuming that:
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are checking an untagged public text file or a read-only text file)

   ```
   file -W filecodeset=UTF-8,pgmcodeset=IBM-1047 myUtf8File
   ```
4. To display the type of a text file containing EBCDIC characters, assuming that automatic conversion has been enabled but the text file is incorrectly tagged as ASCII:
   ```
   file -B myMisTaggedFile
   ```

Localization

file uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

file uses the following environment variables:

_UNIX03
See Appendix N, "Shell commands changed for UNIX03," on page 1039 for more information about the effect of the _UNIX03 environment variable on this command.

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Files

file uses the following file:

/etc/magic
Default system **magic** file.

For **file** to work, you need to copy the **magic** file from the `/samples` directory to the `/etc` directory.

For more information about enabling **file**, see the section on copying configuration files in *z/OS UNIX System Services Planning*. Additional information about the **magic** file can be found in "magic — Format of the /etc/magic file" on page 1004.

Usage notes

1. LC_SYNTAX only affects the interpretation of the input file that did not match any **magic** file template. It does not affect the interpretation of the **magic** file.

   Because of this, an input file that contains characters from a code page other than IBM-1047 cannot match the **magic** file, which contains IBM-1047 characters. If you need to match character in different code pages, you can use the **-m** or **-M** option to specify a magic file created with the desired code page.
2. The tests applying to a file when running the command follow the rules outlined in Table 12.

Table 12. Rules for testing files

If the following options are specified...	Then the position-sensitive tests are applied in the following sequence...	Default context-sensitive tests applied?
None	AMODE > /etc/magic	Yes
-d	AMODE > /etc/magic	Yes
-M MAGIC	MAGIC	No
-m magic	• If the variable **_UNIX03=YES** is set, magic > AMODE > /etc/magic • If the variable **_UNIX03** is unset or is not set to YES, AMODE > magic	Yes
-d -M MAGIC	AMODE > /etc/magic > MAGIC	Yes

Table 12. Rules for testing files (continued)

If the following options are specified...	Then the position-sensitive tests are applied in the following sequence...	Default context-sensitive tests applied?
-M MAGIC -d	MAGIC > AMODE > /etc/magic	Yes
-d -m magic	AMODE > /etc/magic > magic	Yes
-m magic -d	magic > AMODE > /etc/magic	Yes
-M MAGIC -m magic	MAGIC > magic	No
-m magic -M MAGIC	magic > MAGIC	No
-d -M MAGIC -m magic	AMODE > /etc/magic > MAGIC > magic	Yes
-d -m magic -M MAGIC	AMODE > /etc/magic > magic > MAGIC	Yes
-M MAGIC -d -m magic	MAGIC > AMODE > /etc/magic > magic	Yes
-M MAGIC -m magic -d	MAGIC > magic > AMODE > /etc/magic	Yes
-m magic -d -M MAGIC	magic > AMODE > /etc/magic > MAGIC	Yes
-m magic -M MAGIC -d	magic > MAGIC > AMODE > /etc/magic	Yes

Note:

a. The first column specifies the appearance of the -d, -M and -m options in the command line.

b. The second column gives what position-sensitive tests are applied and in what sequence, given the options specified in the first column:
   - AMODE is a default position-sensitive system test which is only used on an executable file to determine the addressing mode.
   - "/etc/magic" means the default position-sensitive tests in `/etc/magic`.
   - "MAGIC" means the position-sensitive tests in the magic file specified by "-M".
   - "magic" means the position-sensitive tests in the magic file specified by "-m".
   - Tests not appearing in the cell are not applied.

c. The third column gives whether the default context-sensitive tests (built into the file command) are applied, given the options specified in the first column.

3. If **-d** option is specified together with **-E** option, the AMODE tests will not be applied. If **-M magic** option is specified alone, the AMODE tests will not be applied.
4. The standard output messages of the **file** utility will contain the specified strings, but not limited to, listed in Table 13.

Table 13. Output messages of the file utility

If file is:	Will contain the string:	See note
Nonexistent	Cannot open	None
Block special	Block special	a
Character special	Character special	a
Directory	Directory	a
FIFO	Fifo	a

Table 13. Output messages of the file utility (continued)

If file is:	Will contain the string:	See note
Socket	Socket	a
Symbolic link	Symbolic link to	a
External symbolic link	External link to	a
Regular file	Regular file	a,b
Empty regular file	Empty	c
Regular file that cannot be read	Cannot open	c
Executable binary	Executable	d,f
ar archive library (see ar)	Archive	d,f
Extended cpio format (see pax)	cpio archive	d,f
Extended tar format (ustar in pax)	tar archive	d,f
Shell script	Commands text	e,f
C-language source	C program text	e,f
FORTRAN source	Fortran program text	e,f
Regular file whose type cannot be determined	Data	None

Note:

a. This is a file attribute test.

b. This test is applied only if the **-i** option is specified.

c. This test is applied only if the **-i** option is not specified.

d. This is a default position-sensitive test.

e. This is a default context-sensitive test.

f. Default position-sensitive tests and default context-sensitive tests are not applied if the -**M magic** option is specified unless the **-d** option is also specified.

Exit values

0 Successful completion

1 Failure due to any of the following:

- A missing *filelist* after **–f**
- More than one **–f** option on the command line
- Cannot find the **magic** file
- Incorrect command-line option
- Too few command-line arguments
- Cannot access a specified file
- Cannot open *filelist*
- Cannot open the **magic** file
- A format error in the **magic** file
- Out of memory for reading or **magic** entries
- A bad number in the **magic** file
- A misplaced > in the **magic** file.
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

All options are extensions of the POSIX standard.

The **–B** and **-W** options are extensions of the POSIX standard.

Related information

"magic — Format of the /etc/magic file" on page 1004 for more information about the **magic** file format.

find — Find a file meeting specified criteria

Format

find *path ... expression*

Description

find searches a given file hierarchy specified by *path*, finding files that match the criteria given by *expression*. Each directory, file, and special file is passed through *expression*. If you use the **-exec**, **-ok**, or **-cpio** primary, *expression* runs a specified command on each file found. A nonexistent *expression* or an *expression* with commands to run automatically uses the **-print** primary to display the name of any file that matches the criteria of *expression*.

find builds *expression* from a set of primaries and operators; juxtaposition of two primaries implies a logical AND operator.

Operators and primaries

find supports the following operators:

–a Used between primaries for a logical AND. You can omit this operator to get the same result, because logical AND is assumed when no operator is used between two primaries.

–o Used between primaries for a logical OR.

! Precedes an expression in order to negate it.

Rules: When using the **find** command, follow these rules:

- When grouping primaries and operators using parentheses, you must escape the parentheses with the \ (backslash) character if the command is being executed in the shell environment.
- You must delimit all primaries, operators, numbers, arguments, and parentheses with white space.

Each *number* in the primary list is a decimal number, optionally preceded by a plus or minus sign. If a number is given without a sign, **find** tests for equality; a plus sign implies "greater than" or "older than" and a minus sign implies "less than" or "newer than".

Options

This section lists the primaries that **find** supports.

Tip: If you use the ACL primaries, with the exception of **-acl**, performance might be affected.

–aaudit *auditmask*
The **-aaudit** primary is used to match the auditor audit bits. See **–audit** *auditmask*.

-acl *c* Matches if the type of ACL is the same as the type given by the character *c*. Possible values of the character are:

a Access ACL (matches only if there are extended ACL entries)
d Directory default ACL
f File default ACL

If **acl** *c* is not defined, then **find** matches any of these ACLs when other ACL primaries are used.

-acl_count *number*
Matches if the numbers of extended ACL entries for any of the types of ACLs for the object is *number*.

number is a decimal number, optionally preceded by a plus or minus sign. If a number is given without a sign, **find** tests for equality; a plus sign implies “greater than” or “older than,” and a minus sign implies “less than” or “newer than”.

-acl_entry *acl_text*
Matches if the ACL on the file contains an entry equivalent to *acl_text* where *acl_text* is a single extended ACL entry. This primary matches using user and group names rather than UID and GID numbers. If aliases exist for a name, then it is possible a match might not occur. This behavior is different than the -acl_user and -acl_group primaries which match based on UID and GID. Extended ACL entries have the following format:

```
[d[efault]: | f[default]:]u[ser]:uid:[+|^]perm
[d[efault]: | f[default]:]g[roup]:gid:[+|^]perm
```

where:

d[efault]
If specified, extended ACL refers to directory default ACL

f[default]
If specified, extended ACL refers to file default ACL

u[ser] Extended ACL refers to a particular numeric user ID (UID) or user name

g[roup]
Extended ACL refers to a particular numeric group ID (GID) or group name

uid User name or numeric user ID (UID)

gid Group name, or numeric group ID (GID)

perm Permissions specified either in absolute form (string `rwx` with `-` as a placeholder or octal form), or in relative format (using the **+** or**^** modifiers).

For relative permission settings, specifying `+perm` means that you want the ACL entry to have that permission turned on. Specifying `^perm` means that you want the ACL entry to have that permission off. For example, specifying the following will find files with an extended access ACL entry for user Billy in which the permissions are either `-w-` or `rw-`:

```
user:Billy:+w^x
```

If the permission field of acl_text is omitted, then the ACL entries are searched to match only the ACL type, and user or group portions of the user-supplied entry.

If you want to find any of the base ACL entries (user, group, or other), you can use the `-perm` primary.

The first field of an ACL entry may specify the type of ACL (access, directory default, or file default) that will be processed. If the type is not specified, the operation applies only to the access ACL. If you are updating the ACL entries, you can specify the base ACL entries; however, specifying the base ACL entries may cause the file or directory's permission bits to change if what is specified is different than the current settings.

-acl_group *groupid*
Matches if the object has an extended group ACL entry for *groupid*. *groupid* can also be a group ID number.

If your security product supports ACLs, the group base ACL entry can be matched using this primary. If a numeric group exists as a group name in the group data base, the group ID number associated with that group is used.

-acl_nogroup
Matches if a group ACL entry (for any type of ACL) exists in which a group is not defined. The GID for at least one extended ACL entry for the file does not have a group name associated with it.

-acl_nouser
Matches if a user ACL entry (for any type of ACL) exists in which a user is not defined. The UID for at least one extended ACL entry for the file does not have a user name associated with it.

-acl_user *userid*
Matches if the ACL of the object has an extended user ACL entry for *userid*. *userid* can also be a user ID number.

If a numeric owner exists as a user name in the user data base, the user ID number associated with that user name is used. If your security product supports ACLs, the user base ACL entry can be matched, using this primary.

–atime *number*
Matches if someone has accessed the file exactly *number* days ago.

number is a decimal number, optionally preceded by a plus or minus sign. If a number is given without a sign, **find** tests for equality; a plus sign implies “greater than” or “older than,” and a minus sign implies “less than” or “newer than”.

–audit *auditmask*

The **-audit** primary is used to match the user audit bits. *auditmask* can be in octal or in symbolic form. The mask can be preceded by a **-** character (as in the **perm** primary), but it is ignored.

Symbolic form is an *operation=condition* list, separated by commas:

```
[rwx]=[sf]
```

where:

=sf Success or failure on any of **rwx**

r=s Success on **read**

r=s, x=sf
Success on **read** or **exec**, failure on **exec**

r, w=s Incorrect syntax

x Incorrect syntax

Octal form is specified by using the **chaudit** bit constant definitions in the /usr/include/sys/stat.h header file. For example, in stat.h, the flag for failing read accesses is AUDTREADFAIL. It is defined to be 0x02000000, which has an octal value of 200000000. This octal value can be used as the *auditmask* to find failure on read.

–cpio *cpio-file*

Writes the file found to the target file *cpio-file* in **cpio** format. This is equivalent to:

```
find ... | cpio -o >cpio-file
```

This primary matches if the command succeeds.

–ctime *number*

Matches if someone changed the attributes of the file exactly *number* days ago.

number is a decimal number, optionally preceded by a plus or minus sign. If a number is given without a sign, **find** tests for equality; a plus sign implies “greater than” or “older than,” and a minus sign implies “less than” or “newer than”.

–depth

Processes directories after their contents. If present, this primary always matches.

–exec *command* **;**

Takes all arguments between **–exec** and the semicolon as a command line, replacing any argument that is exactly {} (that is, the two brace characters) with the current file name. It then executes the resulting command line, treating a return status of zero from this command as a successful match, nonzero as failure. You must delimit the terminal semicolon with white space.

Rule: The semicolon is a shell metacharacter. To use it in *expression*, you must escape it, either by enclosing it in single quotation marks or by preceding it with a backslash (\).

–ext *c* Matches when the regular file has the extended attribute specified by

character *c*. See "extattr — Set, reset, and display extended attributes for files" on page 307 for details on extended attributes. Possible values of the character are:

a Program runs APF authorized if linked AC = 1
l Program is loaded from the shared library region
p Program is considered program-controlled
s Program is allowed to run in a shared address space

–filetag *c*
Matches if the file tag is the same as the one given by character *c*. Possible values of the character are:

b Matches if the file is tagged as binary (txtflag = OFF and ccsid = 0xFFFF)

n Matches if the file has txtflag = OFF

t Matches if the file is tagged as text (txtflag = ON)

u Matches if the file is untagged (ccsid = 0)

–filetag_codeset *codeset*
Matches if the file is tagged with the given code set. *codeset* can be a code set name known to the system or the numeric coded character set identifier (CCSID). If a code set name exists, the numeric CCSID associated with that name is used. Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names.

Note: Because code sets that are aliases of each other exist, tests might fail if the file inquiry operator returns an alias of the code set that you are testing.

–follow
Follows symbolic links. If present, this primary always matches.

–group *name*
Matches if the group owner is *name*. If *name* is not a valid group name, it is treated as a group ID.

–inum *number*
Matches if the file has inode number *number*.

number is a decimal number, optionally preceded by a plus or minus sign. If a number is given without a sign, **find** tests for equality; a plus sign implies "greater than" or "older than," and a minus sign implies "less than" or "newer than".

–level *number*
Does not descend below *number* levels.

number is a decimal number, optionally preceded by a plus or minus sign. If a number is given without a sign, **find** tests for equality; a plus sign implies "greater than" or "older than," and a minus sign implies "less than" or "newer than".

–links *number*
Matches if there are *number* links to the file.

number is a decimal number, optionally preceded by a plus or minus sign. If a number is given without a sign, **find** tests for equality; a plus sign implies "greater than" or "older than," and a minus sign implies "less than" or "newer than".

–mtime *number*
Matches if someone has modified the file exactly *number* days ago.

number is a decimal number, optionally preceded by a plus or minus sign. If a number is given without a sign, **find** tests for equality; a plus sign implies "greater than" or "older than," and a minus sign implies "less than" or "newer than".

–name *pattern*
Compares the current file name with *pattern*. If there is no match, the expression fails. The pattern uses the same syntax as file name generation (see **sh**). It matches as many trailing path name components as specified in *pattern*. Slashes in the pattern are matched explicitly.

–ncpio *cpio-file*
Writes the file found to the target file *cpio-file* in **cpio –c** format. This is equivalent to:

```
find ... | cpio -oc >cpio-file
```

This primary matches if the command succeeds.

–newer *file*
Compares the modification date of the found file with that of the *file* given. This matches if someone has modified the found file more recently than *file*.

–nogroup
Matches if no defined group owns the file.

–none Indicates that some action was taken; thus **find** does not invoke the default **–print** action. If present, this primary always matches.

–nouser
Matches if no defined user owns the file.

–ok*command***;**
Is similar to **–exec**, but before **find** executes the command, it displays the command to confirm that you want to go ahead. **find** executes the command line only if your input matches the expression for "yes" (yes and no expressions are defined in **LC_MESSAGES**). If you type the expression for "no", the primary does not match. You must delimit the terminal semicolon with white space.

Rule: The semicolon is a shell metacharacter. To use it in *expression*, you must quote it.

–perm[-] *mask*
By default, matches if the permissions on file are identical to the ones given in *mask*. You can specify *mask* in octal or in symbolic mode (see **chmod**). If you use symbolic mode, **find** assumes that you begin with no bits set in *mask*, and that the symbolic mode is a recipe for turning the bits you want on and off. A leading minus sign (-) is special. It means that a file matches if at least all the bits in *mask* are set. As a result, with symbolic mode, you cannot use a *mask* value that begins with a minus sign (-).

If you use octal mode, **find** uses only the bottom 12 bits of *mask*. With an initial minus sign (-), **find** again matches only if at least all the limits in *mask* are set in the file permissions lists.

–print Displays the current file name. This primary always matches.

–prune
Stops searching deeper into the tree at this point. If present, this primary always matches. **–prune** has no effect if **–depth** is also specified.

–seclabel *pattern*
Compares the file's security label with *pattern*. If there is no match, the expression fails. The pattern uses the same syntax as file name generation (see "File name generation" on page 622).

–size *number***[c]**
Matches if the size of the file is *number* blocks long, where a block is 512 bytes. If you include the suffix *c*, the file size is *number* bytes.

number is a decimal number, optionally preceded by a plus or minus sign. If a number is given without a sign, **find** tests for equality. A plus sign implies "greater than" or "older than" while a minus sign implies "less than" or "newer than".

–type *c*
Matches if the type of the file is the same as the type given by the character *c*. Possible values of the character are:

b	Block special file (not supported for z/OS UNIX System Services)
c	Character special file
d	Directory
f	Regular file
l	Symbolic link
n	Network file
p	FIFO (named pipe)
s	Socket

–user *name*
Matches if the owner of the file is *name*. *name* can also be a user ID number.

–xdev Does not cross device boundaries from the root of the tree search. If present, this primary always matches.

Examples

1. To find all files with a suffix of **.c** that have the audit mode set to **rwx** (read, write, execute), issue:

   ```
   find / –name "*.c" –audit rwx=sf
   ```

   The quotation marks are required around the "*.c" if you do not want the shell to expand this value to all files with a suffix of **.c** from within the current directory.
2. To find all files with a suffix of **.c** and audit mode bits set to 777 (**rwx**), issue:

   ```
   find / –name "*.c" –audit 777
   ```
3. To find all files with the extensions **.c** and **.h**, starting at the current point in the directory hierarchy:

   ```
   find . –name "*.[ch]"
   ```
4. To find all files that have the extension **.Z** and that have not been accessed in the last three days:

   ```
   find . –name "*.Z" –mtime +3
   ```
5. To find all files that have a security label of OS390:

   ```
   find . -seclabel OS390
   ```
6. To find all files that have a security label starting with OS390:

   ```
   find . -seclabel "OS390*"
   ```

7. To find all files that have no security labels:
   ```
   find . ! -seclabel "*"
   ```
8. To find all files and directories starting at the current directory point, with an extended ACL user entry for user Billy for any ACL (access, file default, or directory default), issue:
   ```
   find  .  -acl_user Billy
   ```
   or
   ```
   find  .  -acl_entry user:Billy -o -acl_entry d:u:Billy -o -acl_entry f:u:Billy
   ```
9. To find all files and directories (starting from the current directory) that have more than 10 extended ACL entries for any of the ACL types, issue:
   ```
   find . -acl_count +10
   ```
10. To find all files and directories containing access ACLs which have an extended ACL entry for user Averi, starting from the current user's home directory:
    ```
    find ~ -acl_entry user:Averi
    ```
11. To find all directories whose file default ACLs have a group entry for Lakers, starting at the current point in the directory hierarchy:
    ```
    find . -acl_entry fdefault:group:Lakers
    ```
12. To find all files for user Marc (in other words, all the files that Marc owns), starting from Marc's home directory:
    ```
    find /u/marc -user marc
    ```
13. To find all directories (starting from current directory) which have file default ACLs:
    ```
    find . -acl f
    ```
14. To find all directories whose file default or directory default ACLs have a group entry for Lakers, starting at the current point in the directory hierarchy:
    ```
    find . -acl_entry fdefault:group:Lakers -o -acl_entry default:group:Lakers
    ```

Localization

find uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Not enough memory
- Incorrect character specified after **–type**
- Inability to get information about a file for **–newer**
- Incorrect permissions for **–perm**
- Inability to open a file for the **–cpio** option
- Unknown user or group name
- Unable to access the **PATH** variable
- Cannot run a command specified for **–exec** or **–ok**

- Syntax error
- Stack overflow caused by an expression that is too complex

2 Failure due to one of the following:
- Incorrect command-line option
- Not enough arguments on the command line
- Missing option
- Argument list that is not properly ended

Messages

Possible error messages include:

bad number specification in *string*
You specified an option that takes a numeric value (for example, **–atime**, **–ctime**) but did not specify a valid number after the option.

cannot stat file *name* **for -newer**
You used a **–newer** option to compare one file with another; however, **find** could not obtain a modification time for the specified file. Typically, the file does not exist or you do not have appropriate permissions to obtain this information.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Most UNIX systems do not have a default action of **–print**. Therefore, they do not need the **–none** option. The **–a** operator is not documented on many UNIX systems.

The following primaries are extensions of the POSIX standard: **–aaudit**, **–acl**, **–acl_count**, **–acl_entry**, **–acl_group**, **–acl_nogroup–acl_nouser**, **–acl_user**, **–audit**, **–audit**, **–cpio**, **–follow**, **–level**, **–ncpio**, **–none**

The **aaudit** and **audit** options are unique to the z/OS shell.

Related information

chaudit, **chmod**, **cpio**, **sh**

filecache — Manage file caches

The **filecache** command manages the kernel file cache for files that are only read.

While it continues to be shipped in **/usr/sbin/filecache**, the **filecache** command is not operational and will not return any cached data.

fold — Break lines into shorter lines

Format

fold [**–bs**] [**–w** *width*] [**–***width*] [*file*...]

Description

fold reads the standard input (stdin) or each file, if you specify any. Each input line is broken into lines no longer than *width* characters. If you do not specify *width*

on the command line, the default line length is 80. The output is sent to the standard output (stdout).

Options

–b Specifies *width* in bytes rather than in column positions; that is, **fold** does not interpret tab, backspace, and carriage return characters. If the last byte specified by *width* is part of a double-byte character, **fold** does not break the character. Instead, the line is broken before the double-byte character.

–s Breaks each line at the last blank within *width* column positions. If there is no blank that meets the requirement, **fold** breaks the line normally.

–w *width*
Specifies a maximum line length of *width* characters.

–width Is identical in effect to **–w** *width*.

Localization

fold uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion
1 Failure because the input file could not be opened
2 Invalid command-line option or a missing *width* argument

Portability

POSIX.2, 4.2BSD.

The *–width* option is an extension of the POSIX standard.

Related information

pr

functions — Display or assign attributes to functions

Format

functions [***tux**][*name ...*]

Note: * indicates a **+** or **–** character.

Description

functions is an alias for **typeset –f**.

See "typeset — Assign attributes and values to variables" on page 781 for more information.

Related information

typeset, **sh**

---

fuser — List process IDs of processes with open files

Format

fuser [**–cfku**] *file ...*

Description

The **fuser** command writes to standard output the process IDs of all processes running on the local system that have one or more named files open. *file* is the path name of the file for which information is to be reported, or, if the **–c** options is used, the path name of a file on the file system for which information is to be reported. It also writes additional information to standard error, such as the user name of the process and a character indicating how the process is using the file.

fuser only reports on local processes, not remote ones.It only reports information for processes that the user has appropriate privileges to access. Only a superuser can access information for processes that belong to another user.

Options

–c Reports on all open files within the file system that the specified file is a member of

–f Reports on only the named files. This is the default.

–k Sends the SIGKILL signal to each local process (with the exception of the **fuser** process and parent processes of **fuser**). Only a superuser can terminate a process that belongs to another user. This option is a z/OS extension.

–u Writes to standard error the user name associated with each process ID written to standard output.

Usage notes

fuser writes the process ID for each process to standard output. **fuser** also writes the following to standard error:

- The path name of each file specified on the command line.
- An indicator of how the process is using this file (written after the process ID):
  –c The process is using the file as its current directory.
  –r The process is using the file as its root directory.

  If no character follows the PID, this means that the process has the file open.
- When the **–u** option is specified, **fuser** writes the user name corresponding to the process' real user ID.

Examples

1. To list the process numbers of local processes using the **/etc/magic** file, enter:

   ```
   fuser /etc/magic
   ```

   which will give you the following output:

   ```
   /etc/magic:  67109274 144
   ```

2. To display the user names associated with the processes accessing the file **/etc/magic**:

   ```
   fuser -u /etc/magic
   ```

   Your output would be:

   ```
   /etc/magic:  67109274(Steve) 144(Fred)
   ```

3. To terminate all of the processes using a given file system, enter either the mount point name or the name of a file in that file system:

   ```
   fuser -ku /u/home
   ```

   or

   ```
   fuser -kuc /u/home/code
   ```

   Your output would look like:

   ```
   /u/home/code:  111111c(Steve) 222222r(Erin) 333333(Garth)
   444444c(Steve) 555555r(Renata) 66666c(Angie)
   ```

   This command lists the process number and user name, and then sends a kill signal to each process that is using the **/u/home** file system. Only a superuser can terminate processes that belong to another user. You might want to use this command if you are trying to unmount the **/u/home** file system and a process that is accessing the file system prevents this.

Exit values

0 Successful completion
1 An error occurred

Related information

kill, **ps**

---

gencat — Create or modify message catalogs

Format

gencat *CatalogFile MessageFile ...*

Description

gencat merges the message text source files *MessageFile* (typically ***.msg**) into a formatted message catalog *CatalogFile* (typically ***.cat**). The file *CatalogFile* is created if it does not already exist. If *CatalogFile* does exist, its messages are modified according to the directives in the *MessageFiles*. If set and message numbers are the same, the new message text defined in *MessageFile* replaces the message text defined in *CatalogFile*.

You can specify any number of *MessageFiles*. **gencat** processes the *MessageFiles* one after another, in the sequence specified. Each successive *MessageFile* modifies the *CatalogFile*.

If **–** is specified for *CatalogFile*, standard output (stdout) is used. If **–** is specified for *MessageFile*, standard input (stdin) is used.

gencat does not accept symbolic message identifiers. You must use **mkcatdefs** if you want to use symbolic message identifiers.

Extended description

The format of a message text source file is defined as follows. All characters must be encoded as single-byte characters except where noted. The fields of a message text source line are separated by a single blank character. Any other blank characters are considered as being a part of the subsequent field.

$set *n comment*
: Specifies the set identifier of the following messages until the next **$set** or end of file appears. The *n* denotes the set identifier, which is defined as a number in the range 1–NL_SETMAX. Set identifiers must be in ascending order within a single source file, but need not be contiguous. Any string following the set identifier is treated as a comment. If no **$set** directive is specified in a message text source file, all messages are located in default message set NL_SETD.

$delset *n comment*
: Deletes message set *n* from an existing message catalog. The *n* denotes the set number, 1–NL_SETMAX. Any string following the set number is treated as a comment.

$ *comment*
: A line beginning with **$** followed by a blank character is treated as a comment.

m message-text
: The *m* denotes the message identifier, which is defined as a number in the range 1–NL_MSGMAX. Message identifiers must be in ascending order within a single set, but need not be contiguous. The length of *message-text* must be in the range –NL_TEXTMAX. The message text is stored in the message catalog with the set identifier specified by the last **$set** directive, and with message identifier *m*. If the message text is empty, and a blank character field separator is present, an empty string is stored in the message catalog. If a message source line has a message number, but not a field separator or message text, the existing message with that number (if any) is deleted from the catalog. The message text can contain double-byte characters.

$quote *c*
: Specifies an optional quotation mark character *c*, which can be used to surround *message-text* so trailing spaces or null (empty) messages are visible in a message source line. By default, or if an empty **$quote** directive is supplied, no quoting of *message-text* is recognized. The quotation mark character can be a double-byte character.

$timestamp
: Specifies a time stamp that can be used to identity the subsequent **.cat** file as having come from this file. The timestamp can be up to 20 characters long and can be any format you want. Typically it follows this format:

```
$timestamp 1994 137 19:09 UTC
```

  The **mkcatdefs** command automatically generates a timestamp in the file it creates for input to **gencat.**

Empty lines in a message text source file are ignored. Lines starting with any character other than those defined are considered invalid.

Text strings can contain the special characters and escape sequences defined in the following table:

Description	Sequence
Backspace	**\b**
backslash	\
Carriage-return	**\r**
Double quotation mark	\"
Form-feed	**\f**
Horizontal tab	**\t**
Newline	**\n**
Octal bit pattern	**\ddd**
Vertical tab	**\v**

These sequences must be encoded as single-byte characters.

The escape sequence **\ddd** consists of backslash followed by one, two, or three octal digits, which are taken to specify the value of the desired character. If the character following a backslash is not one of those specified, the backslash is ignored.

A backslash (\) followed by a newline character is also used to continue a string on the following line. Thus the following two lines describe a single message string:

```
1 This line continues \
to the next line
```

which is equivalent to:

```
1 This line continues to the next line
```

Portability of message catalogs

gencat works with the z/OS XL C/C++ runtime library function **catgets()** to correctly display message text in the locale that the C program using **catgets()** is running in. **gencat** adds information to the *CatalogFile* about the code set that was in effect when **gencat** processed the *CatalogFile*. **gencat** should be run with the same locale that the recipients of the messages will be using. This should be the same locale that was used to create the message text in **MessageFile**.

Message catalogs produced by **gencat** are binary-encoded, meaning that their portability cannot be guaranteed between systems. Thus, just as C programs need to be recompiled, so message catalogs must be recreated via **gencat** when moved to another system.

Examples

To generate a **test.cat** catalog from the source file **test.msg**, enter:

```
gencat test.cat test.msg
```

Localization

gencat uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion
1 An error occurred

Portability

X/Open Portability Guide.

getconf — Get configuration values

Format

getconf –a
getconf *system_var*
getconf [**–a**] *path_var pathname*

Description

getconf writes the value of a configuration variable to the standard output (stdout). You can specify the configuration variable using one of forms listed in the Format section. If you use the first form, **getconf** writes the value of the variable *system_var*. If you use the second form, **getconf** writes the value of the variable *path_var* for the path name given by *pathname*. The **–a** option prompts **getconf** to display all current configuration variables, and their values, to **stdout**.

getconf writes numeric values in decimal format and nonnumeric values as simple strings. If the value is not defined, **getconf** writes the string `undefined` to stdout.

Options

–a Writes out all the configuration variables for the current system, and their values, to stdout. Path variables are written based on a path name of dot (**.**).

Configuration variables

You can use the second form of **getconf** to find the value of the following POSIX.1-1990 standard configuration variables for the specified path name:

LINK_MAX
Specifies the maximum number of links that this file can have.

MAX_CANON
Specifies the maximum number of bytes in the workstation's canonical input queue (before line editing).

MAX_INPUT
Specifies the space available in the workstation's input queue.

NAME_MAX
Specifies the largest filename size.

PATH Specifies the standard PATH setting.

_CS_PATH
Specifies the standard PATH setting.

PATH_MAX
Specifies the maximum number of bytes in a path name.

PIPE_BUF
Specifies the largest atomic write to a pipe.

_POSIX_CHOWN_RESTRICTED
Specifies the restrictions that apply to file ownership changes.

_POSIX_NO_TRUNC
If set, it is an error for any path name component to be longer than NAME_MAX bytes.

_POSIX_VDISABLE
Specifies that processes are allowed to disable ending special characters.

You can use the first form of **getconf** to find the value of the following POSIX.1-1990 standard configuration variables:

ARG_MAX
Specifies the maximum length of arguments for running a program, including environment data.

CHILD_MAX
Specifies the maximum number of simultaneous processes allowed per real user.

CLK_TCK
Specifies the number of intervals per second in the machine clock.

NGROUPS_MAX
Specifies the number of simultaneous group IDs per process.

OPEN_MAX
Specifies the maximum number of open files at any time per process.

STREAM_MAX
Specifies the number of streams that one process can have open at one time.

TZNAME_MAX
Specifies the maximum number of bytes supported for the name of a time zone (not of the **TZ** variable).

_POSIX_ARG_MAX
Specifies the minimum conforming value for ARG_MAX.

_POSIX_CHILD_MAX
Specifies the minimum conforming value for CHILD_MAX.

_POSIX_JOB_CONTROL
Specifies the POSIX job control supported.

_POSIX_LINK_MAX
Specifies the minimum conforming value for LINK_MAX.

_POSIX_MAX_CANON
Specifies the minimum conforming value for MAX_CANON.

_POSIX_MAX_INPUT
Specifies the minimum conforming value for MAX_INPUT.

_POSIX_NAME_MAX
Specifies the minimum conforming value for NAME_MAX.

_POSIX_NGROUPS_MAX
Specifies the minimum conforming value for NGROUPS_MAX.

_POSIX_OPEN_MAX
Specifies the minimum conforming value for OPEN_MAX.

_POSIX_PATH_MAX
Specifies the minimum conforming value for PATH_MAX.

_POSIX_PIPE_BUF
Specifies the minimum conforming value for PIPE_BUF.

_POSIX_SAVED_IDS
Specifies that processes have saved set-user-ID and saved set-group-ID bits set.

_POSIX_SSIZE_MAX
Specifies the value that can be stored in an object of type *ssize_t*.

_POSIX_STREAM_MAX
Specifies the minimum conforming value for STREAM_MAX.

_POSIX_TZNAME_MAX
Specifies the minimum conforming value for TZNAME_MAX.

_POSIX_VERSION
Specifies the version of POSIX adhered to in this release.

You can use the first form of **getconf** to find the value of the POSIX.2 standard configuration variables:

BC_BASE_MAX
Specifies the maximum *ibase* and *obase* values for the **bc** command.

BC_DIM_MAX
Specifies the maximum number of elements permitted in a **bc** array.

BC_SCALE_MAX
Specifies the maximum *scale* size allowed in **bc**.

BC_STRING_MAX
Specifies the maximum number of characters in a string in **bc**.

COLL_WEIGHTS_MAX
Specifies the maximum number of weights assignable to an entry of the LC_COLLATE **order** keyword.

EXPR_NEST_MAX
Specifies the maximum number of expressions that you can nest inside parentheses in an expression evaluated by **expr**.

LINE_MAX
Specifies the maximum number of bytes that a utility can accept as an input line (either from the standard input or a text file) when the utility takes text files as input. This number includes the trailing <newline>.

RE_DUP_MAX
Specifies the maximum number of repeated occurrences of a regular expression when using the interval notation \{*m*,*n*\}.

See Appendix C, “Regular expressions (regexp),” on page 971 for more information.

POSIX2_C_BIND
Indicates if the system supports the C Language Bindings Option.

POSIX2_C_DEV
Indicates if the system supports the C Language Development Utilities Option.

POSIX2_FORT_DEV
Indicates if the system supports the FORTRAN Development Utilities Option.

POSIX2_FORT_RUN
Indicates if the system supports the FORTRAN Runtime Utilities Option.

POSIX2_LOCALEDEF
Indicates if the system supports the creation of locales.

POSIX2_SW_DEV
Indicates if the system supports the Software Development Utilities Option.

POSIX2_CHAR_TERM
Indicates if the system supports at least one terminal type capable of all operations necessary for the User Portability Utilities Option. This parameter name is correct only on if POSIX2_UPE is on.

POSIX2_UPE
Indicates if the system supports the User Portability Utilities Option.

POSIX2_VERSION
Specifies the version of POSIX.2 adhered to in this release.

POSIX2_BC_BASE_MAX
Specifies the minimum conforming value for BC_BASE_MAX.

POSIX2_BC_DIM_MAX
Specifies the minimum conforming value for BC_DIM_MAX.

POSIX2_BC_SCALE_MAX
Specifies the minimum conforming value for BC_SCALE_MAX.

POSIX2_BC_STRING_MAX
Specifies the minimum conforming value for BC_STRING_MAX.

POSIX2_COLL_WEIGHTS_MAX
Specifies the minimum conforming value for EQUIV_CLASS_MAX.

POSIX2_EXPR_NEST_MAX
Specifies the minimum conforming value for EXPR_NEST_MAX.

POSIX2_LINE_MAX
Specifies the minimum conforming value for LINE_MAX.

POSIX2_RE_DUP_MAX
Specifies the minimum conforming value for RE_DUP_MAX.

You can use the third form of **getconf** to find the value of the POSIX.2 standard configuration variables:

_ACL Specifies that access control lists (ACLs) are supported by the security product and file system.

*_PC_ACL*_**ENTRIES_MAX**
Specifies the maximum number of extended ACL entries that can be placed in an access control list for the specified file.

This implementation of **getconf** also supports the following non-POSIX-conforming name:

_CS_SHELL
Specifies the default shell (command interpreter).

_PC_ACL
Security product supports access control lists (ACLs).

_PC_ACL_ENTRIES_MAX
Maximum number of entries that can be placed in an access control list for a specified file.

Examples

This example uses **getconf** to find the minimum conforming value for PATH_MAX, which is contained in the variable _POSIX_PATH_MAX. If you issue

```
getconf _POSIX_PATH_MAX
```

getconf displays

```
255
```

Localization

getconf uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 The specified *parameter_name* was valid and **getconf** displayed its value successfully.
>0 An error occurred.

Portability

POSIX.2, X/Open Portability Guide.

_CS_SHELL is an extension of the POSIX standard. Some symbols are supported only on systems that support POSIX.2.

Related information

bc, **expr**, **sh**

See Appendix C, "Regular expressions (regexp)," on page 971 for more information about **regexp**.

getfacl — Display owner, group, and access control list (ACL) entries

Format

getfacl [**–acdfhmoqs**] [**-e** *user*] *file ...*

Description

getfacl displays the comment header, base ACL (access control list) entries, and extended ACL entries, if there are any, for each file that is specified. It also resolves symbolic links. You can specify whether to display access, file default, or directory default. You can also change the default display format. The output can be used as input to **setfacl**.

A description of access control list entries can be found in *z/OS UNIX System Services Planning*.

Options

–a Displays the access ACL entries. This is the default if **-a**, **-d**, or **-f** is not specified.

–c Displays each ACL entry, using commas to separate the ACL entries instead of newlines, which is the default. Does not display the header.

–d Displays the directory default ACL entries. If the file is not a directory, a warning is issued.

–e *user*
Displays only the ACL entries for the specified types of access control lists (**-a**, **-d**, **-f**) which affects the specified user's access. If users look at the output, they may be able to determine why the access is granted or denied. The user can be an UID or user name. The output includes the user's entry, if it exists, as well as entries for any group to which the user is connected.

–f Displays the file default ACL entries. If the file is not a directory, a warning is issued.

–h Does not resolve the symbolic link. (ACLs are not allowed on symbolic links, so the file will not have anything displayed.)

–m Specifies that the comment header (the first three lines of each file's output) is not to be displayed.

–o Displays only the extended ACL entries. Does not display the base ACL entries.

–q Quiet mode. Suppresses the warning messages and gives a successful return code if there are no other errors.

–s Skips files that only have the base ACL entries (such as owner, group, other). Only files that have the extended ACL entries are displayed.

Examples

1. To display access ACL information for file *file*, issue:

   ```
   getfacl file
   ```

   Where the following is a sample of the output:

   ```
   #file: file
   #owner:  WELLIE
   #group:  SYS
   user::rwx   <=== The owner's permission bit setting
   group::rwx  <=== The group's permission bit setting
   other::rw-  <=== Permission bit setting if neither user nor group
   user:  WELLIE2: rw-
   group:SYS1:rwx
   ```

2. To display access, file default, and directory default ACL information for directory *directory*, issue:

   ```
   getfacl -a -f -d directory
   ```

   Where the following is a sample of the output:

   ```
   #file: file
   #owner:  WELLIE
   #group:  SYS
   user::rwx
   group::rwx
   other::rw-
   user:  WELLIE2: rw-
   group:SYS1:rwx
   fdefault:user:  WELLIE2: rw-
   fdefault:group:SYS1:rwx
   default:user:WELLIE4:---
   ```

3. To copy the ACL entries from file *foo* such that the file *bar* will have the same ACL entries:

   ```
   getfacl foo | setfacl -S - bar
   ```

Localization

getfacl uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion
>0 Failure

getfacl displays the ACL entries in the following order: access, file default, and directory default. Errors will occur in the following situations:
- If a file is not a directory and the **-d** or **-f** option was used, you will get a warning and **getfacl** will continue to the next file.
- If the user does not have access to a file, you will get a warning and **getfacl** will continue to the next file.

Portability

An approved POSIX standard does not exist for **getfacl**.

Related information

find, **ls**, **setfacl**

getopts — Parse utility options

Format

getopts *opstring name* [*arg ...*]

Description

getopts obtains options and their arguments from a list of parameters that follows the standard POSIX.2POSIX.2 option syntax (that is, single letters preceded by a hyphen (–) and possibly followed by an argument value). Typically, shell scripts use **getopts** to parse arguments passed to them. When you specify arguments with the *arg* argument on the **getopts** command line, **getopts** parses those arguments instead of the script command-line arguments (see **set**).

Options

opstring
: Gives all the option letters that the script recognizes. For example, if the script recognizes **–a**, **–f**, and **–s**, *opstring* is `afs`. If you want an option letter to be followed by an argument value or group of values, put a colon after the letter, as in `a:fs`. This indicates that getopts expects the **–a** option to have the form **–a** *value*. Normally one or more blanks separate *value* from the option letter; however, **getopts** also handles values that follow the letter immediately, as in **–a***value*. *opstring* cannot contain a question mark (?) character.

name
: Specifies the name of a shell variable. Each time you invoke **getopts**, it obtains the next option from the positional parameters and places the option letter in the shell variable *name*.

  getopts places a question mark (?) in *name* if it finds an option that does not appear in *opstring*, or if an option *value* is missing.

arg ...
: Each option on the script command line has a numeric *index*. The first option found has an index of 1, the second has an index of 2, and so on. When **getopts** obtains an option from the script command line, it stores the index of the script in the shell variable **OPTIND**.

  When an option letter has a following argument (indicated with a **:** in *opstring*), **getopts** stores the argument as a string in the shell variable **OPTARG**. If an option doesn't take an argument, or if **getopts** expects an argument but doesn't find one, **getopts** unsets **OPTARG**.

  When **getopts** reaches the end of the options, it exits with a status value of 1. It also sets *name* to the character **?** and sets **OPTIND** to the index of the first argument after the options. **getopts** recognizes the end of the options by any of the following situations:
  - Finding an argument that doesn't start with **–**
  - Finding the special argument **—**, marking the end of options
  - Encountering an error (for example, an unrecognized option letter)

  OPTIND and **OPTARG** are local to the shell script. If you want to export them, you must do so explicitly. If the script invoking **getopts** sets **OPTIND** to 1, it can call **getopts** again with a new set of parameters, either the current positional parameters or new *arg* values.

  By default, **getopts** issues an error message if it finds an unrecognized option or some other error. If you do not want such messages printed, specify a colon as the first character in *opstring*.

Examples

Following is an example of using **getopts** in a shell script:

```
# Example illustrating use of getopts builtin. This
# shell script would implement the paste command,
# using getopts to process options, if the underlying
# functionality was embedded in hypothetical utilities
# hpaste and vpaste, which perform horizontal and
# vertical pasting respectively.
#
paste=vpaste    # default is vertical pasting
seplist=" " # default separator is tab

while getopts d:s o
do      case "$o" in
        d)      seplist="$OPTARG";;
        s)      paste=hpaste;;
        [?])  print >&2 "Usage: $0 [-s] [-d seplist] file ..."
                exit 1;;
        esac
done
shift $OPTIND-1

# perform actual paste command
$paste -d "$seplist" "$@"
```

Environment variables

getopts uses the following environment variables:

OPTARG
Stores the value of the option argument found by **getopts**.

OPTIND
Contains the index of the next argument to be processed.

Localization

getopts uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**

See Appendix F, “Localization,” on page 997 for more information.

Usage notes

getopts is a built-in shell command.

Exit values

0 **getopts** found a script command line with the form of an option. This happens whether or not it recognizes the option.

1 **getopts** reached the end of the options, or an error occurred.

2 Failure because of an incorrect command-line option

Portability

POSIX.2, X/Open Portability Guide.

On UNIX systems, **getopts** is built in both the KornShell and Bourne shell.

Related information

sh

---

grep — Search a file for a specified pattern

Format

grep [**–E** | **–F**] [**–Bbcilnqsvx**] [**-W** *option*[,*option*]...] [**–e** *pattern*] ... [**–f** *patternfile*] ... [*pattern*] [*file ...file ...*]

egrep [**–Bbcilnqsvx**] [**-W** *option*[,*option*]...] [**–e** *pattern*] ... [**–f** *patternfile*] ... [*pattern*] [*file ...file ...*]

fgrep [**–Bbcilnqsvx**] [**-W** *option*[,*option*]...] [**–e** *pattern*] ... [**–f** *patternfile*] ... [*pattern*] [*file ...file ...*]

Description

fgrep searches files for one or more *pattern* arguments. It does not use regular expressions; instead, it uses fixed string comparisons to find matching lines of text in the input.

egrep works in a similar way, but uses extended regular expression matching. (For information about regular expression matching, see Appendix C, "Regular expressions (regexp)," on page 971.) If you include special characters in patterns typed on the command line, escape them by enclosing them in apostrophes to prevent inadvertent misinterpretation by the shell or command interpreter. To match a character that is special to **egrep**, put a backslash (\) in front of the character. It is usually simpler to use **fgrep** when you do not need special pattern matching.

grep is a combination of **fgrep** and **egrep**. If you do not specify either **–E** or **–F**, **grep** behaves like **egrep**, but matches basic regular expressions instead of extended ones. You can specify a pattern to search with either the **–e** or **–f** option. If you do not specify either option, **grep** (or **egrep** or **fgrep**) takes the first non-option argument as the pattern for which to search. If **grep** finds a line that matches a pattern, it displays the entire line. If you specify multiple input files, the name of the current file precedes each output line.

If you do not specify any files, the command reads from the standard input (stdin).

Options

grep accepts all the following options while **egrep** and **fgrep** accept all but the **–E** and **–F** options.

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–b Precedes each matched line with its file block number.

–c Displays only a count of the number of matched lines and not the lines themselves.

–E Matches using extended regular expressions (causes **grep** to behave like **egrep**).

–e *pattern*
Specifies one or more patterns separated by newlines for which **grep** is to search.

You can indicate each pattern with a separate **–e** option character, or with newlines within pattern. For example, the following two commands are equivalent:

```
grep –e pattern_one –epattern_two file
grep –e 'pattern_one
pattern_two' file
```

–F Matches using fixed strings (causes **grep** to behave like **fgrep**).

–f *patternfile*
Reads one or more patterns from *patternfile*. Patterns in *patternfile* are separated by newlines.

–i Ignores the case of the strings being matched.

–l Lists only the filenames that contain the matching lines.

–n Precedes each matched line with its fileline number.

–q Suppresses output and returns the appropriate return code.

–s Suppresses the display of any error messages for nonexistent or unreadable files.

–v Complements the sense of the match—that is, displays all lines *not* matching a pattern.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the

system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

–x Requires a string to match an entire line.

Examples

1. To display every line mentioning an astrological element:
   ```
   egrep "earth|air|fire|water" astro.log
   ```
2. To display every line in a text file containing the string ".com":
   ```
   fgrep '.com' myTextFile
   ```
3. To display every line in a text file containing the string ".com" or ".org":
   ```
   egrep '\.com|\.org' myTextFile
   ```
   In this example, the period (.) is escaped by the \ character to ensure the period is not treated as a special character. Otherwise, any string with the letters "com" or "org" preceded by any character would match (for example, lines containing the strings "become" or "forge").
4. To display every line in a text file starting with "Hello" or "hello":
   ```
   grep '^[Hh]ello' myTextFile
   ```
5. To display every line in a text file containing ASCII characters that does not start with the # character, assuming that:
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are displaying an untagged public text file or a read-only text file):

   ```
   grep -W filecodeset=ISO8859-1,pgmcodeset=IBM-1047 -v '^#' myAsciiFile
   ```
6. To display every line in a text file containing EBCDIC characters that has the string "path", regardless of case and assuming that automatic conversion has been enabled but the text file is incorrectly tagged as UTF-8:
   ```
   grep -Bi 'path' myMisTaggedFile
   ```
   In this example, lines containing strings such as "path", "Path", "PATH", and "pAtH" would match.

Localization

grep uses the following localization environment variables:
- **LANG**

- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

grep uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 At least one match for *pattern* was found.

1 No matches for *pattern* were found.

2 Failure due to any of the following:
- The **–e** option was missing *pattern*.
- The **–f** option was missing *patternfile*.
- Out of memory for input or to hold a pattern.
- *patternfile* could not be opened.
- Incorrect regular expression.
- Incorrect command-line option.
- The command line had too few arguments.
- The input file could not be opened.
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

If the program fails to open one input file, it tries to go on to look at any remaining input files, but it returns 2 even if it succeeds in finding matches in other input files.

Messages

Possible error messages include:

input lines truncated—result questionable
One or more input lines were longer than **grep** could handle; the line has been truncated or split into two lines. Shorten the line or lines, if possible. This message does not affect the exit status.

out of space for pattern *string*
grep did not have enough memory available to store the code needed to work with the given pattern (regular expression). The usual cause is that the pattern is very complex. Make the pattern simpler, or try to release memory so that **grep** has more space to work with.

Limits

The longest input record (line) is restricted by the system variable LINE_MAX. It is always at least 2048 bytes. **fgrep** may be able to handle lines longer than LINE_MAX. Longer lines are treated as two or more records.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Only the **grep** command is part of th POSIX and X/Open standards. The **egrep** and **fgrep** commands are extensions. The **–B**, **–b**, and **–W** options are extensions of the POSIX standard.

Related information

ed, **find**

See Appendix C, "Regular expressions (regexp)," on page 971 for more information about **regexp**.

hash — Create a tracked alias

Format

hash [*name ...*]
hash -r

Description

hash creates one or more tracked aliases. Each *name* on the command line becomes an alias that is resolved to its full path name; thus the shell avoids searching the PATH directories for the command whenever you issue it. A tracked alias is assigned its full path name the first time that the alias is used. It is reassigned a path name the first time that it is used after the variable PATH is changed or the shell command **cd** is used.

hash is a built-in alias defined with

```
alias hash='alias -t'
```

If you specify **hash** without any arguments on the command line, **hash** displays the current list of tracked aliases.

Options

–r Removes all current tracked aliases.

Usage notes

hash is a built-in shell command.

Localization

hash uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**

- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure because of an incorrect command-line option

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

alias, **sh**

---

head — Display the first part of a file

Format

head [**–B**] [**-W** *option*[,*option*]...] [**–b** | **–c** | **–k** | **–l** | **–m** | **–n** *num*] [*file ...file ...*]
head [**–B**] [**-W** *option*[,*option*]...] [*–num*] [*file ...file ...*]

Description

By default, **head** displays the first 10 lines of each file given on the command line. If you do not specify *file*, **head** reads standard input (stdin).

Options

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–b *num*
Displays the first *num* blocks (a block is 512 bytes) of each file.

–c *num*
Displays the first *num* bytes of each file.

–k *num*
Displays the first *num* kilobytes (1024 bytes) of each file.

–l *num*
Displays the first *num* lines of each file.

–m *num*
Displays the first *num* megabytes of each file.

–n *num*
Displays the first *num* lines of each file.

–num Displays the first *num* lines of each file.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*.

codeset can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*

Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

Examples

1. To display the first 10 lines of a text file to the standard output (stdout):

   ```
   head myTextFile
   ```

2. To display the first 400 bytes of a text file to the standard output (stdout):

   ```
   head -c 400 myTextFile
   ```

3. To display the first 50 lines of a text file containing UTF-8 characters to the standard output (stdout), assuming that:
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and

- You cannot alter the tag (for example, you are displaying an untagged public text file or a read-only text file):

```
head -n 50 -W filecodeset=UTF-8,pgmcodeset=IBM-1047 myUtf8File
```

4. To display the first 10 lines of two text files containing EBCDIC characters to the standard output (stdout), assuming that automatic conversion has been enabled but the text files are incorrectly tagged as ASCII:

```
head -B myMisTaggedFile01 myMisTaggedFile02
```

Localization

head uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

head uses the following environment variable:

_TEXT_CONV
: Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to open an input file
- Read error on standard input (stdin)
- Write error on standard output (stdout)
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

2 Failure due to any of the following:
- Unknown command-line option
- Missing or incorrect *num* in an **–n** option

Messages

Possible error messages include:

Badly formed line or character count *num*
: The value *num*, following a **–b**, **–c**, **–k**, **–l**, **–m**, or **–n** option, was not a valid number.

Portability

POSIX.2, X/Open Portability Guide.

This program originated with Berkeley Software Distribution (BSD) and is a frequent add-on to UNIX systems.

The POSIX standard included only the **–n** *num* and **–***num* options, though it considers the latter obsolete.

Related information

cat, **sed**, **tail**

history — Display a command history list

Format

history [*first*[*last*]]

tcsh shell:

history [**-hTr**] [*n*]

history -S | **-L** | **-M** [*filename*]

history -c

Description

history is an alias for **fc –l**. Like **fc –l**, **history** displays the list of commands that have been input to an interactive shell. This command does not edit or reenter the commands. If you omit *last*, **history** displays all commands from the one indicated by *first* through to the previous command entered. If you omit both *first* and *last* with this command, the default command range is the 16 most recently entered commands.

See "fc — Process a command history list" on page 310 for more information.

For the tcsh shell, **history**, when used alone, prints the history event list. If *n* is given only the *n* most recent events are printed or saved.

Note: See "tcsh — Invoke a C shell" on page 689 for descriptions of the tcsh shell variables and commands.
The tcsh shell **history** built-in command uses the following options:

- With **-h**, the history list is printed without leading numbers.
- With **-T**, timestamps are printed also in comment form. (This can be used to produce files suitable for loading with **history -L** or **source -h**.)
- With **-r**, the order of printing is most recent first rather than oldest first.
- With **-S**, **history** saves the history list to *filename*. If the first word of the **savehist** shell variable is set to a number, at most that many lines are saved. If the second word of **savehist** is set to merge, the history list is merged with the existing history file instead of replacing it (if there is one) and sorted by time stamp. Merging is intended for an environment like the X Window System with several shells in simultaneous use. Currently it only succeeds when the shells quit one after another.
- With **-L**, the shell appends *filename*, which is presumably a history list saved by the **-S** option or the **savehist** mechanism, to the history list. **-M** is like **-L**, but the contents of *filename* are merged into the history list and sorted by timestamp. In

either case, **histfile** is used if filename is not given and **~/.history** is used if histfile is unset. **history -L** is exactly like **source -h** except that it does not require a filename.

- With **-c**, clears the history list.

tcsh login shells do the equivalent of **history -L** on startup and, if **savehist** is set, **history -S** before exiting. Because only **~/.tcshrc** is normally sourced before **~/.history**, **histfile** should be set in **~/.tcshrc** rather than **~/.login**. If **histlit** is set, the first form (**history** [**-hTr**] [*n*]) and second form (**history -S|-L|-M** [*filename*]) print and save the literal (unexpanded) form of the history list.

Related information

fc, **sh**, **tcsh**

---

iconv — Convert characters from one code set to another

Format

iconv [–cs] [–M|–T] –f *oldset* **–t** *newset* [*file ...file ...*]
iconv [–cs] [–M|–T] –F [-f *oldset*] **–t** *newset* [*file ...file ...*]
iconv –l [**–v**]

Description

iconv converts characters in *file* (or from standard input if no file is specified) from one code page set to another. The converted text is written to standard output (stdout). See *z/OS XL C/C++ Programming Guide* for more information about the code sets supported for this command.

If the input contains a character that is not valid in the source code set, **iconv** replaces it with the byte `0xff` and continues, unless the **–c** option is specified.

If the input contains a character that is not valid in the destination code set, behavior depends on the system's **iconv()** function. See *z/OS XL C/C++ Runtime Library Reference* for more information about the character used for converting incorrect characters.

Also, *z/OS XL C/C++ Programming Guide* has a list of code pages supported by the z/OS shell.

You can use **iconv** to convert single-byte data or double-byte data.

Options

–c Characters containing conversion errors are not written to the output. By default, characters not in the source character set are converted to the value `0xff` and written to the output.

–f *oldset*
Specifies the source code set of the input. *oldset* can be either the code set name that is known to the system, the numeric coded character set identifier (CCSID), or a path name to a file containing an external code set.

–F Uses the input file's coded character set (as defined in the file tag) as the source code set. If **–f** is also specified, and the *oldset* matches the file tag or

if there is no file tag code set, then *oldset* is used as the source code set. If **–F** and **–f** are specified and *oldset* does not match the file tag code set, then **iconv** fails with an error.

–l Lists supported code sets and CCSIDs. (This option was accepted in releases prior to V1R3, but was not supported.)

–M Tags a new output file as mixed. The text flag (txtflag) will be off and the value for code set will be the same as what's specified on the **–t** option.

–s Suppresses all error messages about faulty encodings.

–t *newset*
Specifies the destination code set for the output. *newset* can be either the code set name that is known to the system, the numeric coded character set identifier (CCSID), or a path name to a file containing an external code set.

–T Tag a new output file as text. The txtflag will be on and the value for code set will be the same as what's specified on the **–t** option.

–v Specifies verbose output.

For information about file tagging and code set specifications, see *z/OS UNIX System Services Planning*.

Examples

1. To convert the file **words.txt** from the IBM-1047 standard code set to the ISO 8859-1 standard code set and store it in **converted**:

   ```
   iconv –f IBM-1047 –t ISO8859-1 words.txt > converted
   ```

   Also, for the exact conversion table names, refer to *z/OS XL C/C++ Programming Guide*.
2. To convert the file **mbcsdata**, which is in code page IBM-932 (double-byte ASCII), to code page IBM-939 and put the output in a file called **dbcsdata**:

   ```
   iconv –f IBM-932 –t IBM-939 mbcsdata > dbcsdata
   ```

Localization

iconv uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Insufficient memory
- Inability to open the input file
- Incorrect or unknown option

2 Input contained a character sequence that is not permitted in the source code set

Portability

X/Open Portability Guide.

–v is an extension to the POSIX.2 standard. The **–c**, **–l**, and **–s** options are extensions to the XPG standard.

id — Return the user identity

Format

id [*user*]
id –G [**–n**] [*user*]
id –g [**–nr**] [*user*]
id –u [**–nr**] [*user*]
id –M

Description

id displays the user name and group affiliations of the user who issued the command. Specifying a *user* argument on the command line displays the same information for the given user instead of the person invoking **id**. In this case, you require appropriate permissions.

The output has the format:

```
uid=runum(username) gid=rgnum(groupname)
```

where *runum* is the user's real user ID (UID) number, *username* is the user's real user name, *rgnum* is the user's real group ID (GID) number, and *groupname* is the user's real group name.

A user's real and effective IDs may differ. In this case, there may be separate entries for effective user ID (UID) with the format:

```
euid=eunum(euname)
```

where *eunum* is the effective user ID number and *euname* is the effective user name. An entry for effective group ID has the format:

```
egid=egnum(egname)
```

where *egnum* is the effective group ID number and *egname* is the effective group name.

If a user is a member of other supplemental groups, these are listed at the end of the output, with this format:

```
groups=gnum(groupname)
```

where *gnum*is the user's supplemental group ID number and *groupname* is the user's supplemental group name.

id may also display the multilevel security label for the user's current address space. See *z/OS Planning for Multilevel Security and the Common Criteria* for more information about multilevel security.

Options

–G Displays all different group IDs (effective, real, and supplementary) as numbers separated by spaces.

–g Displays only the effective group ID number.

–M Displays the multilevel security label for the user's current address space. See *z/OS Planning for Multilevel Security and the Common Criteria* for more information about multilevel security.

–n With **–G**, **–g**, or **–u**, displays the name rather than the number.

–r With **–g** or **–u**, displays the real ID rather than the effective one.

–u Displays only the effective user ID number.

Localization

id uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_NUMERIC**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Examples

```
> id -M
SYSHIGH
```

Usage notes

See *z/OS Planning for Multilevel Security and the Common Criteria* for more information about multilevel security and seclabels.

Exit values

0 Successful completion

1 You specified an incorrect user with the **–u** option

2 Failure due to an incorrect command-line argument

Portability

POSIX.2, X/Open Portability Guide, UNIX System V.

Related information

logname

inetd daemon — Provide service management for networks

Format

inetd [**–d**] [*configuration file*]

Description

The **inetd** daemon provides service management for a network. For example, it starts the rlogind program whenever there is a remote login request from a workstation.

The rlogind program is the server for the remote login command **rlogin** commonly found on UNIX systems. It validates the remote login request and verifies the password or password phrase of the target user. It starts a z/OS shell for the user and handles translation between ASCII and EBCDIC code pages as data flows between the workstation and the shell.

When **inetd** is running and receives a request for a connection, it processes that request for the program associated with that socket. For example, if a user tries to log in from a remote system into the z/OS shell while **inetd** is running, **inetd** processes the request for connection and then issues a **fork()** and **execl()** to the rlogin program to process the rlogin request. It then goes back to monitoring for further requests for those applications that can be found as defined in the `/etc/inetd.conf` file.

Options

–d Specifies that the **inetd** daemon be started in debug mode. All debug messages are written to standard error (stderr).

configuration file
Specifies that the **inetd** daemon be started with a configuration file other than the default `/etc/inetd.conf` file.

Signals

inetd recognizes the following signals:

SIGTERM
Terminates **inetd** in an ordinary fashion and deletes `/etc/inetd.pid`. You can restart **inetd**, if you want.

SIGINT
Same as SIGTERM.

SIGHUP
Rereads the **inetd** configuration file. This can be used to start new services, or to restart services with a different port.

Other signals that normally end a process (such as SIGQUIT or SIGKILL) should not normally be sent to **inetd** because the program will not have a chance to remove `/etc/init.pid`.

Usage notes

1. Buffer sizes should only be specified if the documentation for the daemon being specified in the inetd.conf statement calls for something other than the default.
2. The configuration file is field-sensitive, but not column-sensitive. Fields must be arranged in the order shown in Table 14 on page 357. Continuation lines for an entry must begin with a space or tab. Each entry must contain all fields. The **inetd** daemon uses the configuration file entry to properly set up the environment expected by the server. Specifying an incorrect value for one or more of the parameters is likely to cause the server to fail.

Table 14. Fields in the configuration file (inetd daemon)

Field	Description
`[ip_address:]service_name`	`ip_address` is a local IP, followed by a colon. If specified, the address is used instead of INADDR_ANY or the current default. To specifically request INADDR_ANY, use "*:". If `ip_address` (or a colon) is specified, without any other entries on the line, it becomes the default for subsequent lines until a new default is specified. `service_name` is a well-known service name such as **login** or **shell**. The name and protocol specified must match one of the server names defined in `/etc/services`. For more information about `/etc/services`, see *z/OS V2R1.0 Communications Server: IP Configuration Reference*. and *z/OS Communications Server: New Function Summary*
`socket_type`	Stream or dgram
`protocol` *[,sndbuf=n][,rcvbuf=n]*	**protocol** can be **tcp** or **udp**, or (for IPv6) **tcp6** or **udp6**. **tcp4** and **udp4** can also be specified to explicitly request IPv4. The protocol is used to further qualify the service name. Both the service name and the protocol should match an entry in **/etc/services**, except that, the "4" or the "6" should not be included in the **/etc/services** entry. For more information about **/etc/services**, see *z/OS V2R1.0 Communications Server: IP Configuration Reference* and *z/OS Communications Server: New Function Summary*. Note that, if **tcp6** or **udp6** is specified, the socket will support IPv6 (that is, AF_INET6 will be used.) **sndbuf** and **rcvbuf** specify the size of the send and receive buffers. The size may be in bytes, or a "k" or "m" may be added to indicate kilobytes or megabytes respectively. *sndbug* and *rcvbuf* can be used in either order.
`wait_flag [.max]`	**Wait** or **nowait**. **Wait** indicates the daemon is single-threaded and another request will not be serviced until the first one completes. If **nowait** is specified, the **inet** daemon issues an accept when a connect request is received on a stream socket. If **wait** is specified, the **inet** daemon does not issue the accept. It is the responsibility of the server to issue the accept if this is a stream socket. **max** is the maximum number of users allowed to request service in a 60 second interval. Default is 40. If exceeded, the service's port is shut down.

`login_name`	User ID and group that the forked daemon is to execute under. **inetd** can run a program with a UID that is not 0. However, if the program that **inetd** runs needs to change the identity of the process to that of the user, then the login_name must have been defined to RACF via ADDUSER as a superuser with a UID of 0 (UID 0) and the login_name must have been defined to RACF. This will allow **inetd** to use special functions like **setgid()** and **setuid()**.
	
	If the program that will be invoked by **inetd** requires the use of special functions like **setuid()** and **seteuid()**, then it must be permitted to the BPX.DAEMON class as in the following example for login, which is a typical ADDUSER command.
	`ADDUSER rlogind omvs(uid(0) home(/)`
	
	A typical permit command is:
	`permit bpx.daemon class(facility)`
	`  id(rlogind) access(read)`
	
	How you set up security for daemons is the final determining factor. For more information, see the topic on establishing the correct level of security for daemons in *z/OS UNIX System Services Planning*.

Table 14. Fields in the configuration file (inetd daemon) (continued)

Field	Description
`server_program`	Full path name of the service. For example: `/usr/sbin/rlogind` is the full path name for the **rlogind** command.
`server_arguments`	Maximum of 20 arguments. The first argument is the server name and must be provided. Additional arguments are optional.

Related information

The **inetd** daemon creates a temporary file, `/etc/inetd.pid`, that contains the PID of the currently executing **inetd** daemon. This PID value is used to identify syslog records that originated from the **inetd** daemon process, and also to provide the PID value for commands such as **kill** that require you to specify a PID, and to provide a lock to prevent more than one **inetd** from being active at one time.

For more information about setting up the **inetd** configuration file and configuring daemons in general, see the topic on daemons in *z/OS UNIX System Services Planning* or *z/OS V2R1.0 Communications Server: IP Configuration Reference*.

infocmp — Compare or print the terminal description

Format

infocmp [**–ducn**] [**–ILC**] [**–1Vv**] [**–s d**|**i**|**l**|**c**] [**–A** *directory*] [**–B** *directory*] [*term_names...*]

Description

infocmp compares terminfo database entries, or prints a terminfo database entry. Output is written to standard output (stdout).

The Curses application uses the terminfo database, which contains a list of terminal descriptions. This enables you to manipulate a terminal's display regardless of the terminal type. To create the terminfo database, use **tic**. For information about defining the terminfo database database, see *z/OS UNIX System Services Planning*.

For more information about curses, see *z/OS C Curses*.

Options

d Prints the two terminal definitions showing the differences between the capabilities.

u Prints the differences between the two terminal definitions.

c Prints entries that are common to the two terminfo databases.

n Does not print entries in either terminfo database.

I Prints the current terminal description using capname. (*capname* is the short name for a capability specified in the terminfo source file.)

C Prints the current terminal description using termcap.

L Prints the current terminal description using variables (names that the curses functions can use when working with the terminfo database)

1 Single-column output.

V Prints the program version.

v Prints debugging information (verbose) to **stderr.**

s Changes sort order of the fields printed.
- **d** Sorts by database
- **i** Sorts by terminfo
- **c** Sorts by termcap
- **l** Sorts by the variables (names that the curses function can use when working with the terminfo database)

A First terminfo database.

B Other terminfo database.

term_names
Names of entries to be processed.

Usage notes

When displaying terminal database information for entries that are to be processed, **infocmp** operates as follows:

1. If you omit *term_names*, **infocmp** locates the terminal database information specified by the **TERM** environment variable and displays that as the entry's terminal database information.
2. If you specify a single *term_name*, **infocmp** displays terminal database information for that named entry.
3. If you specify more than one *term_name*, **infocmp** displays the results of a terminal database comparison between all of the specified *term_names*.

Examples

1. To print out the current terminal description using capname, issue:

   ```
   infocmp
   ```

   You will see:

   ```
   infocmp ibm3101
   #    Reconstructed via infocmp from file:/usr/share/lib/terminfo/i
   ibm3101|IBM 3101-10:\

   ibm3101|IBM 3101-10,
      am,
      cols#80, lines#24,
      bel=¬?, clear=¬.\322, cr=\r, cub1=\b, cud1=\n,
      cuf1=¬.\303,
   ```

2. To print out the current terminal description using the curses capability names, issue:

   ```
   infocmp –L
   ```

   You will get:

```
infocmp –L ibm3101
#    Reconstructed via infocmp from file:/usr/share/lib/terminfo/i
ibm3101|IBM 3101-10:\

Terminal type ibm3101
  ibm3101|IBM 3101-10
flags
  auto_right_margin,

numbers
  columns = 80, lines = 24,

strings
  bell = '¬?', carriage_return = '\r', clear_all_tabs = '¬.\310',
  clear_screen = '¬.\322', clr_eol = '¬.\311', clr_eos = '¬.\321',
```

3. To print out the current terminal description using capname, issue:
   `infocmp –I`

   You will get:

```
infocmp –I ibm3101
#    Reconstructed via infocmp from file:/usr/share/lib/terminfo/i
ibm3101|IBM 3101-10:\

ibm3101|IBM 3101-10,
   am,
   cols#80, lines#24,
   bel=¬?, clear=¬.\322, cr=\r, cub1=\b, cud1=\n,
   cuf1=¬.\303,
```

4. To print out the current terminal description using termcap, issue:
   `infocmp –C`

   You will get:

```
infocmp –C ibm3101
#    Reconstructed via infocmp from file:/usr/share/lib/terminfo/i
ibm3101|IBM 3101-10:\
   :am:bs:\
   :.co#80:li#24:kn#2:\
   :.cd=\EJ:.ce=\EI:.cl=\EK:\
   :.c:.cm=\EY%p1%' '%+%c%p2%'
'%+%c:.ct=\EH:.ho=\EH:\
   :.nd=\EC:.st=\E0:.up=\EA:
```

5. To print entries in single-column format, issue:
   `infocmp –1`

   You will get:

```
infocmp –C –1 ibm3101
#    Reconstructed via infocmp from file:/usr/share/lib/terminfo/i
ibm3101|IBM 3101-10:\
   :am:\
   :bs:\
   :co#80:\
   :li#24:\
   :kn#2:\
   :.cd=\EJ:\
   :.ce=\EI:\
   :.cl=\EK:\
```

6. To print the two terminal definitions showing the difference between the capabilities (F indicates False, entry not present; T indicates True, entry present):

   ```
   infocmp –d ibm3101 hft-c
   ```

   You will get:

   ```
   #    Reconstructed via infocmp from file:/usr/share/lib/terminfo/i
   ibm3101|IBM 3101-10:\
           comparing ibm3101 to hft-c.
              comparing booleans.
              bw:F:T.
              msgr:F:T.
              xon:F:T.
                comparing numbers.
              it:-1:8.
              lines:24:25.
                comparing strings.
              batt1:'NULL','\206\361'.
              batt2:'NULL','\206\361\224\204'.
   ```

   To print the capabilities that are different between the two terminal definitions. The values for the first terminal definitions are shown.

   ```
   infocmp –u ibm3101 hft-c
   ```

   You will get:

   ```
   #    Reconstructed via infocmp from file:/usr/share/lib/terminfo/i
   ibm3101|IBM 3101-10:\
           ibm3101|IBM 3101-10,
               bw@, msgr@, xon@,
               it@, lines#24,
               batt1@, batt2@, blink@, bold@, box1@, box2@,
               clear=¬.\322, colb0@, colb1@, colb2@, colb3@, colb4@,
               colb5@, colb6@, colb7@, colf0@, colf1@, colf2@,
               colf3@, colf4@, colf5@, colf6@, colf7@, cub@, cud@,
               cuf@, cuf1=¬.\303,
   ```

7. To print the capabilities that are the same in both terminal definitions, issue:

   ```
   infocmp –c ibm3101 hft-c
   ```

   You will get:

   ```
   #    Reconstructed via infocmp from file:/usr/share/lib/terminfo/i
   ibm3101|IBM 3101-10:\
        comparing ibm3101 to hft-c.
           comparing booleans.
              am= T.
           comparing numbers.
              cols= 80.
           comparing strings.
              bel= '¬?'.
              cr= '\r'.
              cub1= '\b'.
              cud1= '\n'.
   ```

8. To print the capabilities that are not found in either terminal definition, issue:

   ```
   infocmp –u ibm3101 hft-c
   ```

   You will get:

```
#    Reconstructed via infocmp from file:/usr/share/lib/terminfo/i
ibm3101|IBM 3101-10:\
   comparing ibm3101 to hft-c.
      comparing booleans.
         !bce.
         !ccc.
         !chts.
         !cpix.
         !crxm.
         !da.
         !daisy.
```

Environment variables

infocmp uses the following environment variables:

TERMINFO
Contains the pathname of the terminfo database.

TERM Contains the name of your terminal, that is, the current terminal definition.

Related information

captoinfo, **tic**

integer — Mark each variable with an integer value

Format

integer [*number*]

Description

integer is an alias for **typeset –i**. Like **typeset –i**, **integer** marks each variable as having an integer value, thus making arithmetic faster. If *number* is given and is nonzero, the output base of each variable is *number*. The default is decimal.

See “typeset — Assign attributes and values to variables” on page 781 for more information.

Related information

typeset, **sh**

ipcrm — Remove message queues, semaphore sets, or shared memory IDs

Format

ipcrm [**–m SharedMemoryID**] [**–M SharedMemoryKey**] [**–q QMessageID**] [**–Q MessageKey**] [**–s SemaphoreID**] [**–S SemaphoreKey**]

Description

ipcrm removes one or more message queues, semaphores set, or shared memory identifiers.

Options

–m SharedMemoryID
Removes the shared memory identifier **SharedMemoryID.** The shared memory segment and data structure associated with **SharedMemoryID** are also removed after the last detach operation.

–M SharedMemoryKey
Removes the shared memory identifier, created with the key **SharedMemoryKey.** The shared memory segment and data structure associated with it are also removed after the last detach operation.

–q MessageID
Removes the message queue identifier **MessageID** and the message queue and data structure associated with it.

–Q MessageKey
Removes the message queue identifier, created with the key **MessageKey,** and the message queue and data structure associated with it.

–s SemaphoreID
Removes the semaphore identifier **SemaphoreID** and the set of semaphores and data structure associated with it.

–S SemaphoreKey
Removes the semaphore identifier, created with the key **SemaphoreKey**, and the set of semaphores and data structure associated with it.

The msgctl, shmctl, and semctl subroutines provide details of the remove operations. You can use the **ipcs** command to find the identifiers and keys.

Examples

1. To remove the shared memory segment associated with **SharedMemoryID 18602**, enter:
   ```
   ipcrm –m 18602
   ```
2. To remove the message queue that was created with a key of 0xC1C2C3C3, enter:
   ```
   ipcrm –Q 0xC1C2C3C4
   ```

Exit values

0 Successful completion

1 Incorrect command-line option

Related information

ipcs

ipcs — Report status of the interprocess communication facility

Format

ipcs [–mqsS] [–a b c o p t w x y M B]

Description

ipcs writes to the standard output information for active interprocess communication facilities. If you do not specify any flags, **ipcs** writes information in a short form about currently active message queues, shared memory segments, and semaphores.

The column headings and the meaning of the columns in an **ipcs** command listing are listed in Table 15. . The letters in parentheses indicate the command flags that cause the corresponding heading to appear. *(all)* means that the heading is always displayed. These flags determine what information is provided for each facility. They do not determine which facilities are listed.

Table 15. Explanation of the ipcs command listing

Column heading	Meaning of the column
T (all except y)	The type of facility: • **q**: Message queue • **m**: Shared memory segment • **s**: Semaphore • **S**: Map Memory Service
ID (all except x,w,y,S,B)	The identifier for the facility entry
KEY (all except y,S,B)	The key used as a parameter to the **msgget** subroutine, the **semget** subroutine, or the **shmget** subroutine to make the facility entry. (The key of a shared memory segment is changed to IPC_PRIVATE when the segment is removed until all processes attached to the segment detach it.)
MODE (all except x,w,y,S,B)	The facility access modes and flags. The mode consists of 11 characters that are interpreted as follows: The first two characters can be the following: **R** If a process is waiting in a **msgrcv()** system call. **S** If a process is waiting in a **msgsnd()** system call. **D** If the associated shared memory segment has been removed. It disappears when the last process attached to the segment detaches it. The next nine characters are interpreted as three sets of three characters each. The first set refers to the owner's permissions; the next to permissions of others in the user group of the facility entry; and the last to all others. Within each set, the first character indicates permission to read, the second character indicates permission to write or alter the facility entry, and the last character is currently unused. The permissions are indicated as follows: **r** If read permission is granted **w** If write permission is granted **a** If alter permission is granted **–** If the indicated permission is not granted
OWNER (all, except S,B)	The login name or user ID of the owner of the facility entry.
GROUP (all)	The name or group ID of the group that owns the facility entry.

Table 15. Explanation of the ipcs command listing (continued)

Column heading	Meaning of the column
CREATOR (a,c)	The login name or user ID of the creator of the facility entry.
CGROUP (a,c)	The group name or group ID of the creator of the facility entry.
CBYTES (a,x,o)	The number of bytes in messages currently outstanding on the associated message queue.
INFO (x)	Provides additional extended state information. Under this field will be returned one or more of the following codes (codes are not mutually exclusive unless noted): For shared memory output: **M** megaroo For semaphore output: **P** PLO in use. Mutually exclusive with **L**. **L** Latch in use. Mutually exclusive with **P**. **B** Binary semaphore. For message queue output: **P** PLO in use. Mutually exclusive with **L**. **L** Latch in use. Mutually exclusive with **P**. **R** RCV type PID. **S** Send type PID. **1** PLO1 flag on—IPC_PLO1 set on msgget() **2** PLO2 flag on—IPC_PLO2 set on msgget()
QNUM (a,o)	The number of messages currently outstanding on the associated message queue.
QBYTES (a,b)	The maximum number of bytes allowed in messages outstanding on the associated message queue.
LSPID (p)	The ID of the last process that sent a message to the associated queue.
LRPID (p)	The ID of the last process that received a message from the associated queue.
STIME (a,t)	The time when the last message was sent to the associated queue.
RTIME (a,t)	The time when the last message was received from the associated queue.
CTIME (a,t)	The time when the associated entry was created or changed.
NATTCH (a,o)	The number of processes attached to the associated shared memory segment.
SEGSZPG (a,b,x)	The size in **pages** of the associated shared memory segment.
PGSZ (a,b,x)	The page size of the associated shared memory segment.
SEGSZ (a,b,x)	The size in **bytes** of the associated shared memory segment.
CPID (p)	The process ID of the creator of the shared memory entry.

Table 15. Explanation of the ipcs command listing (continued)

Column heading	Meaning of the column
LPID (p)	The process ID of the last process to attach or detach the shared memory segment.
ATIME (a,t)	The time when the last attach was completed to the associated shared memory segment.
DTIME (a,t)	The time the last detach was completed on the associated shared memory segment.
NSEMS (a,b)	The number of semaphores in the set associated with the semaphore entry.
OTIME (a,t)	The time the last semaphore operation was completed on the set associated with the semaphore entry.
RCVWAIT (x)	A count of **msgrcv()** waiters.
SNDWAIT (x)	A count of **msgsnd()** waiters.
MSGQPID (w)	For the message Q report, up to 10 lines of data will be shown under this heading.
MSGQTYPE (w)	For the message Q report, up to 10 lines of data will be shown under this heading.
RCVPID (w)	The process ID of a **msgrcv()** waiter. A maximum of 10 process IDs can be written.
RCVTYP (w)	The message type of a **msgrcv()** waiter associated with RCVPID. A maximum of 10 message type will be written. If the caller does not have read access, this field is not displayed.
SNDPID (w)	The process ID of a **msgsnd()** waiter. A maximum of 10 process IDs can be written
SNDLEN (w)	The message send length of a **msgsnd()** waiter associated with SNDPID. A maximum of 10 message send lengths can be written.
TERMA (x)	The number of times sem_val was changed during termination for semaphore adjustments.
CNADJ (x)	The current number of processes with semaphore adjustments.
SNCNT (x)	The number of waiters waiting for a sem_val greater than zero.
SZCNT (x)	The number of waiters waiting for a sem_val equal to zero.
WTRPID (w)	The process IDs of a semop waiter. A maximum of 10 semop waiters are written.
WTRNM (w)	The semaphore number associated with WTRPID. A maximum of 10 semaphore numbers are written.
WTROP (w)	The semaphore operation value associated with WTRNM and WTRPID. A maximum of 10 semaphore operation values are written.
AJPID (w)	The process ID of a process with semaphore adjustments. A maximum of 10 process IDs are written.
AJNUM (w)	The semaphore number of the semaphore adjustment associated with AJPID. A maximum of 10 semaphore numbers are written.
AJPID (w)	The process ID of a process with semaphore adjustments. A maximum of 10 process IDs are written.

Table 15. Explanation of the ipcs command listing (continued)

Column heading	Meaning of the column
AJNUM (w)	The semaphore number of the semaphore adjustments associated with AJPID. A maximum of 10 semaphore numbers are written.
AJVAL (w)	The semaphore adjustment value associated with AJNUM and AJPID. A maximum of 10 semaphore adjustment values are written.
ATPID (x)	The process ID of a process that is attached to this shared memory segment. A maximum of 10 process IDs are written.
ATADDR (x)	The shared memory address where the process ATPID is attached to this segment. A maximum of 10 addresses are written.
MNIDS (y)	The system limit for maximum number of message queues, semaphores, or shared memory IDs.
HWIDS (y)	The most message queues, semaphores, or shared memory IDs created.
CIDSA (y)	The current number of message queues, semaphores, or shared memory IDs available.
CPRIV (y)	The current number of message queues, semaphores, or shared memory IDs created with IPC_PRIVATE
CKEY (y)	The current number of message queues, semaphores, or shared memory IDs created with a key.
GETEX (y)	The number of times **msgget**, **semget**, or **shmget** exceeded the maximum number of IDs MNID.
MAXQB (y)	The system limit for maximum number of bytes on a message queue.
QMNUM (y)	The system limit for maximum number messages on a message queue.
ENOMEM (y)	The number of times **msgsnd()** calls returned ENOMEM.
MNSEMS (y)	The system limit for maximum number of semaphores per set.
MNOPS (y)	The system limit for maximum number of operations per semop.
CSBYTES (y)	The current number of bytes used by the system for semaphores.
TPAGES (y)	The system limit for number of system-wide shared memory pages
SPAGES (y)	The system limit for number of pages per shared memory segment.
SEGPR (y)	The system limit for number of segments per process.
CPAGES (y)	The current number of system-wide shared memory pages
MAXSEG (y)	The largest number of shared memory pages allocated to a single shared memory segment.
CREATEPID (S,B)	The creator PID of the map memory area. It is an unique identifier of the map area.
USERPID (S,B)	The user PID of the map memory area, which is currently using it.

Table 15. Explanation of the ipcs command listing (continued)

Column heading	Meaning of the column
USER (S,B)	The user name of the user of the map memory segments entry.
SHUTDOWN (S,B)	This field indicates that for this particular map memory object, shutdown flag has been marked for freeing of this area. While blocks can be freed in this area, the map memory object is not freed until the last process using it terminates.
BLKSIZE (B)	The block size of the map area object in megabytes.
BLKSINUSE (B)	The number of blocks is in use in the map memory area object.
BLKSINMAP (B)	The number of blocks in this map area object.
BLKSMAPPED (B)	The number of blocks mapped by this process.
SECLABEL (M)	The multilevel security label associated with Message queues, Semaphores, and Shared Memory.

Options

–q Writes information about active message queues.

–m Writes information about active shared memory segments.

–s Writes information about active semaphore set.

–S Write information about active __map memory segments.

If **–q**, **–m**, **–s**, or **–S** are specified, only information about those facilities is written. If none of these four are specified, information about message queues, shared memory segments and semaphores are written subject to the following options. __Map memory information will not written unless the **–S** is specified.

–a Uses the **–b**, **–c**, **–o**, **–p**, and **–t** flags.

–b Writes the maximum number of bytes in messages on queue for message queues, the size of segments for shared memory, and the number of semaphores in each semaphores set. This option will be ignored for __map memory option [**–S**].

–c Writes the login name and group name of the user that made the facility. This option will be ignored for __map memory option [**–S**].

–m Writes information about active shared memory segments.

–o Writes the following usage information:

- Number of messages on queue
- Total number of bytes in messages in queue for message queues
- Number of processes attached to shared memory segments

–p Writes the following:

- Process number of the last process to receive a message on message queues
- Process number of the creating process
- Process number of last process to attach or detach on shared memory segments

–q Writes information about active message queues.

–s Writes information about active semaphore set.

–t

- Time of the last control operation that changed the access permissions for all facilities
- Time of the last msgsnd() and msgrcv() on message queues
- Time of the last shmat and shmdt on shared memory
- Time of the last semop on semaphore sets

–w Writes message queue wait status and semaphore adjustment status in these fields:

Fields			
AJNUM	KEY	RCVPID	T
AJPID	MSGQPID	RCVTYP	WTRNM
AJVAL	MSGQTYP	SNDLEN	WTROP
GROUP	OWNER	SNDPID	WTRPID

This option ignores all other print options except **–x** and **–y**.

–x Writes extended status in these fields:

Fields			
ATADDR	KEY	SEGSZ	T
ATPID	OWNER	SEGSZPG	TERMA
CNADJ	PGSZ	SNCNT	
GROUP	QCBYTES	SNDWAIT	
INFO	RCVWAIT	SZCNT	

This option will be ignored for __map memory option [**–S**]. This option ignores all other print options except the **–y** option.

–y Writes summary and system limit status in these fields:

Fields			
CIDSA	ENOMEM	MAXSEG	SPAGES
CKEY	GETEX	MNIDS	TPAGES
CPAGES	HWIDS	MNOPS	
CPRIV	QMNUM	MNSEMS	
CSBYTES	MAXQB	SEGPR	

This option ignores all other print options. This option is a summary and system limit status for message queues, semaphores and shared memory. It will not include the __map memory segments [**–S**] summary and system limit status.

–M Writes the multilevel security label associated with the resources except the __map memory facility. See *z/OS Planning for Multilevel Security and the Common Criteria* for more information about multilevel security.

–B Writes extended information about __map memory segments in these fields: BLKSIZE, BLKSINUSE, BLKSINMAP, and BLKSMAPPED. This option only applies to __map memory segments [**–S**].

Examples

Following is a sample output from entering **ipcs** without flags:

```
IPC status as of Wed Apr  6 14:56:22 EDT 1994
  Message Queues:
  T         ID     KEY        MODE       OWNER    GROUP
  q 1234567890 0x4107001c -Rrw-rw----     root   printq
  Shared Memory:
  T         ID     KEY        MODE       OWNER    GROUP
  m          0 0x0d07021e --rw-------     root   system
  m          1 0x0d08c984 --rw-rw-rw-     root   system
  Semaphores:
  T         ID     KEY        MODE       OWNER    GROUP
  s       4096 0x0108c86e --ra-------     root   system
  s          1 0x6208c8ef --ra-r--r--     root   system
  s          2 0x4d0b00a6 --ra-ra----     root   system
  s      24579 0x00bc614e --ra-ra-ra-     xlin   vendor
  s     176132 0x00000058 --ra-ra-ra-     xlin   vendor
```

Following is a sample output from entering **ipcs -S**:

```
IPC status as of Wed Oct 6 14:56:22 EDT 2002
   Map Memory Service:
  T    CREATEPID   USERPID      USER     GROUP     SHUTDOWN
  S      1096       165         root    system         Y
  S         4       114         John    system         Y
  S         6       324         John    system        N
  S      1052       111        Andrew   vendor        N
  S        96       678          xlin   vendor        Y
```

Exit values

0 Successful completion
1 Failure due to incorrect command-line option

Related information

ipcrm

---

jobs — Return the status of jobs in the current session

Format

jobs [**–l**|**–p**] [*job-identifier...*]

tcsh shell: **jobs** [**-l**]

Description

jobs produces a list of the processes in the current session. Each such process is numbered for easy identification by **fg** or **kill**, and is described by a line of information:

[job-identifier] default state shell_command

job-identifier
Is a decimal number that identifies the process for such commands as **fg** and **kill** (preface *job-identifier* with **%** when used with these commands).

default Identifies the process that would be the default for the **fg** and **bg** commands (that is, the most recently suspended process). If *default* is a **+**,

this process is the default job. If *default* is a **–**, this job becomes the default when the current default job exits. There is at most one **+** job and one **–** job.

state Shows a job as:

Running
If it is not suspended and has not exited

Done If it exited successfully

Done(exit status)
If it exited with a nonzero exit status

Stopped (*signal***)**
If it is suspended; *signal* is the signal that suspended the job

shell_command
Is the associated shell command that created the process.

In the tcsh shell, **jobs** lists the active jobs. With**-l**, lists process IDs in addition to the normal information. See "tcsh — Invoke a C shell" on page 689.

Options

–l Displays the process group ID of a job (before *state*).

–p Displays the process IDs of all processes.

The **–l** and **–p** options are mutually exclusive.

Localization

jobs uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Usage notes

jobs is a built-in shell command.

Exit values

0 Successful completion
2 Failure due to an incorrect command-line argument

Portability

POSIX.2 User Portability Extension.

Related information

bg, **fg**, **kill**, **ps**, **wait**, **tcsh**

join — Join two sorted textual relational databases

Format

join [**–a** *n*] [**–e** *s*] [**–o** *list*] [**–t** *c*] [**–v** *n*] [**–1** *n*] [**–2** *n*] *file1 file2*
join [**–a** *n*] [**–e** *s*] [**–j**[*n*] *m*] [**–o** *list*] [**–t** *c*] *file1 file2*

Description

join joins two databases. It assumes that both *file1* and *file2* contain textual databases in which each input line is a record and that the input records are sorted in ascending order on a particular join key field (by default the first field in each file). If you specify **–** in place of *file1* or *file2*, **join** uses the standard input (**stdin**) for that file. If you specify **– –** in place of both *file1* and *file2*, the output is undefined.

Conceptually, **join** computes the Cartesian product of records from both files. By default, spaces or tabs separate input fields and **join** discards any leading or trailing white space. (There can be no white-space-delimited empty input fields.) It then generates output for those combined records in which the join key field (the first field by default) matches in each file. The default output for **join** is the common join key field, followed by all the other fields in *file1*, and then all the other fields in *file2*. The other fields from each file appear in the same order they appeared in the original file. The default output field separator is a space character.

Options

–a *n* Produces an output line for lines that do not match in addition to one for a pair of records that does match. If you specify *n* as one of `1` or `2`, **join** produces unpaired records from only that file. If you specify both **–a** `1` and **–a** `2`, it produces unpaired records from both files.

–e *string*
Replaces an empty field with *string* on output. In a double-byte locale, *string* can contain double-byte characters.

–j[*n*] *m*
Uses field number *m* as the join key field. By default, the join key field is the first field in each input line. As with the **–a** option, if *n* is present, this option specifies the key field just for that file; otherwise, it specifies it for both files.

–o *list* Specifies the fields to be output. You can specify each element in *list* as either *n.m*, where *n* is a file number (`1` or `2`) and *m* is a field number, or as `0` (zero), which represents the join field. You can specify any number of output fields by separating them with blanks or commas. The POSIX-compatible version of this command (first form in the syntax) requires multiple output fields to be specified as a single argument; therefore, shell quoting may be necessary. **join** outputs the fields in the order you list them.

–t *c* Sets the field separator to the character *c*. Each instance of *c* introduces a new field, making empty fields possible. In a double-byte locale, *c* can be a double-byte character.

–v *n* Suppresses matching lines. If you specify *n* as one of `1` or `2`, **join** produces unpaired records from only that file. If you specify both **–v** `1` and **–v** `2`, it produces unpaired records from both files. This does not suppress any lines produced using the **–a** option.

–1 *n* Uses the *n*th field of *file1* as the join key field.

–2 *n* Uses the *n*th field of *file2* as the join key field.

Examples

1. The following script produces a report about files in the working directory containing filename, file mode, and an estimate at what the file contains:

```
file * | tr –s ':' ';' >temp1
ls –l | tr –s ' ' ' ';' >temp2
join –t';' –j2 9 –o 1.1 2.1 1.2 ---
temp1 temp2
rm temp[12]
```

2. This example uses the historical implementation of the **join** command. The third line in the POSIX-compatible script could be:

```
join –t';' –2 9 –o 1.1,2.1,1.2 -- temp1 temp2
```

Localization

join uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Incorrect syntax
- The wrong number of command-line arguments
- Inability to open the input file
- Badly constructed output list
- Too many **–o** options on the command line

2 Failure due to an incorrect command-line argument

Messages

Most diagnostics deal with argument syntax and are self-explanatory. For example:

Badly constructed output list at *list*
Indicates that the list for a **–o** option did not have the proper syntax.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

POSIX considers the **–j** option to be obsolete.

Related information

awk, **comm**, **cut**, **paste**, **sort**

kill — End a process or job, or send it a signal

Format

kill –l [*exit_status*]
kill [**–s** *signal_name*] [
kill –K [*pid*...][*job-identifier*...]
kill [**–***signal_name*] [*pid ...*] [*job-identifier ...*]
kill [**–***signal_number*] [*pid ...*] [*job-identifier ...*]

tcsh shell:
kill [*-signal*] *%job | pid ...*
kill –K *%job | pid...*
kill -l

Description

kill ends a process by sending it a signal. The default signal is **SIGTERM**.

kill is a built-in shell command.

In the tcsh shell, **kill** [*-signal*] *%job | pid ...* sends the specified signal (or if none is given, the TERM (terminate) signal) to the specified jobs or processes. *job* can be a number, a string, '', %, + or - . Signals are either given by number or by name. Enter the *signal_name* with uppercase characters. For example, if you want to send the SIGTERM signal, you would enter **kill -TERM** *pid* not **kill -SIGTERM** *pid*.

Restriction: When using the tcsh **kill** command, do not use the first three characters (*SIG*) of the *signal_name*.

There is no default *job*. Specifying **kill** alone does not send a signal to the current job. If the signal being sent is TERM or HUP (hangup), then the job or process is sent a CONT (continue) signal as well.

kill -l lists the signal names. See “tcsh — Invoke a C shell” on page 689.

The *signal_numbers* and *signal_names* described in “Options” are also used with the tcsh **kill** command.

Options

–K Sends a superkill signal to force the ending of a process or job that did not end as a result of a prior KILL signal. The process is ended with a non-retryable abend. The regular KILL signal must have been sent at least 3 seconds before the superkill signal is sent. The superkill signal cannot be sent to a process group (by using *pid* of 0 or a negative number) or to all processes (by using a *pid* of -1).

–l Displays the names of all supported signals. If you specify *exit_status* and it is the exit code of an ended process, **kill** displays the ending signal of that process.

–s *signal_name*
Sends the signal *signal_name* to the process instead of the SIGTERM signal. When using the **kill** command, do not use the first three characters (*SIG*) of the *signal_name*. Enter the *signal_name* with uppercase characters. For example, if you want to send the SIGABRT signal, enter:

```
kill –s ABRT pid
```

–signal_name
(Obsolete.) Same as **–s** *signal_name*.

–signal_number
(Obsolete.) A non-negative integer representing the signal to be sent to the process, instead of SIGTERM.

The *signal_number* represents the following signal names:

0 SIGNULL
1 SIGHUP
2 SIGINT
3 SIGQUIT
4 SIGILL
5 SIGPOLL
6 SIGABRT
7 SIGSTOP
8 SIGFPE
9 SIGKILL
10 SIGBUS
11 SIGSEGV
12 SIGSYS
13 SIGPIPE
14 SIGALRM
15 SIGTERM
16 SIGUSR1
17 SIGUSR2
18 SIGABND
19 SIGCONT
20 SIGCHLD
21 SIGTTIN
22 SIGTTOU
23 SIGIO
24 SIGQUIT
25 SIGTSTP
26 SIGTRAP
27 SIGIOERR
28 SIGWINCH
29 SIGXCPU
30 SIGXFSZ
31 SIGVTALRM
32 SIGPROF
37 SIGTRACE
38 SIGDCE
39 SIGDUMP

The signal_numbers (3 and 6) associated with SIGQUIT and SIGABRT, respectively, differ from the values of SIGQUIT and SIGABRT used by the z/OS kernel, but they are supported for compatibility with other UNIX platforms. (The **kill** command will send the SIGQUIT or SIGABRT to the process.) This note is also true for **kill** in the tcsh shell.

Operands

job-identifier
Specifies the job identifier reported by the shell when a process is started with **&**. It is one way to identify a process. It is also reported by the **jobs** command. When using the job identifier with the **kill** command, the job

identifier must be prefaced with a percent (%) sign. For example, if the job identifier is 2, the **kill** command would be entered as follows:

```
kill –s KILL %2
```

pid Specifies the process ID that the shell reports when a process is started with **&**. You can also find it using the **ps** command. The *pid* argument is a number that may be specified as octal, decimal, or hexadecimal. Process IDs are reported in decimal. **kill** supports negative values for *pid*.

If *pid* is negative but not -1, the signal is sent to all processes whose process group ID is equal to the absolute value of *pid*. The negative *pid* is specified in this way:

```
kill –KILL — –nn
```

where *nn* is the process group ID and may have a range of 2 to 7 digits (*nn* to *nnnnnnn*).

```
kill –s KILL — –9812753
```

The format must include the — before the *–nn* in order to specify the process group ID.

If *pid* is `0`, the signal is sent to all processes in the process group of the invoker.

The process to be killed must belong to the current user; however, any process can be killed by a superuser.

Localization

kill uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Usage notes

1. z/OS UNIX signal delivery restrictions are documented in the "Environmental Restrictions" section of *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.

Exit values

0 Successful completion

1 Failure due to one of the following:
- The job or process did not exist
- There was an error in command-line syntax

2 Failure due to one of the following:
- Two jobs or processes did not exist
- Incorrect command-line argument
- Incorrect signal

>2 Tells the number of processes that could not be killed

Messages

Possible error messages include:

job-identifier **is not a job**
You specified an incorrect ID.

signal_name **is not a valid signal**
You specified a noninteger signal for **kill**, or you specified a signal that is outside the range of valid signal numbers.

Portability

POSIX.2, X/Open Portability Guide.

Related information

jobs, **ps**, **sh**, **tcsh**

[(left bracket) — Test for a condition

See the **test** command.

Note: When working in the shell, to view man page information about **[** (left bracket), type: `man left`.

ld — Link object files

Related information

Format

ld [**–cVv**]
[**–b** *option*[,*option*]...]...
[**–e** *function*]
[**–f** *filename*]...
[**–L** *directory*]...
[**–l** *libname*]...
[**–O** *name*[,*name*]...]
[**–o** *outfile*]
[**–S** *syslibdset*]...
[**–u** *function*]
[**–x** *sidefile*]
[*file.o*] ... [*file.a*] ... [*file.x*]... [**–l** *libname*] ...

Description

The **ld** utility combines object files and archive files into an output executable file, resolving external references. **ld** runs the Program Management Binder.

Options

-b *option*[**,***option*]**...**
Specifies options to be passed to the binder. For more information about the binder and its options, see *z/OS MVS Program Management: User's Guide and Reference*. Binder options that are not specified will take the binder default, except when other **ld** options affect binder options.

–c Causes pseudo-JCL to be written to stdout without actually running the binder. Pseudo-JCL provides information about exactly which binder options are being passed, and also which data sets are being used.

Also see **–v**.

-e *function*
Specifies the name of the function to be used as the entry point of the program.

The default value of the **-e** option is affected by the setting of environment variable _LD_ENTRY_POINT (see Environment Variables). If the **-e** option is not specified and _LD_ENTRY_POINT is null, or if *function* is null, the default rules of the binder will determine the entry point of the program. For more information about the binder and the ENTRY control statement, see *z/OS MVS Program Management: User's Guide and Reference*.

Also see **-O**.

-f *filename*
Specifies a file that contains a list of the names of object and archive files to be used as input. The listed files will be used in addition to any files specified as operands.

-L *directory*
Specifies the directories to be used to search for archive libraries specified by the **-l** operand. The directories are searched in the order specified, and then in the directories specified by the _LD_LIBDIRS environment variable or its default. You cannot specify an MVS data set as an archive library directory.

-l *libname*
Specifies the name of an archive library. **ld** searches for the file **lib** *libname***.a** in the directories specified on the **-L** option and then in the directories specified by the _LD_LIBDIRS environment variable or its default. The first occurrence of the archive library is used.

You can also specify an MVS data set; you must specify the full data set name, because there are no rules for searching library directories.

The data set specified must be a C370LIB object library or a load library. If a data set specified as a library has undefined (U) record format, then it is assumed to be a load library. For more information about the object library utility, see *z/OS XL C/C++ User's Guide*.

-O *name*[**,** *name*]**...**
Specifies the name of the code topic to be ordered to the beginning of the executable. The binder control statement order will be generated. The default value of **-O** can be provided by the environment variable **_LD_ORDER** (see Environment Variables).

-o *outfile*
Specifies the name of the executable file produced by **ld**. The default output file is **a.out**.

-S *syslibdset*
Specifies the name of a system library (SYSLIB) data set that will be used to resolve symbols.

-u *function*
Specifies the name of the function to be added to the list of external symbols to be resolved. This option can be useful if the only input is archive libraries. If this option is not specified, no external symbol is added.

-V This verbose option produces binder listings and directs them to stdout.

-v This verbose option causes pseudo-JCL to be written to stdout before the binder is run. It provides information about exactly which binder options are being passed, and also which data sets are being used.

-X *sidefile*
Specifies the name of a side deck file or data set that **ld** will write to when producing a DLL (dynamic link library).

Operands

file.a Specifies the name of an archive file, as produced by the **ar** command, to be used by the binder for resolving external references. To specify an MVS data set name, precede the name with double slash (//), in which case the last qualifier of the data set name must be LIB. The data set specified must be a C370LIB object library or a load library. See the description of the –l libname operand for more information about using data sets as libraries.

file.o Specifies the name of an object file, produced by the C/C++ run-time compiler or assembler, to be link-edited.

To specify an MVS data set name to be link-edited, precede the file name with double slash (//), in which case the last qualifier of the data set name must be OBJ.

If a partitioned data set is specified, more than one member name may be specified by separating each with a comma. For example:

```
ld //file.OBJ(mem1,mem2,mem3)
```

file.x Specifies the name of a definition side-deck produced by **ld** when creating a DLL (dynamic link library), and used by **ld** when linking an application using the DLL. See the description of side-deck processing in *z/OS MVS Program Management: User's Guide and Reference*.

To specify an MVS data set name, precede the file name with double slash (//), in which case the last qualifier of the data set name must be EXP.

If a partitioned data set is specified, more than one member name can be specified by separating each with a comma. For example:

```
ld //file.EXP(mem1,mem2,mem3)
```

Environment variables

You can use environment variables to specify necessary system and operational information to **ld**. When a particular environment variable is not set, **ld** uses the default shown. For information about the JCL parameters used in these environment variables, see *z/OS MVS JCL User's Guide*.

_LD_ACCEPTABLE_RC
The maximum allowed return code (result) of the binder invocation. If the result is between zero and this value (inclusive), then it is treated internally by **ld** exactly as if it were a zero result, except that message IEW5033 might be issued. For more information about binder return codes, see *z/OS MVS Program Management: User's Guide and Reference*. The default value is:

```
"4"
```

_LD_ASUFFIX
The suffix by which **ld** recognizes an archive file. This environment variable does not affect the treatment of archive libraries specified as **-l** operands, which are always prefixed with lib and suffixed with .a. The default value is:

"a"

_LD_ASUFFIX_HOST
The suffix by which **ld** recognizes a library data set. This environment variable does not affect the treatment of data set libraries specified as **-l** operands, which are always used exactly as specified. The default value is:

"LIB"

_LD_DAMPLEVEL
The minimum severity level of dynamic allocation messages returned by dynamic allocation message processing. Messages with severity greater than or equal to this number are written to stderr. However, if the number is out of the range shown here (that is, less than 0 or greater than 8), then**ld** dynamic allocation message processing is disabled. The default value is:

"4"

Following are the values:

0 Informational

1–4 Warning

5–8 Severe

_LD_DAMPNAME
The name of the dynamic allocation message processing program called by **ld**. It must be a member of a data set in the search order used for MVS programs. The default dynamic allocation message processing program is described in *z/OS MVS Programming: Authorized Assembler Services Guide*. The default value is:

"IEFDB476"

_LD_DCBU
The DCB parameters used by **ld** for data sets with the attributes of record format undefined and data set organization partitioned. This DCB is used by **ld** for the output file when it is to be written to a data set. The default value is:

"(RECFM=U,LRECL=0,BLKSIZE=6144,DSORG=PO)"

_LD_DCB80
The DCB parameters used by **ld** for data sets with the attributes of record format fixed blocked and logical record length 80. The default value is:

"(RECFM=FB,LRECL=80,BLKSIZE=5680)"

_LD_DEBUG_DUMP
The name of a data set to be used for capturing diagnosis data during execution of the binder. An unformatted dump will be written to this data set by the binder when it encounters a binder ABEND situation (usually accompanied by message IEW2900W) or when the binder option DUMP is specified. The data set must have been created before **ld** is invoked, and must be created with RECFM=VBA and LRECL=125. If this environment variable is null, the binder dump will not be captured. The default value is

"" (null)

_LD_DEBUG_TRACE
The name of a data set to be used for capturing diagnosis data during execution of the binder. An unformatted trace will be written to this data set by the binder. The data set must have been created before **ld** is

invoked, and must be created with RECFM=VB and LRECL=84. If this environment variable is null, the binder trace will not be captured. The default value is

```
"" (null)
```

_LD_ENTRY_POINT
The value to be used as the **-e** option if **-e** is not specified. The default value is

```
"" (null)
```

_LD_EXTRA_SYMBOL
The value to be used as the **-u** option if **-u** is not specified. The default value is

```
"" (null)
```

_LD_LIBDIRS_
The directories used by **ld** as the default place to search for archive libraries which are specified using the –l operand. The default value is:

```
"/lib /usr/lib"
```

_LD_ORDER
The value to be used as the **-O** option if **-O** is not specified. The default value is

```
"" (null)
```

_LD_NEW_DATACLAS
The DATACLAS parameter used by **ld** for any new data sets it creates. The default value is

```
"" (null)
```

_LD_NEW_DSNTYPE
The DSNTYPE parameter used by **ld** for any new data sets it creates. The default value is

```
"LIBRARY"
```

which means that new data sets will be created as type PDSE.

_LD_NEW_MGMTCLAS
The MGMTCLAS parameter used by **ld** for any new data sets it creates. The default value is

```
"" (null)
```

_LD_NEW_SPACE
The SPACE parameter used by **ld** for any new data sets it creates. The default value is

```
"" (null)
```

_LD_NEW_STORCLAS
The STORCLAS parameter used by **ld** for any new data sets it creates. The default value is

```
"" (null)
```

_LD_NEW_UNIT
The UNIT parameter used by **ld** for any new data sets it creates. The default value is

```
"" (null)
```

_LD_OPERANDS
These operands are parsed as if they were specified after all other operands on the **ld** command line. The default value is

"" (null)

_LD_OPTIONS
These options are parsed as if they were specified after all other operands on the **ld** command line. The default value is

"" (null)

_LD_OSUFFIX
The suffix by which **ld** recognizes an object file. The default value is

"o"

_LD_OSUFFIX_HOST
The suffix by which **ld** recognizes an object data set. The default value is

"OBJ"

_LD_SYSLIB
The system library data set concatenation to be used to resolve symbols. The default value is:

" " (null)

_LD_SYSIX
The system definition side-deck list to be used to resolve symbols. A definition side-deck contains link-editing phase IMPORT control statements naming symbols which are exported by a DLL. The default value is

"" (null)

_LD_XSUFFIX
The suffix by which **ld** recognizes a definition side-deck file of exported symbols. The default value is

"x"

_LD_XSUFFIXHOST
The suffix by which **ld** recognizes a definition side-deck data set of exported symbols. The default value is

"EXP"

Usage notes

1. Messages generated from the use of the **ld** command are provided in *z/OS MVS System Messages, Vol 8 (IEF-IGD)*.
2. **ld** provides similar function to the link-edit step of the **c89** command. It does not provide any functions of the compile and assembly phases of **c89**, nor any steps of the link-edit phase except for the link-edit step **--ld** merely calls the program management binder. The other main difference is that **c89** has default settings that are designed for linking an object file produced by the C/C++ run-time compiler for execution in the Language Environment, whereas the default settings of **ld** do not include compiler or environment assumptions, and it can therefore be more easily used to link objects from other compilers or that are destined for environments other than Language Environment.

   You can use **ld** options, operands, or environment variables to cause **ld** to create executable modules that are compatible with those **c89** produces by default:

Option or operand	Environment variable	Value for c89 compatibility
-e	**_LD_ENTRY_POINT**	CEESTART or, for AMODE 64 code, CELQSTRT

Option or operand	Environment variable	Value for c89 compatibility
-O	**_LD_ORDER**	CEESTART or, for AMODE 64 code, CELQSTRT
-S	**_LD_SYSLIB**	//'CEE.SCEELKEX': //'CEE.SCEELKED': //'CBC.SCCNOBJ': //'SYS1.CSSLIB' or installation equivalent names
-u	**_LD_EXTRA_SYMBOL**	CEEMAIN or, for AMODE 64 code, CELQMAIN
file.a	**_LD_OPERANDS**	//CEE.SCEEOBJ

3. When a data set name is specified, the argument must start with double-slash (//) followed by the data set name. If the name is enclosed in single quotes, it is assumed to be fully qualified and is taken as is. Otherwise, the user login name followed by a period is prefixed.
4. To be able to specify an operand that begins with a dash (-), you must use the double dash (--) end-of-options delimiter.
5. When **ld** is invoked from the shell, any option-arguments or operands specified that contain characters with special meaning to the shell must be escaped. For example, source files specified as PDS member names contain parentheses; and if they are specified as fully qualified names, they contain single quotes. To escape these special characters, either enclose the option-argument or operand in double quotes, or precede each character with a backslash.
6. Options and arguments are processed in the order read (from left to right). Where there are conflicts, the last specification is used. If options that require arguments are specified more than once, the last specification is used except as follows:

   -b Binder options are appended in the order they are specified

   -f Each file is processed when the **-f** option is encountered

   -L Library directories are appended in the order they are specified

   -l Libraries are searched when the **-l** option is encountered

   -S SYSLIB data sets are appended in the order they are specified

   All operands are processed in the order they are specified.
7. Because archive library files are searched when their names are encountered, the placement of **-l** operands and **file.a** operands is significant. You may have to specify a library multiple times on the command string, if subsequent specification of **file.o** files requires that additional symbols be resolved from that library.
8. The following environment variable specifies the name of an MVS program to be executed and can be at most eight characters in length. You can dynamically alter the search order used to find MVS programs by using the

STEPLIB environment variable. For more information about the STEPLIB environment variable, see the section on commonly used environment variables in *z/OS UNIX System Services Planning*. It is also described under the **sh** command.

- _LD_DAMP_NAME

9. The following environment variables can be at most 15 characters in length. You should not specify any periods (.) when setting these environment variables because they would then never match their corresponding operands:
   - _LD_ASUFFIX
   - _LD_ASUFFIX_HOST
   - _LD_OSUFFIX
   - _LD_OSUFFIX_HOST
   - _LD_XSUFFIX
   - _LD_XSUFFIX_HOST
10. The following environment variable is a parsed colon-delimited data set name, and represents a data set concatenation or a data set list:
    - _LD_SYSLIB
11. The following environment variables specify the names of MVS databases and can be at most 44 characters in length:
    - _LD_DEBUG_DUMP
    - _LD_DEBUG_TRACE
12. The following environment variables can be at most 63 characters in length:
    - _LD_NEW_DATACLAS
    - _LD_NEW_DSNTYPE
    - _LD_NEW_MGMTCLAS
    - _LD_NEW_SPACE
    - _LD_NEW_STORCLAS
    - _LD_NEW_UNIT
13. The following environment variable is for specification of the SPACE parameter, and supports only the syntax as shown below, including all commas and parentheses (example: "(,(10,10,10))"). PRIMARY is the number of tracks of primary to be allocated, SECONDARY the number of secondary tracks, and DIRBLOCKS the number of directory blocks. DIRBLKS must be specified even when it is not needed.
    - _LD_NEW_SPACE
14. The following environment variable is for specification of the DSNTYPE parameter, and supports only the sub-parameters LIBRARY or PDS (or null for the default, LIBRARY):
    - _LD_NEW_DSNTYPE
15. The following environment variables can be at most 127 characters in length:
    - _LD_DCBU
    - _LD_DCB80

    Restriction: These environment variables are for specification of DCB information, and support only the following **DCB** sub-parameters, with the noted restrictions:

    RECFM
    Incorrect values are ignored.

LRECL
None

BLKSIZE
None

DSORG
Incorrect values are treated as if no value had been specified.

16. The following environment variables are parsed as blank-delimited words, and therefore no embedded blanks or other white space is allowed in the value specified. The maximum length of each word is 1024 characters:
    - _LD_LIBDIRS
    - _LD_OPTIONS
    - _LD_OPERANDS

Localization

ld uses the following localization environment variables:

- LANG
- LC_ALL
- LC_CTYPE
- LC_MESSAGES

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion.

>0 An error occurred during processing.

Related information

c89

let — Evaluate an arithmetic expression

Format

let *expression ...*
((*expression***))**

Description

let evaluates each arithmetic *expression* from left to right, with normal algebraic precedence (multiplication before addition, for example). **let** uses long integer arithmetic with no checks for overflow. No output is generated; the exit status is `0` if the last *expression* argument has a nonzero value, and 1 otherwise.

The following two lines are equivalent: the second form avoids quoting and enhances readability. These two forms are extensions to the POSIX standard.

```
let "expression"
((expression))
```

The POSIX version of this command is as follows:

```
$((expression))
```

Expressions consist of named variables, numeric constants, and operators. Characters in the names of named variables must come from thePOSIX portable character set.

See "Arithmetic substitution" on page 618.

Examples

Examples of the three forms of the **let** command are as follows:

1. The example

   ```
   let a=7
   echo $a
   ```

   produces:

   ```
   7
   ```

2. The example

   ```
   echo $((a=7*9))
   ```

   produces:

   ```
   63
   ```

3. The example

   ```
   ((a=3*4))
   echo $a
   ```

   produces:

   ```
   12
   ```

Usage notes

let is a built-in shell command.

Localization

let uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 The last argument evaluated to a nonzero value

1 The last argument evaluated to a zero value, or the expression contained a syntax error or tried to divide by zero

Portability

POSIX.2. **let** and *((expression))* are extensions to the POSIX.2 standard. The POSIX.2 portable facility for arithmetic expression evaluation is *$((expression))*. See "Arithmetic substitution" on page 618 for more information.

The (( )) syntax only works if the **set –o korn** option is in effect.

Related information

expr, **sh**, **test**

---

lex — Generate a program for lexical tasks

Format

lex [**–achlntTv**] [**–o** *file.c*] [**–P** *proto*] [**–p** *prefix*] [*file.l ...*]

Description

lex reads a description of a lexical syntax, in the form of regular expressions and actions, from *file.l*. If you do not provide *file.l*, or if the file is named **–**, **lex** reads the description from standard input (**stdin**). It produces a set of tables that, together with additional prototype code from **/etc/yylex.c**, constitute a lexical analyzer to scan those expressions. The resulting recognizer is suitable for use with **yacc**. You can find detailed information about the use of **lex** in *z/OS UNIX System Services Programming Tools*.

For a description of the typedefs, constants, variables, macros, and functions in the table file, which can be used to access the lexical analyzer's variables or to control its operations, see *z/OS UNIX System Services Programming Tools*.

A *locale* is the subset of a user's environment that depends on language and cultural conventions. A locale defines such things as the definition of characters, and the collation sequence of those characters. POSIX.2 defines a POSIX locale, which is essentially USASCII. Because **lex** generates code that is then compiled before being executed, it is difficult for **lex** to act properly on collation information. The POSIX.2 standard therefore does not require **lex** to accept any locales other than the POSIX locale. **lex** accepts regular expressions in this locale only.

Options

–a Generates 8-bit tables instead of 7-bit tables. On systems with 8-bit character sets (such as this one), this option is always enabled.

–c Generates C code. Because this is the default, this option is provided only for compatibility with other implementations.

–h Prints a brief list of the options and quits.

–l Suppresses **#line** directives in the generated code.

–n Suppresses the display of table sizes by the **–v** option. If you did not specify **–v** and their are no table sizes specified in *file.1*, **lex** behaves as though you specified **–n**.

–o *file.c*
Writes the lexical analyzer (internal state tables) onto the named output file, instead of the default file **lex.yy.c**.

–P *proto*
Uses the named code file, instead of the default prototype file **/etc/yylex.c**.

–p *prefix*
Uses the given prefix instead of the prefix **yy** in the generated code.

–T Writes a description of the analyzer onto the file **l.output**.

–t Writes the lexical analyzer onto standard output (**stdout**) instead of the file **lex.yy.c**.

–v Displays the space used by the various internal tables. Normally **lex** displays these statistics on **stdout**, but if you also specified the **–t** option, it displays them on **stderr**. If you did not choose this option and *file.1* specifies table sizes, **lex** still displays these statistics unless you specified the **–n** option.

The **lex** library contains a number of functions essential for use with **lex**. These functions are described in *z/OS UNIX System Services Programming Tools* . The actual library to use depends on your system and compiler. For z/OS programs, you should use **–ll**.

Some **lex** programs can cause one or more tables within **lex** to overflow. These tables are the NFA, DFA, and move tables; **lex** displays an appropriate message if an overflow occurs. Change table sizes by inserting the appropriate line into the *definition* section of the **lex** input, with the number *size* giving the number of entries to use. This is shown in Table 16.

Table 16. Internal table sizes (lex command)

Line	Table size affected	Default
%e*size*	Number of NFA entries	1000
%n*size*	Number of DFA entries	500
%p*size*	Number of move entries	2500

You can often reduce the NFA and DFA space to make room for more move entries.

Files

lex uses the following files:

l.output
Scanner machine description

lex.yy.c
Tables and action routines

/etc/yylex.c
The prototype **lex** scanner

/usr/lib/libl.a
lex archive library with functions compiled for 31–bit addressing mode.

/usr/lib/liblxp.a
lex archive library with functions compiled with XPLINK. Includes two versions: 64–bit addressing mode and 31–bit addressing mode.

Localization

lex uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following reasons:
- Inability to create an output file
- Inability to open the file
- Missing output file name after **–o**
- Missing prefix after **–p**
- No **lex** rules
- No memory for DFA moves
- Out of NFA state space
- Out of DFA move space
- Out of DFA state space
- Push-back buffer overflow
- Read error on file
- Table too large for machine
- Too many character classes
- Too many translations
- Unknown option
- Write error on file
- Incomplete %{ declaration
- Token buffer overflow

Limits

The parser stack depth is limited to 150 levels. Attempting to process complicated syntaxes might result in an overflow, causing an error.

Portability

POSIX.2, POSIX.2 C-Language Development Utilities Option, UNIX systems.

The **–a**, **–h**, **–l**, **–o**, **–p**, **–P**, and **–T** options are extensions of the POSIX standard.

Related information

yacc

For more information, see *z/OS UNIX System Services Programming Tools*.

line — Copy one line of standard input

Format

line

The **line** utility is fully supported for compatibility with older UNIX systems. However, it is recommended that the **read** utility be used instead because it may provide greater functionality and is considered the standard for portable UNIX applications as defined by POSIX.2 IEEE standard 1003.2-1992.

Description

Examples

```
echo "Enter name:\c"
NAME='line'
```

Localization

line uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 A line was read successfully

1 **line** reached end-of-file before finding a newline character

Portability

X/Open Portability Guide, UNIX System V.

Related information

cat, **head**, **read**, **sh**, **tail**

link — Create a hard link to a file

Format

link *oldfile newfile*

Description

link creates a hard link to an existing file. A link is a new directory entry that refers to the same file. This entry can be in the same directory that currently contains the file or in a different directory. The result is that you get a new path name that refers to the file. You can access the file under the old or new path name since both path names are of equal importance. If you use **rm** to remove one path name, the other remains and the file contents are still available under that name. The contents of the file do not disappear until the last remaining link associated with the file is removed.

Following the format, *new* becomes a new path name for the existing file *old*. If *old* names a symbolic link, **link** creates a hard link to the file that results from resolving the path name contained in the symbolic link.

Links are allowed to files only, not to directories. A file can have any number of links to it. Thus, you can establish any number of different path names for any file.

link is implemented as a shell built-in.

Localization

link uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- A file specified could not be found
- No write permission on the directory intended to contain the link
- No search permission on a path name component of old or new
- No permission to access old
- The path name of one of the arguments is a directory
- The new link file already exists

2 Failure due to incorrect number of arguments

Related information

link, **ln**, **rm**

ln — Create a link to a file

Format

ln [–fiRrs] *old new*
ln [–fiRrs] *old old ... dir*
ln -e [-fi] *old new*

Description

ln creates a link to an existing file or set of files. A *link* is a new directory entry that refers to the same file. This entry can be in the same directory that currently contains the file or in a different directory. The result is that you get a new path name that refers to the file. You can access the file under the old path name or the new one. Both path names are of equal importance. If you use **rm** to remove either name, the other one still remains and the file contents are still available under that name. The contents of the file do not disappear until you remove the last link.

A file can have any number of links to it. Thus you can establish any number of different path names for any file.

In the first form given in the syntax, *new* becomes a new path name for the existing file *old*. In the second form, **ln** creates entries for all the *old* files under the directory *dir*. For example,

```
ln yourdir/* mydir
```

creates links under **mydir** to all the files under **yourdir**. The files have the same names under **mydir** that they had under **yourdir**. **ln** always assumes this directory

form when the last operand on the command line is the name of a directory. In this case, none of the *old* names can be a directory, unless **-r** or **-R** is specified.

There could already be a file with the same name as the link you are trying to set up: a conflicting path name. To deal with a conflicting path name, **ln** follows these steps.

- If you have specified **–i**, **ln** writes a prompt to **stderr** to ask if you want to get rid of the conflicting path name. If you answer affirmatively, **ln** attempts to remove it.
- Otherwise, if you have specified **–f**, **ln** attempts to remove the existing file without a warning.
- Otherwise, **ln** prints a diagnostic message.
- **ln** gets to this point if it is going to get rid of the conflicting path name. It therefore attempts to get rid of the conflicting path name in the same way that **rm** does. **ln** deletes the file associated with the path name if this path name is the last link to the file. If **ln** can't get rid of the conflicting path name, it does not attempt to establish the new link; it simply prints an error message on **stderr** and goes on to process any other files.
- If **ln** successfully gets rid of the conflicting path name, it then establishes the link.

Options

–e Specifies that the link created by **ln** is to be an external link. One purpose for creating an external link is to create a mount point that an NFS client can use to access a data set through the Network File System feature. If you specify one of these options with **-e**, the command will fail. The normal content of an external link is a name that refers to an object outside the hierarchical file system, such as a data set. The data set that the Network File System feature uses can be any type of MVS data set. For a partitioned data set, however, you specify a fully qualified name in all caps. For example:

```
ln -e NOLL.PLIB.PGMA /u/noll/plib/pgma
```

The **-e** option is mutually exclusive with **-r**, **-R** and **-s**.

Restriction: Due to the NFS protocol limitation, **-e** does not create an external link on NFS. If you want to create an external link on NFS, see the topic on creating an external link for details in *z/OS Network File System Guide and Reference*.

External links can also be used to map a z/OS UNIX file name to a PDS or PDSE member name for an executable load module. An example of how you would define the external link is:

```
ln -e MYPGM /u/smorg/mylongpgmname
```

If an application attempts to access **/u/smorg/mylongpgmname** as an executable file, the kernel will attempt to load MYPGM from the current MVS search order (Job Pack Queue, STEPLIB/JOBLIB, LPA, LINK LIST). The kernel services which behave this way for external links are:

- **exec()** (all flavors)
- **spawn()** (including _spawn2, spawnp, _spawnp2)
- **loadhfs** which is used for all DLL processing and locales

An external link can be used as a shell command to invoke a program in the current MVS search order.

–f Deletes any conflicting path names without asking you for confirmation. If **-i** is also specified, regardless of the order in which **-i** and **-f** appear on the command line, **-i** is ignored.

–i Checks with you before deleting conflicting path names. If **-f** is also specified, regardless of the order in which **-i** and **-f** appear on the command line, **-i** is ignored.

–R Links files recursively. That is, you can link an entire hierarchy of subdirectories at once. **-R** is mutually exclusive with the **-e** option.

–r Is identical to **–R**. **-r** is mutually exclusive with the **-e** option.

–s Creates a symbolic link. The **-s** option is mutually exclusive with the **-e** option.

For a symbolic link, *old* refers to the file you want to create the link to. That file does not have to exist. The name of the symbolic link that you are creating is *new*.

Example: If you have a file called **f1** and you want to create a symbolic link to it called **my_sym**, issue:

```
ln -s f1 my_sym
```

The locale settings for LC_COLLATE, LC_CTYPE, and LC_MESSAGES affect the program's interpretation of what constitutes a Yes answer when **ln** asks if you want to delete a conflicting path name.

Examples

If you define **/u/user1/name1** as a symbolic link to **/u/user1/name2**, and then invoke *name1*:

1. The shell will spawn *name1*.
2. **spawn()** will access the file for *name1* unaware that there is a symbolic link already established. It will access the *name2* file by its underlying vnode, not the *name2* handle.
3. If the sticky bit is on for the *name2* file, **spawn()** will do the MVS search for *name1* (the only name it has to work with).

Symbolic and external links with a sticky bit:

Note: DLLs, and all flavors of **spawn()** and **exec()**, follow the same processing as described in this section. Where it says **exec()**, it covers all forms of module loading.

1. External links:

   exec() does a **stat()** on the passed filename. **stat()** does the search, not **exec()**. If the filename is an external link, then **stat()** fails with a unique reason code which causes **exec()** to read the external link. If the external link name is a valid PDS member name (1–8 alphanumeric or special characters), then **exec()** will attempt to locate the module in the MVS search order. If it cannot be found, **exec()** fails.

   The external link is normally used when you want to set the sticky bit on for a file name which is longer than 8 characters or contains characters unacceptable for a PDS member name.
2. Symbolic links:

   If the filename you specify is a symbolic link, and **exec()** sees the sticky bit on, then it will truncate any dot qualifiers. So, as long as the base filename is an

acceptable PDS member name, the need to set up links in order to get **exec()** to go to the MVS search order should not be an issue.

For example, if you have a file named java.jll, when you put the sticky bit on, **exec()** will attempt to load JAVA. If **exec()** cannot find JAVA, it will revert to using the java.jll file in the file system.

The important thing to understand is that **exec()** never sees the name that the symbolic link resolves to even though it can see the **stat()** data for the final file.

Localization

ln uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 All requested links were established successfully.

1 Failure due to any of the following:
- An argument had a trailing / but was not the name of a directory.
- A file could not be found.
- An input file could not be opened for reading.
- An output file could not be created or opened for output.
- The new link file already exists.
- A link could not be established.
- A read error occurred on an input file.
- A write error occurred on an output file.
- The input and output files were the same file.
- Inability to access a file when using **–r**.
- Inability to read a directory when using **–r**.
- Inability to create a directory when using **–r**.
- A target is not a directory when using **–r**.
- Source and destination directory are the same when using **–r**.

2 Failure due to any of the following:
- Incorrect command-line option.
- Too few arguments on the command line.
- A target that should be a directory but isn't.
- No space left on target device.
- Out of memory to hold the data to be copied.
- Inability to create a directory to hold a target file.

Messages

Possible error messages include:

link to target *name* **failed**
ln could not establish the link to the given file or directory. This may be because you do not have appropriate permissions, or because the target did not exist.

source *name* **and target** *name* **are identical**
The source and the target are actually the same file (for example, because of links, on UNIX systems). In this case, **ln** does nothing.

target directory *name* **on different file system than source** *name*
You cannot establish a normal link between files that are two different file systems.

target *name* **must be a directory**
The target name must be a directory

cannot find file *name*
The file name could not be found.

target file *name* **already exists**
The target file name already exists.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Only the **-f** option is part of the POSIX standard.

Related information

cp, **locale**, **mv**, **rm**

locale — Get locale-specific information

Format

locale [–a|–m]locale [–ck] *name* ...

Description

locale displays information about the current locale and all locales accessible to the current application. **locale** searches directory **/usr/lib/nls/locale** for all the compiled locales.

Invoking **locale** with no options or operands displays the values of the LANG and LC_* environment variables. If a **LC_*** variable is not set or is overridden by LC_ALL, **locale** displays its implied value in double quotes.

The operand *name* can be a category name, keyword name, or the reserved name `charmap`. If it is a category name, **locale** selects the given category and all keywords within it for output. If *name* is a keyword name, **locale** selects the given keyword and its category for output. If *name* is `charmap`, **locale** displays the name of the charmap used with the **localedef –f** option when the locale was created.

Options

–a Displays information about all accessible locales including POSIX and the POSIX locale.

Note: Some of the accessible locales that are displayed will only work in specific environments. For example, the XPLINK locales will not work in the z/OS shell environment. When using this information to specify a

locale, the convention is to use the descriptive locale name. See the section on locale naming conventions in *z/OS XL C/C++ Programming Guide*.

–c Displays the names of selected categories.

–k Displays the names of selected keywords. If you do not specify the **–k** option, **locale** displays the values of selected keywords but not their names. With **–k**, strings are written in an unambiguous form using the `escape` character from the current locale.

–m Displays a list of all available character maps.

The following list contains valid **locale** keywords:

abday Abbreviated day names

abmon
Abbreviated month names

alpha All alphabetic characters (upper and lower case)

am_pm
A.m. and p.m. string

backslash
Encoding of \

blank How a blank is represented

character-collation
The collating sequence

charmap
Mapping of character symbols to actual character encodings

circumflex
Encoding of ^

cntrl Control characters

codeset
Same as **code_set_name**

code_set_name
Name of the coded character set used

commercial_at
Encoding of @

currency_symbol
Local currency symbol of the current locale

d_fmt Date format

d_t_fmt
Date and time format

day Full day names

decimal_point
Decimal-point characters

digit All numeric characters

dollar_sign
Encoding of $

daylight_name
The name of the daylight saving time zone (DST). The value will be overwritten if it is different from the keyword setting defined by the TZ environment variable.

end_day
Day of the week when daylight saving time (DST) ends. The value will be overwritten if it is different from the keyword setting defined by the TZ environment variable.

end_month
Week of the month when daylight saving time (DST) ends. The value will be overwritten if it is different from the keyword setting defined by the TZ environment variable.

end_time
Number of seconds after midnight when daylight saving time (DST) ends. The value will be overwritten if it is different from the keyword setting defined by the TZ environment variable.

end_week
Month of the year when daylight saving time (DST) ends. The value will be overwritten if it is different from the keyword setting defined by the TZ environment variable.

exclamation_mark
Encoding of !

frac_digits
Number of digits to the right of the decimal place in monetary quantities

graph Graphic characters

grave_accent
Encoding of `

grouping
String indicating the size of each group of digits in formatted nonmonetary quantities

int_curr_symbol
International currency symbol for the current locale

int_frac_digits
The number of displayed digits to the right of the decimal place for internationally formatted monetary quantities

left_brace
Encoding of {

left_bracket
Encoding of [

lower Lowercase alphabet

mb_cur_max
Maximum number of bytes used to represent a character

mon Full month names

mon_decimal_point
Decimal-point character used to format monetary quantities

mon_grouping
String indicating the size of each group of digits in formatted monetary quantities

mon_thousands_sep
Separator for digits in formatted monetary quantities

n_cs_precedes
1 if the `currency_symbol` precedes the value for a negative formatted monetary quantity; 0 if it does not

n_sep_by_space
1 if the `currency_symbol` is separated by a space from the value of a negative formatted monetary quantity; 0 if it does not; 2 if a space separates the symbol and the sign string–if adjacent

n_sign_posn
Value indicating the position of the `negative_sign` for a negative formatted monetary quantity

negative_sign
String indicating the negative sign used in monetary quantities

noexpr
Expression for negative

number_sign
Encoding of #
p_cs_precedes
1 if the `currency_symbol` precedes the value for a nonnegative formatted monetary quantity; 0 if it does not
p_sep_by_space
1 if the `currency_symbol` is separated by a space from the value of a nonnegative formatted monetary quantity; 0 if it does not; 2 if a space separates the symbol and the string–if adjacent
p_sign_posn
Value indicating the position of the `positive_sign` for a nonnegative formatted monetary quantity
positive_sign
String indicating the positive sign used in monetary quantities
print Printable characters
punct Punctuation characters
right_brace
Encoding of }
right_bracket
Encoding of]
shift DST time shift in seconds. The value will be overwritten if it is different from the keyword setting defined by the TZ environment variable.
space How white space is represented
start_day
Day of the week when daylight saving time (DST) starts. The value will be overwritten if it is different from the keyword setting defined by the TZ environment variable.
start_month
Month of the year when daylight saving time (DST) starts. The value ranges from 1 through 12. The value will be overwritten if it is different from the keyword setting defined by the TZ environment variable.
start_time
Number of seconds after midnight when daylight saving time (DST) starts. The value will be overwritten if it is different from the keyword setting defined by the TZ environment variable.
start_week
Week of the month when daylight saving time (DST) starts. The value will be overwritten if it is different from the keyword setting defined by the TZ environment variable.
t_fmt Time format
t_fmt_ampm
Long date format
tilde Encoding of ~
timezone_difference
Time zone difference in minutes. The value will be overwritten if it is different from the keyword setting defined by the TZ environment variable.
timezone_name
Time zone name. The value will be overwritten if it is different from the keyword setting defined by the TZ environment variable.
tolower
Uppercase to lowercase conversion
thousands_sep
Character used to separate groups of digits to the left of the decimal-point character in formatted nonmonetary quantities

toupper
Lowercase to uppercase conversion
uctname
Coordinated Universal Time. The value will be overwritten if it is different from the keyword setting may be overridden if TZ is set.
upper Uppercase alphabet
vertical_line
Encoding of |
xdigit Hexadecimal digits
yesexpr
Expression for affirmative

Examples

In the following examples, let's assume that locale environment variables are set as follows:

```
LANG=locale_x
LC_COLLATE=locale_y
```

1. The command:

   ```
   locale
   ```

   produces the following output:

   ```
   LANG=locale_x
   LC_CTYPE="locale_x"
   LC_COLLATE=locale_y
   LC_TIME="locale_x"
   LC_NUMERIC="locale_x"
   LC_MONETARY="locale_x"
   LC_SYNTAX="locale_x"
   LC_TOD="locale_x"
   LC_MESSAGES="locale_x"
   LC_ALL=
   ```

2. The command:

   ```
   LC_ALL=POSIX locale -ck decimal_point
   ```

   produces:

   ```
   LC_NUMERIC
   decimal_point="."
   ```

3. The following command shows an application of **locale** to determine whether a user supplied response is affirmative:

   ```
   if printf "s%\n" "$response" | grep -Eq "$(locale yesexpr)"
   then
           affirmative processing goes here
   else
           nonaffirmative processing goes here
   fi
   ```

Environment variables

locale uses the following environment variable:

TZ Contains the time zone to be used when displaying date and time strings.

Localization

locale uses the following localization environment variables:
- **LANG**

- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion
1 An error occurred
2 A usage message was printed

Portability

POSIX.2, UNIX System V.

Related information

localedef

---

localedef — Define the locale environment

Format

localedef [**–c**] [**–f** *charmap*] [**–i** *sourcefile*] [**–m** *methodfile*] [**–w**] [**–A**] [**–L** *bindeoptions*] [**–X**] [**–6**] *name*

Description

localedef converts source definitions for locale categories into a format usable by functions and utilities.

localedef, which is installed as part of the Language Environment element of z/OS, utilizes **c89**, which is installed as part of z/OS Run-Time Library Extensions.

c89 requires the installation of the C/C++ optional feature of z/OS (which provides among other things a C compiler).

A TSO/E utility called LOCALDEF is installed as part of Language Environment.

- It is not supported by the z/OS shell; for more information see *z/OS XL C/C++ User's Guide*.
- The TSO/E BATCH versions of the utility do not support ASCII (-A) nor AMODE-64 (-6) options.

For information about the charmap file and locale definition source file formats, see *z/OS XL C/C++ Programming Guide*.

Options

–c Creates permanent output even if there were warning messages. Normally, **localedef** does not create permanent output when it has issued warning messages.

–f *charmap*
Specifies a *charmap* file that contains a mapping of character symbols and collating element symbols to actual character encodings.

–i *sourcefile*
Specifies the file that contains the source definitions. If there is no **–i**, **localedef** reads the source definitions from the standard input.

–m *methodfile*
Specifies the name of a method file that describes the methods to be overridden when constructing a locale. **localedef** reads the method file and uses entry points when constructing the locale objects. The code set methods specified are also used in parsing the file pointed to by the CharMap variable. This requires that you provide the overriding methods in a DLL which is explicitly loaded by **localedef** before processing the *charmap* file. User method files are supported only for ASCII locales. The **-m** option is invalid without the **-A** option.

–w Produces warning messages for duplicate definitions.

–A Instructs **localedef** to generate an ASCII locale object. The **–X** option is implied when this option is specified.

–L *binderoptions*
Instructs **localedef** to pass additional binder options (mostly for diagnostic purposes).

–X Instructs **localedef** to generate an XPLINK AMODE 31 locale object (DLL).

–6 Instructs **localedef** to generate an XPLINK AMODE 64 locale object (DLL). The -X option is implied when this option is specified.

name Is the target locale. If it contains no slashes, the locale is public and **localedef** converts *name* to a full path name using the NLSPATH environment variable. If *name* contains one or more slashes, **localedef** interprets it as a full path name of where to store the created definition.

See locale for related information.

Localization

localedef uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

The LC_COLLATE and LC_CTYPE environment variables do not affect **localedef**. **localedef** always behaves as though these variables were set to the POSIX locale.

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 No errors occurred; the locale was successfully created.

1 Warnings occurred; the locale was successfully created.

2 The locale specification exceeded implementation limits, or the coded character set used was not supported by implementation. No locale was created.

3 The capability to create new locales is not supported by the implementation. (POSIX2_LOCALEDEF is not defined.)

>3 Warnings or errors occurred; no output was created.

localedef issues warnings when:

- The LC_CTYPE or LC_COLLATE category description uses a symbolic name that was not found in the *charmap* file.
- The number of operands to the **order** keyword exceeds the `COLL_WEIGHTS_MAX` limit.

Portability

POSIX.2; UNIX System V.

Related information

locale

---

logger — Log messages

Format

logger [**–IisTu**] [**–d** *dest*] [**–f** *filename*] [**–p** *priority*] [**–t** *tag*] [**–a** *tag2*] *string ...*

Description

`logger` saves a message in the console log; the message consists of the *string* operand on the command line. Some options of **`logger`** might be in effect by default. If they are on by default, they cannot be disabled.

The `-u` and `-i` options are in effect by default. As a result, all messages from **`logger`** are prefixed by the process ID and user login user name.

If there is no message specified on the command line, the standard input is read. Because each line of standard input is treated as a log message, all terminal input is logged as a message. To prevent all subsequent input from being processed by **`logger`** , enter the designated escape character, such as `¢`, followed by a capital `C`. For example: `¢C`.

If **–f** *filename* is specified, the file is read instead of the standard input.

Options

–f *filename*
: Reads log messages from the file *filename* rather than from the standard input.

–I
: Adds the parent process ID (PPID) of **`logger`** to the message.

–i
: Adds the process ID (PID) of **`logger`** to the message. This option is in effect by default, so all messages from **`logger`** are prefixed by the PID.

–s
: Overrides any destination options and causes logging to the standard error output.

–T
: Adds a time stamp (`%x %X` format, per date) to the message. This time stamp is always in the POSIX locale, no matter the locale of the message.

–u
: Adds the login name of the controlling terminal to the message. This option is in effect by default, so all messages from **`logger`** are prefixed by the login name.

Note: The following options work on z/OS systems. However, because they are system-specific, they might not work on another system.

–d *destination*
Must be a list of numbers, separated by spaces, tabs, or commas, in the range of 1 to 128, and represents a bit in the routing code number (that is, ROUTCDE=) in the WTO macro. The default destination value is `0` (no bits set in the routing code number).

If you use **d1**, the message goes to the system console.

–p *priority*
Must be a list of numbers, separated by spaces, tabs, or commas, in the range of 1 to 16 and represents a bit in the message descriptor code (that is, DESC=) in the WTO macro (WTO == write to operator). The default priority value is 0 (that is, no bits set).

–t *tag* Adds *tag* to the start of the message.

–a *tag2*
Adds *tag2* in front of all the options and the message.

For more information about the *destination* and *priority* options, refer to *z/OS MVS JCL Reference*.

Examples

1. If you issue:
   ```
   logger -d1 This is a message.
   ```
   (Note the number 1.) You will see:
   ```
   +WELLIE4: 2097152017: This is a message.
   ```
2. If you issue:
   ```
   logger -d1 -a TheTag A message
   ```
   (Note the number 1.) You will see:
   ```
   +TheTag: WELLIE4: 213076449: A message.
   ```

Localization

logger uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

>0 An error occurred

Messages

Possible error messages include:

-f *filename* **invalid if message given**
Both a file name and message was specified; only one is allowed.

file *filename***: system error**
The file specified by **–f** *filename* could not be opened.

Formatted log message too long -- limit LINE_MAX (*number***)**
The log message specified was longer than the limit specified by LINE_MAX.

Unknown option *option*
You specified an incorrect option to **logger** .

Portability

POSIX.2, X/Open Portability Guide.

All the options are extensions of the POSIX standard.

---

logname — Return a user's login name

Format

logname

Description

logname displays the login name of the person who issued the command. It obtains the login name through the **getlogin()** function defined in the POSIX standard. The login name is displayed as all uppercase letters, regardless of how it was entered.

Environment variables

logname uses the following environment variable:

LOGNAME
Contains your user name.

Localization

logname uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_TYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion
1 **logname** could not determine the login name

Portability

POSIX.2, X/Open Portability Guide, UNIX System V.

Related information

env, **id**

---

lp — Send a file to a printer

Format

lp [**–cmsw**] [**–d** *dest*] [**–n** *number*] [**–o** *printer-option*] [**–t** *title*] [*file ...*]

Description

lp prints one or more input files on a printer. If you do not specify any files on the command line, or if you specify a file name of **–** (dash), **lp** reads and prints the standard input. The files are printed in the same order that they are specified on the command line.

Note: If you are using the z/OS Infoprint Server Feature, your system automatically uses that version of the **lp** command.

Options

–c Immediately copies the files to be printed. This ensures that the version of the file that exists when the print request is made is the version printed.

–d *dest*
Specifies *dest* as the output device. **–d** takes precedence over the LPDEST environment variable, which in turn takes precedence over the PRINTER environment variable.

dest is a comma-separated list of arguments that is passed to JES. The first item must be the "destination_name". The destination name can take the form *NODE.USER*. The second item must be the "class". The third item must be the "forms". Not all items must be specified, but the items must be specified in the proper order. The definition of "destination_name", "class", and "forms" is defined by JES.

For more information about the *dest* option, see *z/OS MVS JCL Reference*.

–m This option is not implemented.

–n *number*
Prints *number* copies of each input file (the default is 1 copy).

–o *printer-option*
This option is not implemented.

–s This option is not implemented.

–t This option is not implemented.

–w This option is not implemented.

Examples

1. To send a previously formatted file to a JES printer:
   ```
   lp filename
   ```

   You can specify more than one file name with the command.

2. The following prints the file **temp.prt** using the default printer destination and specifying class c (where c is the locally designated class for secured information):

```
lp –d ,c temp.prt

lp –d,c temp.prt
```

   The parameters on the **-d** option are positional, so if you omit a destination, you must still include the comma.

Environment variables

lp uses the following environment variables:

LPDEST
Names the output device. This variable takes precedence over **PRINTER**.

PRINTER
Names the output device if **LPDEST** is not defined.

Localization

lp uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

>0 An error occurred

Portability

POSIX.2, X/Open Portability Guide.

The **–m**, **–o**, **–s**, **–t**, and **–w** options are extensions to the POSIX standard.

lpstat — Show status of print queues (stub command)

Format

lpstat [**–drst**] [**–a** [*list*]] [**–c** [*list*]] [**–o** [*list*]] [**–p** [*list*]] [**–u** [*list*]] [**–v**] [*list*] [*queue_id* ...]

Description

lpstat shows the status of print queue or queues, specified by *queue_id*. If no *queue_id* is given, **lpstat** lists information for all of the printers on the system.

lpstat is recognized, but its functions are not supported.

If you are using the z/OS Print Server Feature, your system automatically uses that version of the **lpstat** command.

ls — List file and directory names and attributes

Format

ls [**–AabCcDdEFfgHikLlmMnopqRrsTtuWx1**] [*pathname ...*]

Description

ls lists files and directories. If the *pathname* is a file, **ls** displays information about the file according to the requested options. If it is a directory, **ls** displays information about the files and subdirectories therein. You can get information about a directory itself using the **–d** option.

If you do not specify any options, **ls** displays only the file names. When **ls** sends output to a pipe or a file, it writes one name per line; when it sends output to the terminal, it uses the **–C** (multicolumn) format.

Note: Code sets that are aliases of each other exist which might cause the test to fail, because the file inquiry operator might return an alias of the code set that you are testing.

Options

ls displays at least the file name; you can request more information with the following options:

–A Lists all entries including those starting with periods (**.**); but excluding any **.** or **..** entries.

–a Lists all entries including those starting with a period (**.**).

–b Displays nonprintable characters as octal bytes with the form *\ooo*.

–C Puts output into columns, sorted vertically; this is the default output format to the terminal.

–c Uses the time of the last change of the file's attributes for sorting (**–t**) or displaying (**–l**).

–D Displays from directories.

–d Does not display the contents of named directories, but information about the directories themselves.

–E Displays extended attributes for regular files:

- **a** Program runs APF-authorized if linked AC=1
- **p** Program is considered program-controlled
- **s** Program is enabled to run in a shared address space
- **l** Program is loaded from the shared library region
- **—** Attribute not set

See “Long output format” on page 409.

–F Puts a **/** after each directory name, a * after every executable file, a **|** after every FIFO file, a @ after every symbolic link, and a **=** after every socket. It also puts an & character after an external link name.

–f Forces the *pathname* argument to be a directory; turns off sorting. **ls** gives

the ordered list of file names in a directory file. The directory file is read and the file names are listed in the same order as they are returned. The contents of a directory file are shown.

–g Same as **–l** except that it does not display owner.

–g turns on the Long Output Format. See "Long output format" on page 409 for details.

–H Displays file formats for regular files:

—— Not specified

bin Binary data

rec Record. (File data consists of records with prefixes. The record prefix contains the length of the record that follows. From the shell command perspective, files with this format will be treated as if they were binary files.)

Or the following text data delimiters:

nl Newline character
cr Carriage return
lf Line feed
crlf Carriage return followed by line feed
lfcr Line feed followed by carriage return
crnl Carriage return followed by new line

–H turns on the Long Output Format. See "Long output format" on page 409 for details.

–i Displays file serial (inode) numbers along with file names.

–k Uses 1024 bytes for block size.

–L Follows symbolic links.

–l Displays permissions, links, owner, group, size, time, name. See "Long output format" on page 409 for details.

–M Displays the security label of the file, as in this example:

```
> ls -M  has_seclabel no_seclabel
SECLABEL has_seclabel
          no_seclabel
```

ls –M does not turn on the **–l** option. **ls –M** can be used with other options. See "Long output format" on page 409 for details.

–m Displays names in a single line, with commas separating names.

–n Displays UID number and GID number.

–o Same as **–l** except that it does not display group.

–o turns on the long output format. See "Long output format" on page 409 for details.

–p Puts / after directory names.

–q Displays nonprintable characters as ?.

–R Lists subdirectories recursively.

–r Sorts in reverse of typical order; you can combine this with other options that sort the list.

–s Displays size in blocks, after the file serial (inode) number, but before other information. The block size is 512 bytes unless the **–k** option is used.

–T Displays file tag information associated with the file. The format of this output will be similar to the output from **chtag –p**.

An example output:

```
> ls -T file
t   IBM-1047     T=on   file1
```

ls –T does not turn on the **–l** option. **ls –T** can be used with other options. See "Long output format" for details.

–t Sorts by time. By default, this option sorts the output by the modification times of files. You can change this with the **–c** and **–u** options.

–u Uses the last access time for sorting (**–t**) or displaying (**–l**) .

–W Enables the audit bits to be displayed. This option turns on the **–l** option.

These bits are printed in a 6-character field directly after the field displaying the file permission bits. These 6 characters are really two groups of 3 bits each. The first group of 3 describes the user-requested audit information. The second group of 3 describes the auditor-requested audit information. Each 3 characters displayed are the read, write, and execute (or search) audit options. Each character indicates the audit option as:

s (Audit successful audit attempts)
f (Audit failed access attempts)
a (Audit all accesses)
– (No audit)

–W turns on the long output format. See "Long output format" for details.

–x Puts output into sorted columns, with output going across the rows.

–1 Forces output to be one entry per line.

Note: When you specify options that are mutually exclusive (for example, **–c** and **–u**), the option that appears last on the command line is used.

Long output format

The output from **ls –l** summarizes the most important information about the file on a single line. If the specified *pathname* is a directory, **ls** displays information about every file in that directory (one file per line). It precedes this list with a status line that indicates the total number of file system blocks occupied by files in the directory (in 512-byte chunks or 1024-bytes if **–k** option is used). Following is a sample of the output along with an explanation:

```
total 11
drwxr-xr-x       3 ROOT   SYS1    0 Mar 12 19:32 tmp
drwxrwxrwx       4 ROOT   SYS1    0 Mar 12 19:32 usr
drwxr-xr-x       2 ROOT   SYS1    0 Mar 12 19:32 bin
-rwxr--r--       1 ROOT   SYS1  572 Mar 12 19:32 foo
-rwxr--r--       1 ROOT   SYS1  640 Mar 12 19:33 abc
```

If **–T** is specified, file tag information is displayed first on the line.

The first character identifies the file type:

– Regular file
b Block special file (not supported for z/OS UNIX System Services)

c Character special file
d Directory
e External link
l Symbolic link
p FIFO
s Socket file type

The next 9 characters are in three groups of 3; they describe the permissions on the file. The first group of 3 describes owner permissions; the second describes group permissions; the third describes other (or "world") permissions. Characters that might appear are:
r Permission to read the file
w Permission to write on the file
x Permission to execute the file

The following characters appear only in the execute permission (x) position of the output.
S Same as s, except that the execute bit is turned off.
s If in owner permissions section, the set-user-ID bit is on; if in group permissions section, the set-group-ID bit is on.
T Same as t, except that the execute bit is turned off.
t The sticky bit is on.

The following character appears after the permissions if the file contains extended ACL entries:

+

For example:

```
ls -l file
-rwxrwxrw-+       WELLIE         SYS 167 Jan 11 09:54 file
```

Use **getfacl** to display the extended ACL entries. You can set permissions with either **chmod** or **setfacl**.

After the permissions are set, **ls** displays the following (using the preceding example), in order:

- The number of links to the file.
- The name of the owner of the file or directory.
- The name of the group that owns the file or directory.
- The size of the file, expressed in bytes. For character special files, it displays the major and minor device types.
- For a file, the date and time the file was last changed; for a directory, when it was created. The **–c** and **–u** options can change which time value is used. If the date is more than 6 months old or if the date is in the future, the year is shown instead of the time.
- The name of the file or directory.

Note: When files owned by user ID 0 (UID=0) are transferred from any UNIX-type system across an NFS connection to another UNIX-type system, the UID changes to –2 (UID = –2). Because –2 is not a valid UID on a z/OS system, **ls** displays a **–2** in place of the user name.

If **ls –E** is issued, an additional four characters follow the original 10 characters:

```
total 11
-rwxr-xr-x  -ps-   1 ROOT   SYS1  101 Mar 12 19:32 her
-rwxrwxrwx  a-s-   1 ROOT   SYS1  654 Mar 12 19:32 test
-rwxr-xr-x  a--    1 ROOT   SYS1   40 Mar 12 19:32 temp
-rwxr--r--  ap-l   1 ROOT   SYS1  572 Mar 12 19:32 foo
-rwxr--r--  --sl   1 ROOT   SYS1  640 Mar 12 19:33 abc
```

If **ls –H** is issued, an additional four characters follow the original 10 characters:

```
total 32
-rwxr-xr-x   ----   1 ROOT   SYS1     0 Mar 26 08:47 tmp
drwxr-xr-x          2 ROOT   SYS1  8192 Mar 26 08:50 usr
-rwxr--r--   cr     1 ROOT   SYS1    40 Mar 26 08:55 abc
-rwxr-x---   rec    1 ROOT   SYS1    80 Dec 26 09:55 newfmt
```

If **ls –E** is used in conjunction with **–H**, then the four characters will follow the four characters that are normally associated with **ls –E**:

```
ls -EH
-rwxr-xr-x  ap-l bin   1 ROOT   SYS1   101 Mar 12 19:21 foo
```

If **ls –W** is issued, an additional 6 characters, in two groups of 3, follow the original 10 characters. The first group of 3 describes the user-requested audit information; the second group describes auditor-requested audit information.

```
total 11
drwxr-xr-x  fff---     3 ROOT   SYS1    0 Mar 12 19:32 tmp
drwxrwxrwx  fff---     4 ROOT   SYS1    0 Mar 12 19:32 usr
drwxr-xr-x  fff---     2 ROOT   SYS1    0 Mar 12 19:32 bin
-rwxr--r--  fff---     1 ROOT   SYS1  572 Mar 12 19:32 foo
-rwxr--r--  fff---     1 ROOT   SYS1  640 Mar 12 19:33 abc
```

Usage notes for the ls command

1. To display information about a directory from a symbolic link to the directory, either add a trailing slash to the symbolic link name, or use the **-L** option. For example, if the `/etc` directory was converted into a symbolic link, issuing an **ls** on `/etc` without a trailing slash gives you the following information:

   ```
   > ls -l /etc
   lrwxrwxrwx   1 BPXROOT  BIN           12 Oct 18 19:46 /etc -> $SYSNAME/etc
   ```

   However, if you add the trailing slash, the following information about `/etc` is displayed:

   ```
   > ls /etc/
   ```

Information

IBM	**cmx**	**ioepdcf**	**rc**	**yylex.c**
NetQ	**csh.cshrc**	**ldap**	**recover**	**yyparse.c**
Printsrv	**csh.login**	**log**	**security**	**zoneinfo**
TextTools	**dfs**	**magic**	**socks.conf**	
booksrv	**imoisinf**	**mailx.rc**	**startup.mk**	
bpe	**init.options**	**profile**	**utmpx**	

The same information is displayed when the **-L** option is used:

```
ls -L /etc
```

Information

IBM	**cmx**	**ioepdcf**	**rc**	**yylex.c**
NetQ	**csh.cshrc**	**ldap**	**recover**	**yyparse.c**
Printsrv	**csh.login**	**log**	**security**	**zoneinfo**
TextTools	**dfs**	**magic**	**socks.conf**	
booksrv	**imoisinf**	**mailx.rc**	**startup.mk**	

Information
bpe **init.options** **profile** **utmpx**

2. When issuing the **ls** command against a large directory structure, the following message might be returned:

   ```
   FSUM6786  too many directory entries in "dir"
   ```

   To alleviate this problem, set the _CEE_RUNOPTS="HEAP(,,,FREE)" environment variable before invoking the **ls** command. Language Environment will free all unused storage to avoid exhausting the user heap. For more information about heap tuning, see *z/OS Language Environment Programming Reference*.

Environment variables

ls uses the following environment variables:

COLUMNS
Contains the terminal width in columns. **ls** uses this value to determine the number of output columns to write using the **–C** option.

TZ Contains the time zone to be used when displaying date and time strings.

Localization

ls uses the following localization environment variables:
- LANG
- LC_ALL
- LC_COLLATE
- LC_CTYPE
- LC_MESSAGES
- LC_TIME
- LC_SYNTAX
- NLSPATH

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Out of memory
- Inability to find a file's information
- Too many directories
- File or directory not found
- Specified on the command line

2 Incorrect command-line option

Messages

Possible error messages include:

File or directory *name* **is not found**
The requested file or directory does not exist.

Cannot allocate memory for sorting
To sort its output, **ls** needs to allocate memory; this message says that there was not enough memory for the sorting operation.

Too many directory entries in *dir*
This message appears only when **ls** runs out of dynamically allocated memory.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–A**, **–b**, **–E**, **–f**, **–g**, **–L**, **–m**, **–n**, **–o**, **–p**, **–s**, **–W**, and **–x** options are extensions of the POSIX standard.

Related information

Appendix I, "Format of the TZ environment variable," on page 1021 explains how to set the local time zone with the TZ environment variable.

ls-f, **sh**, **tcsh**

mail — Read and send mail messages

Format

mail [**–e** | **–p**] [**–qr**] [**–f** *file...*]
mail [**–t**] *name...*

Note: The **mail** utility is fully supported for compatibility with older UNIX systems. However, it is recommended that the **mailx** utility be used instead because it may provide greater functionality and is considered the standard for portable UNIX applications as defined by POSIX.2 IEEE standard 1003.2-1992.

Description

mail lets you read mail sent to you and sends mail to other users. It has two modes of operation, one for reading mail and one for sending mail. If you start **mail** without any arguments, it checks for mail to be read and then presents the messages in read mode. If you start it with an argument or arguments, it assumes you are sending a message to the address named as the argument and enters send mode. The text of the message is taken from standard input until **mail** encounters either EOF or a line consisting of only a single dot (.).

For example, to read mail, enter:

```
mail
```

To send a mail message to the users Chris and Lee, enter:

```
mail chris lee
```

Options

The **–t** option is used only when sending mail; the others only when reading mail.

–e Tests for the existence of mail and exits. If there is mail in the system mailbox, the return status is successful.

–f Reads mail from *file* instead of the system mailbox. This option is often used to read mail saved in other files.

–p Prints all mail to standard output without querying.

–q Quits the **mail** session after an interrupt signal; normally, an interrupt ends only the message being written.

–r Saves messages in first-in, first-out order, the reverse of the default. Normally, the most recently received message is written first.

–t Lists the recipients at the beginning of the message (default).

Reading mail

When you start **mail** without arguments, **mail** checks your system mailbox for mail. If there is no mail, **mail** exits with a return code of 1; if there is waiting mail, **mail** displays the first message. (If you specify **–p** on the command line, it displays all messages.)

Commands within **mail** control how messages are handled. The following commands are available:

d Deletes the current message.

m[*name...***]**
Sends the current message to the specified user. If a user is not specified, the mail is sent to you.

p Prints the message on the screen again.

q Quits mail, storing any undeleted messages in the file **$HOME/mbox**.

s[*file***]** Saves the message in the specified file. If a file is not specified, **mail** saves the message in **mbox** in your home directory.

w[*file***]** Saves the message (same as **s**), but without header lines.

x Exits mail without changing the mailbox file.

ENTER (or newline)
Displays the next message.

!*command*
Runs *command* using the shell.

+ Displays the next message (same as ENTER or newline).

— Displays the previous message.

***** Displays a summary of internal commands.

Because the commands are read from standard input, you can create **mail** command files and use input redirection to have **mail** execute them.

Sending mail

To send mail, start **mail** with a list of addresses as arguments. Enter the text of the message, and end the message with either EOF or with a single dot (.) on a line followed by a <newline>.

The **–t** option inserts at the beginning of the message a list of the addresses; a path name beginning with a slash (/) is recognized as a valid address (assuming you have the correct permissions).

If the address is not valid or recognized, or if the message is interrupted (see the **–q** option), **mail** stores the message in the file **dead.letter** in the current directory. If it can't create **dead.letter** in the current directory, it creates the file in your home directory. If **dead.letter** already exists, the new contents overwrite the old.

The **mail** program modifies the message text slightly; because lines beginning with `From` (including the trailing space) are used to separate files in the mailbox, **mail** changes any lines in the message that begin with `From` to read `>From`.

Examples

To send the file **how2mail** to user Chris, enter:

```
mail chris < how2mail
```

Usage notes

1. Wherever the POSIX standard doesn't define the behavior of **mail**, this implementation resembles **mailx**.
2. **mail** doesn't require a delivery path or mechanism to the destination, though for most uses, this is preferable.

Environment variables

mail uses the following environment variables:

HOME
: Specifies your home directory; used to locate the **mbox** and **dead.letter** files.

TZ
: Specifies the time zone to be used in date and time strings.

Localization

mail uses the following localization environment variables:

- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

The ability of **mail** to handle double-byte characters (or even 8-bit ASCII depends on the underlying mail transport mechanism. You should restrict all messages to the POSIX portable character set. To send messages containing double-byte characters or even binary files, encode them first with **uuencode**.

Files

mail uses the following files:

dead.letter
: The most recently canceled message.

mbox
: The default file for saving read mail, stored in the directory specified by **HOME**.

Exit values

0
: The session was successfully completed; if reading, there was mail.

1 There was no mail, or the session could not be started.

2 An error occurred after starting the session, or you supplied an invalid option, resulting in a usage message.

Portability

POSIX.2

Because this utility is due to be withdrawn from POSIX, you may want to use **mailx** for portable applications. The ability to write directly to a file is an extension to POSIX.

Limits

Any individual line is limited to LINE_MAX bytes; of course, transport mechanisms between systems may impose shorter limits.

Related information

mailx, **uudecode**, **uuencode**

Appendix I, "Format of the TZ environment variable," on page 1021 also explains how to set the local time zone with the TZ environment variable.

mailx — Send or receive electronic mail

Format

mailx [**–efHiNn**] [**–u** *user*] [*filename*]

mailx [**–FinU**] [**–h** *number*] [**–r** *address*] [**–s** *subject*] *user ...*

Description

mailx helps you read electronic mail messages. It can also send messages to users on your system, but it has no built-in facilities for sending messages to other systems.

The command line:

```
mailx [options] user user user ...
```

sends a mail message to the given users. If you do not specify any users on the command line, **mailx** lets you read incoming mail interactively. For more information, see **sendmail**.

In a double-byte locale, aliases, variables, and addresses can contain double-byte characters.

This description of **mailx** is divided into several sections:
- Options
- General overview
- Command-mode subcommands
- Input-mode subcommands
- Startup files
- Examples

- Environment variables
- Files
- Exit values
- Portability
- Related information

Options

You can use the following options when reading messages:

–e Checks to see if you have any messages waiting to be read. With this option, nothing is displayed. If you have waiting messages, **mailx** exits with a successful status return; otherwise, **mailx** exits with a failure return.

–f *filename*
Looks for messages in the specified file instead of in your current mailbox. If you do not specify *filename*, **mailx** reads messages from **$HOME/mbox**.

–H Displays only the header summary of a message.

–N Does not display the header summary of messages.

–u *user*
Looks for messages in the system mailbox of the specified user. This works only if you have read permission on the user's system mailbox.

You can use the following options only when sending messages:

–F Records your message in a file with the same name as the first user specified on the command line. This option overrides the **record** variable, if it has been set.

–h *number*
Indicates how many "hops" a message has already made from one machine to another (in a network of machines). This option is not intended for most users; network mail software uses the option to prevent infinite loops (the same message cycling through a sequence of machines without ever getting to its intended destination).

–r *address*
Passes the given address to network mail software. If this option is present, it disables all input mode commands. Again, this option is not intended for most users.

–s *subject*
Uses the given *subject* string in the `Subject` heading line of the message. If the subject contains spaces or tab characters, the string should be enclosed in double quotation marks or single quotation marks. If you specify this option on the command line, **mailx** does not prompt you to enter a subject line when you type in the text of the message. The subject accepts at most LINE_MAX-10(2038) bytes. Any subjects longer than that will be truncated at 2038.

–U Converts the address from UNIX-to-UNIX Copy Program (UUCP) style to Internet Protocol standards. This option overrides the effect of the **conv** variable.

This option is not supported.

You can use these options ***for both sending and reading messages:***

–i Ignores interrupts (for example, from pressing <Break> or <Ctrl-c>).

–n Does not initialize your **mailx** session from the system's **/etc/mailx.rc** file.

General overview

This section describes the default behavior of **mailx**.

The simplest command to send a message is:

```
mailx address address address ...
```

where each *address* names someone who is to receive the message. The simplest kind of address is the *login name* of someone else who uses your shell.

You can also send messages as input to commands. To do this, use an address that consists of a pipe symbol (|) followed by a command line that invokes the appropriate command; enclose this whole address in single quotation marks. For example:

```
mailx ROBIN '|cat >save'
```

mails a message to `ROBIN` and also copies the message into a file called **save**.

After you type in the command to send a message, **mailx** asks you to enter the subject of the message (a brief description of what the message is about), and then lets you type in the text of the message. This brief description can be up to 256 characters long. Your message can consist of any number of lines, and may include blank lines. When you finish entering the message, type a line consisting only of a tilde (~), followed by a period (`.`); then press the enter key. This tells **mailx** that the message is ready to be sent.

mailx puts the completed message into a file called the recipient's system mailbox. The message stays in the system mailbox until the recipient asks to read the message. At that point, the message is obtained from the system mailbox and displayed on the recipient's workstation. The message is then saved in the recipient's personal mailbox. Since this is typically a file named **mbox** in the recipient's home directory, we use the name *mbox* to represent the personal mailbox and *mailbox* for a system mailbox.

The simplest way to read incoming messages is to type the command **mailx** (with no addresses on the command line). This starts an *interactive session* in which **mailx** lets you read your mail and perform other operations. For example, you can display new messages, delete old ones, reply to messages, or forward them to someone else, and so on. When you are performing operations in this way, you are in *command mode.* When you are typing in the text of a message, you are in *input mode*.

A message consists of a sequence of *header lines,* followed by the body of the message. The header lines tell who sent the message, the time and date that the message was sent, the subject of the message, and so on. **mailx** automatically creates header lines. Some of the common header lines are:

Cc: *name name* **...**
: Stands for “carbon copies”. This indicates that copies of this message are to be sent to the specified recipients. The names of these recipients appear in the header lines of everyone receiving the message.

Bcc: *name name* **...**
: Stands for “blind carbon copies”. This is similar to `Cc:`, but the names of

people receiving carbon copies do not appear in the header lines of the message. Recipients do not know that these people received a copy of the message.

Subject: *text*
Gives the subject of the message.

To: *name name* **...**
Gives the names of people who were sent the message directly.

All messages are in one of the following states:

deleted You used a **delete**, **dp**, or **dt** command to delete the message. When **mailx** quits, messages in this state are deleted.

new The message is in the system mailbox and you have not yet read it or otherwise changed its state. When **mailx** quits, messages in this state are kept in your system mailbox.

preserved
You used a **preserve** command on the message. When **mailx** quits, messages in this state are kept in their current locations.

read You used one of the following commands on the message:

```
~F          copy        Print       type
~f          mbox        print       undelete
~M          next        top
~m          pipe        Type
```

or you used **delete** , **dp**, or **dt** on the preceding message and the **autoprint** variable was set. When **mailx** quits and you are in your system mailbox, **read** messages are kept in your personal mailbox—unless the **hold** variable is set, in which case, **read** messages are kept in your system mailbox. If you are in your personal or a secondary mailbox when **mailx** quits, **read** messages are kept in their current location.

saved You used a **save** or **write** command on the message. If the current mailbox is the system mailbox and the variable **keepsave** was set, messages in the state saved are saved to the **mbox**. If the current mailbox is the system mailbox and you used a **quit** or **file** command to exit the current mailbox, messages in the state saved are deleted from the current mailbox.

unread You have run more than one **mailx** session with the message in the system mailbox and you have not read it or otherwise changed its state. When **mailx** quits, messages in this state are kept in your system mailbox.

Command-mode subcommands

The standard format of a command-mode subcommand is:

[**subcommand**][*refs*][*arguments*]

If no **subcommand** is specified, the default **subcommand** depends on the setting of the **_UNIX03** variable:

If the variable **_UNIX03=YES** is set, then **n[ext]** is assumed.

If the variable **_UNIX03** is unset or is not set to **YES**, then **p[rint]** is assumed.

The *refs* argument indicates the messages to which you want to apply the **subcommand**. **mailx** numbers incoming messages sequentially as they are received. The easiest way to refer to a message is to give its number. For example, the subcommand:

```
p 3
```

displays message number 3. At any point in a **mailx** session, there is one message that is considered the *current message.* This is the message you most recently did something with (for example, the one you most recently read). If you omit the *refs* argument in a subcommand that uses *refs*, the subcommand works with the current message.

You can also use special notations as the *refs* value:

refs	Meaning
n	Message number `n`
n-m	Messages `n` through `m`
.	The current message
^	The first undeleted message (or first deleted message for *undelete*)
$	The last message
+	Next message
-	Previous message
*	All messages
user	All messages from the given user
/string	All messages with `string` in the subject line (the case of characters in `string` is ignored)
:d	All deleted messages
:n	All new messages
:o	All old messages
:r	All messages that have already been read
:u	All unread messages

Several *refs* arguments may be specified for the same subcommand, separated by spaces. For example:

```
p alice lewis
```

displays all messages from `alice` plus all messages from `lewis`.

The arguments allowed at the end of a command-mode subcommand depend on the subcommand itself. If a subcommand allows a file name as an argument, you can use the usual file name generation characters in the file name (see **sh**).

File names, where expected, are subjected to the following transformation, in sequence:

- If the file name begins with an unquoted plus sign, and the **folder** variable is defined, the plus sign will be replaced by the value of the **folder** variable followed by a slash. If the **folder** variable is unset or set to null, the file name will be unchanged.
- Shell word expansions will be applied to the file name. If more than one path name results from this expansion and the command is expecting one file, the multiple path names will be combined into one argument.

The following list shows the subcommands recognized in command mode. In every subcommand name, some characters are enclosed in square brackets. These characters are optional. For example, the **p[rint]** command may be given as **p**, **pr**, **pri**, **prin** or **print**.

a[lias] [*alias* **[***name* **...]]**
Sets up an address *alias*. If you enter a subcommand to send mail to the given *alias*, the messages are sent to the given list of names. For example, you might enter the subcommand:

```
alias joe JSMITH
```

From this point onward, you can address messages to `joe` and they are sent to `jsmith`. You may also set up an alias for several people, as in:

```
alias choir SOPRANO ALTO TENOR BASS
```

After you have done this, you can send messages to `choir` and they are sent to the names that follow `choir` in the command.

Alias substitution only takes place when *alias* is used as the whole mail address. Alias substitution doesn't take place when replying to a message that has an *alias* match in the addresses.

If you use only one argument, **alias** lists the value of that alias. For example, `alias joe` would display `jsmith`. Entering the **alias** subcommand without any arguments displays a list of the currently defined aliases.

Note: Aliases entered interactively remain in effect only until the end of the current interactive session. To make an alias permanent, include the **alias** subcommand in your startup file (see "Startup files" on page 429). See also **group**.

alt[ernates] *name*
Lists a set of alternate names for your own login name. This is useful for people who login under several different names. When you reply to a message, **mailx** typically sends your reply to the author of the message and all the recipients as well; however, it does not send the message to any of your alternate login names. You don't have to worry about sending mail to yourself.

Specifying alternates without names displays your list of currently defined alternate names.

cd *directory*
Makes *directory* your new working directory. If no *directory* is specified, **cd** goes to your **HOME** directory.

ch[dir] *directory*
Is the same as **cd**.

c[opy] [*refs***] [***filename***]**
Copies the messages referred to by *refs* into the given file. The *filename* must be specified. If the file does not already exist, it is created.

If no *refs* are specified, the current message is saved. If no *filename* is specified, your *mbox* is saved.

This operation does not mark the message as saved; if it was previously unread, it is still regarded as an unread message. Thus, the original message remains in your system mailbox. See also **save**.

C[opy] [*refs*]
Is similar to the **copy** command, except that the messages referred to are saved in a file the name of which is derived from the author of the first message referred to. The name of the file is the author's name, stripped of any network addressing. If the **folder** variable is set, the file is saved to the specified directory. The copied messages are not marked as "saved". If *refs* is not specified, the current message is copied.

d[elete] [*refs*]
Deletes the specified messages from your system *mailbox*. If *refs* is not specified, the current message is deleted. After a delete operation, the current message is set to the message after the last message deleted. Deleted messages are not thrown away until you end your session with the current mailbox (see **quit** and **file**). Until then, they can be undeleted (see **undelete**).

di[scard] [*header*...]
Does not display the given *header* fields when displaying a message. For example:

```
discard References
```

tells **mailx** not to display the `References` line at the beginning of any mail message. These header lines are retained when the message is saved; they are just not shown when the message is displayed. See also **ignore** and **retain**.

dp [*refs*]
Deletes the specified messages and then displays the message after the last message deleted. If there is no subsequent message, **mailx** displays its command prompt.

dt [*refs*]
Is the same as the **dp** subcommand.

ec[ho] *string* ...
Echoes the given *strings* (like the **echo** subcommand).

e[dit] [*refs*]
Lets you edit the messages specified by *refs*. The messages are stored in a temporary file and an editor is invoked to let you edit the file. The default editor is **ed**, but you can change this using the **EDITOR** environment variable.

ex[it] Quits **mailx** without changing the system *mailbox*. Contrast this with **quit**, which ordinarily removes from the system mailbox those messages you've read, saved, or deleted.

fi[le] [*filename*]
Quits the system mailbox (as if a **q[uit]** subcommand were run) and then reads in the specified file as the new mailbox to examine. If no file name is specified, the default is your current mailbox.

Several special strings can be used in place of *filename*:

`%` Your system mailbox.

`%user` The system mailbox for user

`#` The previous file

`&` Your *mbox* (personal mailbox)

`+file` The named file in the **folder** directory

fold[er] [*filename*]
Is the same as the **file** subcommand.

folders
Displays the names of the files in the directory given by the **folder** variable. See "Environment variables" on page 430.

F[ollowup] [*refs*]
Replies to the first message given in *refs*; **mailx** sends this reply to the authors of every message given in *refs*. The `Subject` line is taken from the first message in *refs*. Your reply is automatically saved in a file which derives its name from the author of the message to which you are replying.

If the variable **_UNIX03=YES** is set, then the command overrides the **record** variable if **record** is set.

If the variable **_UNIX03** is unset or is not set to **YES**, then the command does not override the **record** variable.

To create your reply, **mailx** puts you into input mode, where you can use all of the input mode commands.

fo[llowup] [*ref*]
Replies to the specified message; if no message *ref* is given, you reply to the current message. Your reply is automatically saved in a file which derives its name from the author of the message to which you are replying. This overrides the **record** environment variable if **record** is set.

To create your reply, **mailx** puts you into input mode, where you can use all of the input mode commands.

f[rom] [*refs*]
Displays the header summary for the specified messages. If *refs* is not given, the current message is used.

g[roup] [*alias* [*name* **...**]]
Is the same as the **alias** command.

h[eaders] [*ref*]
Displays the headers of a screenful of messages surrounding the message given by *ref*. The number of lines in a screen is given by the **screen** variable. If no *ref* is specified, the current message doesn't change; otherwise the current message is changed to the message specified by *ref*.

hel[p] Displays a summary of the command-mode subcommands.

ho[ld] [*refs*]
Retains the specified messages in your system mailbox. For example, you might decide to **ho**ld a message if you read it, but decide not to act upon it immediately. If *refs* is not specified, the current message is held. If any of the specified messages have been marked as deleted, the **hold** subcommand overrides that and still retains the messages. Subsequent **delete**, **dp**, and **dt** commands during the same **mailx** session can delete files marked for retention. See also **preserve** and the variables **hold** and **keepsave**.

i[f] *code mailx subcommands* | **[el[se]** *mailx subcommands*] | **[en[dif]]**
Is primarily intended for use in startup files. The *code* must be the character `r` or `s`. If it is `r`, the first set of mailx subcommands are executed if **mailx** is in receive mode, and the second set if **mailx** is in send mode. If *code* is `s`, the opposite is true. The **else** part is optional. See "Startup files" on page 429.

ig[nore] [*header* **...**]
Is the same as the **discard** subcommand.

l[ist] Displays the names of all command-mode subcommands.

m[ail] *address* **...**
Sends a message to the specified recipients. **mailx** goes into input mode to let you enter the text of the message.

mb[ox] [*refs*]
Indicates that the given messages are to be saved in your *mbox* (personal mailbox) when **mailx** quits normally (that is, through the **quit** command as opposed to **exit**).

n[ext] [*refs*]
Goes to the next message in the mailbox that appears in the list of *refs*. For example:

```
n user
```

goes to the next message from the specified *user*.

pi[pe] [[*refs*] *command*]
Pipes the messages given by *refs* through the specified shell *command*. These messages are considered read. If *refs* is not specified, the current message is used. If no *command* is specified, **mailx** uses the command specified by the **cmd** variable. See "Environment variables" on page 430. If the **page** variable has a value, a form feed character is sent into the pipe after every message.

The subcommand | [*refs*] [*command*] is equivalent to **pipe**.

pre[serve] [*refs*]
Is the same as the **hold** subcommand.

P[rint] [*refs*]
Displays the specified messages on the screen. If *refs* is not specified, the current message is displayed. All header fields are displayed; the **discard**, **ignore** and **retain** subcommands do not affect **Print**. If the **crt** variable is set to an integer, messages with more lines than that integer are "paginated" using the command specified by the **PAGER** variable.

p[rint] [*refs*]
Displays the specified messages on the screen. If *refs* is not specified, the current message is displayed. Header fields specified by **discard**, **ignore** and **retain** subcommands affect **print**. If the **crt** variable is set to an integer, messages with more lines than that integer are "paginated" using the command specified by the **PAGER** variable. For more information, see "Environment variables" on page 430.

q[uit] Ends a **mailx** session. This is the usual method to leave **mailx**. Messages that have been read but not saved or deleted are stored in your *mbox* (personal mailbox). Messages that are still unread are retained in your system mailbox. Messages that have been deleted or explicitly saved in other files are discarded. Typing the end-of-file character has the same effect.

R[eply] [*refs*]
Sends a reply to the authors of each of the messages specified by *refs*. If *refs* is not specified, the current message is used. The `Subject` line of the

reply message is taken from the first message in *refs*. If the **record** environment variable is set to a file name, your reply message is appended to the end of that file.

Normally, you use **Reply** if you just want to send your reply to the author of a message, and **reply** if you want to send your reply to the author and all recipients. If set, the **flipr** environment variable reverses the meanings of the **R** and **r** commands. See "Environment variables" on page 430.

r[eply] [*ref***]**
Sends a reply to the author of a specific message, and all other recipients of the message. If *ref* is not specified, **mailx** replies to the current message. If the **record** environment variable is set to a file name, your reply message is appended to the end of that file.

R[espond] [*refs***]**
Is the same as the **Reply** subcommand.

r[espond] [*ref***]**
Is the same as the **reply** subcommand.

ret[ain] [*header* **...]**
Is the opposite of the **discard** subcommand. It tells **mailx** to display the given *header* fields when displaying a message. The comparison of *header* fields is not case sensitive. You can use **retain** to override existing **discard** and **ignore** commands. If you do not specify any *header* fields, **retain** displays a list of currently retained header fields.

S[ave] [*refs***]**
Saves the specified messages in a file the name of which is taken from the author of the first message (the file name is the author's name, without any attached network addressing). If the **folder** variable is set, the file is saved to the specified directory.

s[ave] [*refs***][***filename***]**
Saves the specified messages in the given file. If *refs* is not given, the current message is added to the *mbox*. (The value of the **append** variable determines whether the message is added to the beginning or the end of the *mbox*). The file is created if it does not already exist. If you do not specify *filename*, **mailx** saves the messages in *mbox* (your personal mailbox). A message that has been saved with **s**ave is normally deleted from *mailbox* when *mailx* ends (see **quit**); but see the variables **hold** and **keepsave**.

se[t] *name*
Defines a variable with the given *name* and assigns it a null value. If you omit *name*, **set** displays a list of all defined variables and their values.

se[t] *name***=***value*
Defines a variable with the given *name* and assigns it the given *value*, which may be a string or a number.

se[t] no*name*
Is the same as the **unset** *name* subcommand.

sh[ell] Invokes the shell given by the **SHELL** environment variable.

si[ze] [*refs***]**
Displays the size in bytes of each of the specified messages. If no *refs* are specified, the current message is used.

so[urce] *file*
Reads the specified text *file*, executes its contents as command-mode subcommands, and then returns to read more commands from the original source.

to[p] [*refs*]
Displays the first few lines of each of the specified messages. If *refs* is not specified, the current message is used. If the **toplines** variable has a numeric value, that many lines are displayed from each message; otherwise, five lines are displayed from each message.

tou[ch] [*refs*]
"Touches" the specified messages, making them appear to have been read. This means that when you **quit mailx**, the messages are saved in your *mbox* (personal mailbox) if they are not deleted or explicitly saved in another file. If *refs* is not specified, the current message is touched.

T[ype] [*refs*]
Is the same as the **Print** subcommand.

t[ype] [*refs*]
Is the same as the **print** command.

una[lias] [*alias*[*name* **...**]]
Deletes specified alias names.

u[ndelete] [*refs*]
Restores previously deleted messages. When messages are deleted, they are not discarded immediately; they are just marked for deletion and are deleted when **mailx** ends. Until **mailx** ends, you can use **undelete** to restore the specified messages. You cannot **undelete** messages deleted in previous sessions. If you do not specify *refs*, this command restores the first deleted (but not yet undeleted) message following the current message; if no such message exists, it restores the last deleted (but not yet undeleted) message preceding the current message. If the **autoprint** variable is set, the last restored message is displayed. This is the only subcommand that lets you give a *ref* to a message that has been deleted.

U[nread] [*refs*]
Marks the specified messages as unread.

uns[et] *name* **...**
Discards the specified variables.

ve[rsion]
Displays version information about **mailx**.

v[isual] [*refs*]
Edits the specified messages with a screen editor. If *refs* is not specified, the current message is edited. The messages are saved in a temporary file and the screen editor is invoked to edit that file. The editor used is given by the **VISUAL** variable. See "Environment variables" on page 430.

w[rite] [*refs*] *filename*
Writes the specified messages into the given file. If *refs* is not specified, the current message is written. **write** is the same as **save**, except that it does not write out the header lines and the blank line at the end of the message.

x[it] Is the same as the **exit** command.

z[+|-] Scrolls the header display forward (if **z** or **z+** is specified) or backward (if **z-** is specified) one screenful.

! *command*
Executes the given shell *command*. For example:

```
!lc
```

lists all files in the current directory. The shell that will be used to run the command is given by the SHELL environment variable. See "Environment variables" on page 430.

#*comment*
Specifies that **mailx** should ignore everything from the **#** to the end of the line. This is useful for putting comments into startup files.

? Is the same as the **help** command (it displays a summary of the command-mode subcommands).

= Displays the current message number.

Input-mode subcommands

You can use input-mode subcommands when entering the text of a message. You must type mode subcommands at the beginning of an input line; you cannot type them in the middle of a line. By default, each input-mode subcommand begins with the tilde (~) character, called the *escape character.* You can use the **escape** variable to change the escape character, but in the documentation that follows, we always use tilde.

~. Marks the end of input in a mail message.

~? Displays a summary of the input-mode subcommands.

~A Inserts the autograph string at this point in the message. This autograph string is given by the **Sign** variable.

~a Is similar to **~A**, except that it uses the variable **sign**.

~b *name* **...**
Adds the specified names to the blind carbon copy list.

~c *name* **...**
Adds the specified names to the carbon copy list.

~d Reads in the **dead.letter** file.

~e Invokes an editor on the message that you have composed. The **editor** variable determines the editor that is invoked.

~F [*refs***]**
Forwards the given messages. The text of the messages is inserted at this point in the message you are composing. The message headers are also inserted with all header fields regardless of the **discard**, **ignore**, and **retain** subcommands. This is valid only when you entered **mailx** in command mode and then went into input mode to compose a message.

~f [*refs***]**
Is similar to ~F except that the header fields included are determined by the **discard**, **ignore**, and **retain** subcommands.

~h Prompts you to enter the following header lines:

```
Subject   Cc   Bcc   To
```

For some of these, **mailx** displays an initial value for the header. You can edit this initial value as if you had just typed it in yourself, using backspaces and line deletes.

~i *name*
Inserts the value of the named variable followed by a newline at this point in the message.

~M [*refs*]
Inserts the text of the specified messages at this point in the message. If *refs* is not specified, the current message is used. Messages inserted in this way have each line prefixed with the value of the **indentprefix** variable. The message headers are also inserted with all header fields included regardless of the **discard**, **ignore**, and **retain** subcommands. This is valid only when you entered **mailx** in command mode and then went into input mode to reply to a message.

~m [*refs*]
Is similar to ~M, except that the header fields are determined by the **discard**, **ignore**, and **retain** subcommands.

~p Displays the message being composed.

~q Quits input mode as if you had interrupted the message. If you have already composed part of a message, the partial message is saved in the **dead.letter** file; the description of the **dead** environment variable has more information..

~r *filename*
Reads in the contents of the specified file and adds that text at this point in the message.

~s *text* Sets the `Subject` line to the given *text*.

~t *address address ...*
Adds the given addresses to the `To:` list (people who will receive the message).

~v Invokes a screen (visual) editor on the message that you have composed. The **VISUAL** variable determines the editor that is invoked.

~w *file* Writes the current text of your message to the specified *file*. The header lines for the message are not written.

~x Quits in the same way as ~q, except that the message is not saved in the **dead.letter** file.

~< *filename*
Is the same as the ~r command.

~< !*command*
Runs the given shell *command* and adds the standard output of that command at this point in the message. For example, your message might contain:

```
My program is giving me this odd output:
~< !prog
What do you think is causing it?
```

~: *mail_command*
Runs the given command-mode *mail_command*. This is valid only when you entered **mailx** in command mode and then went into input mode to compose a message.

~_ *mail_command*
Is the same as the **~:** command.

~! *command*
Runs the given shell *command*. For example, you can use:

```
>~! ls
```

to get a list of files in the working directory. The shell that is invoked to run the command is given by the **SHELL** environment variable. If the **bang** variable is set, **mailx** replaces each unescaped exclamation mark (!) in *command* with the command run by the previous command or ~! command escape.

~ *command*
Pipes the current message through the specified shell *command*. If the *command* ends with a successful exit status, the output of the command replaces the text of the current message. For example:

```
~|fmt
```

fills and justifies the lines of your message and replaces the message with the formatted message. ~| uses the shell given by the **SHELL** environment variable to run *command*.

Startup files

When you run **mailx** in command mode, **mailx** does the following:

- Sets all variables to their default values. **mailx** processes command-line options, using them to override any corresponding default values.
- Imports appropriate external environment variables, using them to override any corresponding default values.
- Reads commands from the system startup file, **/etc/mailx.rc**. This sets up variable values and definitions that should be common to all users. If you do not want **mailx** to read the system startup file, use the **–n** option on the **mailx** command line.
- After reading and processing the system startup file, **mailx** does the same with a personal startup file, which is **MAILRC** by default. This is a file in your **HOME** directory. The name of the file is **.mailrc.**

Startup files typically set up display options and define aliases. However, any command is valid in a startup file except for the following:

- **Copy**
- **edit**
- **followup**
- **Followup**
- **hold**
- **mail**
- **preserve**
- **reply**
- **Reply**
- **respond**
- **Respond**
- **shell**
- **visual**
- **!**

If a line in a startup file contains an error or an incorrect command, the rest of the startup file is ignored. **mailx** ignores blank lines in a startup file.

Examples

The following example composes and sends a message to several users. Items shown in bold are output by **mailx**.

```
mailx JEAN
Subject: Greetings
This is just a short note to say hello.
 ~c JUAN JOHN JOHANN
 ~.
```

On the first line, the message is just addressed to `jean`. The **~c** line adds more people who will receive copies of the message.

Environment variables

A large number of variables are used to control the behavior of **mailx**. These environment variables are divided into two classes: those that always come from the external environment, and those that may be set up in either the external environment or within a **mailx** session.

The following variables always come from the external environment; they can be changed inside a **mailx** session, except where marked.

DEAD
Gives the name of a file that can be used as the **dead.letter** file. Partial messages are saved in this file if an interrupt or error occurs during creation of the message or delivery. By default, the name of this file is **$HOME/dead.letter**.

EDITOR
Gives a command, possibly with options, that is run when using the command mode **edit** or the input mode **~e**. The default is **ed** (see "ed — Use the ed line-oriented text editor" on page 278 for more information about **ed**).

HOME
Gives the name of your home directory. This cannot be changed inside **mailx** .

LISTER
Gives a command, possibly with options, that **mailx** invokes when displaying the content of the **folder** directory for the **folders** subcommand. If this variable is null or unset, **mailx** uses **ls**. By default, this variable is unset.

LOGNAME
Gives your login name.

MAIL Gives the path name of the user's mailbox file for purposes of incoming mail notification.

MAILDIR
Gives the name of the directory where system mailboxes are stored. If this is not set, the default is **/usr/mail**. The actual name of a user's system mailbox is derived in a system-dependent way by combining **MAILDIR** and the user's login name. For **mailx** to work properly, the **MAILDIR** directory must exist.

MAILRC
Gives the name of your startup file. This cannot be changed inside **mailx**.

By default, **MAILRC** has the value **$HOME/.mailrc**. For more information about startup files, see "Startup files" on page 429.

MBOX
Gives the name of your mbox (personal mailbox) file. Messages that have been read but not saved elsewhere are saved here when you run **quit** (but not when you run **exit**). The default is **$HOME/mbox**.

PAGER
Gives a command, possibly including options. **mailx** sends display output through this command if the output is longer than the screen length given by **crt**. The default value is more (see "more — Display files on a page-by-page basis" on page 475 for more information about **more**).

SHELL
Gives a command, possibly with options. **mailx** assumes that this command is a command interpreter. **mailx** invokes this command interpreter whenever it is asked to run a system command (for example, through the ! command-mode command). The default is **sh** (see "sh — Invoke a shell" on page 604 for more information about **sh**).

TERM Contains the name of the terminal type. This cannot be changed inside **mailx**.

TZ This variable may determine the time zone used to calculate date and time strings written in **mailx**. This cannot be changed inside **mailx** .

_UNIX03
For more information about the effect of _UNIX03 on this command, see Appendix N, "Shell commands changed for UNIX03," on page 1039.

VISUAL
Gives a command, possibly with options, that **mailx** invokes when using the command-mode **visual** subcommand or the input mode **~v** subcommand. The default is **vi** (see "vi — Use the display-oriented interactive text editor" on page 828 for more information about **vi**).

The HOME and LOGNAME variables must be set before you enter **mailx**. Otherwise, **mailx** will not work properly. The TZ variables can only be set before you enter **mailx**. If not set or set to null, a default time zone ("UTC0") will be used. These variables are typically set during shell login. (You can login with the**OMVS** TSO/E command, **telnet**, **rlogin**, or **ssh**.) If you do not log in, you must set the variables in some other way, using the commands:

```
export LOGNAME=name
export HOME=directory
```

The remaining variables can be set in the external environment or in the course of a **mailx** session. You can set or change the value of a variable with the **set** subcommand; you can discard a variable with the **unset** subcommand. You may find it convenient to create a startup file that sets these variables according to your preferences; this eliminates the need to set variables each time you enter **mailx**.

Many of the following variables represent on-off options. If you set the variable itself (to any value), the option is turned on. To turn the option off, you can unset the variable, or set a variable consisting of *no* followed by the name of the original variable. For example, setting **autoprint** turns the autoprint option on, and setting **noautoprint** turns it off.

allnet Assumes that network addresses with the same login component refer to the same person. Network addresses typically consist of several

components, giving information that lets a mail server identify a machine on the network, a route to that machine, and the login name of a user on that machine. **mailx** assumes that the login name is the last component. For example:

```
print name
```

displays all messages that originated from the same login `name`, regardless of the rest of the network address. The default is **noallnet**, where different addresses are assumed to be different users, even if the login name components are the same.

append
Appends messages to the end of the *mbox* file (your personal mailbox) after termination. The default is **noappend**; messages are placed at the beginning of the *mbox* file instead of the end.

ask Prompts you for a `Subject:` line when composing a message (if you have not already specified one with the **–s** option). This option is on by default; to turn it off, set *noask*. *ask* is the same as **asksub**. **noask** is the same as **noasksub**.

askbcc
Prompts you for a `Bcc:` list when composing a message. The default is **noaskbcc**; you are not prompted.

askcc Prompts you for a `Cc:` list when composing a message. The default is **noaskcc**; you are not prompted.

asksub
Prompts you for a `Subject:` line when composing a message (if you have not already specified one with the **–s** option). This option is turned on by default; to turn it off, set **noasksub**. **asksub** is the same as **ask**. **noasksub** is the same as **noask**.

autoprint
Automatically displays the last message deleted with the **delete** subcommand or the last message undeleted with **undelete**. The default is **noautoprint**; you are not shown messages that you delete or undelete.

bang Records shell commands run inside the **mailx** session (for example, through the **~!** input-mode command). Then, if you issue a shell command and the shell command contains a `!` character, **mailx** replaces that character with the command line for the previous shell command. The default is **nobang**, in which case a `!` in a shell command line is not treated specially.

cmd Contains a command, possibly with options. This specifies a default command line to be used for the command-mode **pipe** subcommand. For example:

```
set cmd="cat"
```

pipes messages through **cat** when the **pipe** subcommand is invoked. The default is **nocmd**.

crt Contains an integer number. If a message has more than this number of lines, the message is piped through the command given by the **PAGER** variable, whenever the message is displayed. **crt** is not set; the default is **nocrt**.

debug Enables verbose diagnostics for debugging. Messages are not delivered. The default is **nodebug**.

dot Accepts a line consisting only of a dot (**.**) to indicate the end of a message in input mode. Thus **.** is equivalent to ~.. The default is **nodot**. If **ignoreeof** is set, **mailx** ignores a setting of **nodot**; the period is the only way to end input mode.

escape Gives the character used to begin input-mode subcommands. The default is the tilde (~). If this variable is unset, tilde is used as the escaping character. If this variable is set to null, **mailx** disables command escaping.

flipr Reverses the meanings of the **R** and **r** subcommands. The default is **noflipr**. See also **Replyall**.

folder Contains the name of a directory in which **mailx** saves mail files, if you use a plus sign + in front of the filename. This lets you specify a standard directory for saving mail files. Whenever you specify a filename for a **mailx** command, putting a plus sign (+) in front of the name specifies that the file is to be accessed or stored in the **folder** directory.

If the value of **folder** begins with a slash, it is taken as an absolute path name; otherwise, **mailx** assumes that the directory is directly under your HOME directory. The default is **nofolder**. If you want to use + in file names that appear on the **mailx** command line itself (as opposed to commands in a **mailx** session), you must make **folder** an exported shell environment variable.

header
Displays a summary of message headers at the beginning of a **mailx** command-mode session. This is the default.

hold Keeps all messages in your system mailbox instead of saving them in your personal *mbox*. The default is **nohold**.

ignore Ignores interrupts received while composing a message. The default is **noignore**.

ignoreeof
Ignores end-of-file markers found while entering a message. The message can be ended by "**.**" or **~.** on a line by itself. The default is **noignoreeof**.

indent Contains a string that **mailx** uses as a prefix to each line in messages that ~m and ~M insert. The default is one tab character.

indentprefix
As with **indent**, contains a string that **mailx** uses as a prefix to each line in messages that ~m and ~M insert. The default is one tab character. If both **indent** and **indentprefix** are set, **indentprefix** takes precedence.

keep Does not remove your system mailbox if the mailbox contains no messages. The mailbox is truncated to zero length—that is, it is merely emptied, although it still exists. If the default **nokeep** is in effect, empty mailboxes are removed.

keepsave
Keeps messages in your system mailbox even if they have been saved in other files. The default, **nokeepsave**, deletes messages from the system mailbox if they have been saved elsewhere.

mailserv
Identifies the mail server being used for remote mail.

metoo When replying to a message with your login name in the recipient list, sends a reply to all other recipients, the author, and you. If **nometoo** is set, you are not to be sent the reply. The default is **nometoo**.

onehop
Attempts to send replies directly to the recipients instead of going through the original author's machine. When you reply to a message, your reply is sent to the author and to all recipients of the message. On a network, **mailx** normally specifies the recipient addresses so that all the replies go to the original author's machine first, and then on to the other recipients. The default is **noonehop**.

outfolder
Causes files used to record outgoing messages (see the description of **record**) to be located in the directory given by folder unless folder contains an absolute path name.

The default is **nooutfolder**.

page Tells the **pipe** subcommand to insert a form-feed character after each message that it sends through the pipe. The default is **nopage**.

prompt
Contains a string that **mailx** displays to prompt for output in command mode. The default is a question mark followed by a space (`? `).

quiet Does not display the opening message and version number when **mailx** begins a session. The default is **noquiet**.

record Contains a file name where every message you send is to be recorded. If **record** is not an absolute path name and the **outfolder** variable has not been set, the file is located in the current directory. If the **outfolder** variable is set, the file is located in your **folder** directory. The default is **norecord**.

replyall
Reverses the senses of the **reply** and **Reply** subcommands (so that **reply** replies only to the author of a message, and **Reply** replies to the author and all other recipients). See also **flipr**.

save Saves messages in your **dead.letter** file if they are interrupted while being composed. The name of your **dead.letter** file is given by the **dead** variable. Setting **nosave** disables this automatic save feature. The default is **save**.

screen Gives the number of headers that are to be displayed by the **headers** and **z** subcommands. If **screen** is not specified, the current window size shall be used to determine the number of headers displayed.

sendmail
Contains a command, possibly with options, that **mailx** invokes to send mail. The default is **/usr/lib/tsmail**. It can be any command that takes addresses on the command line and message contents on standard input.

sendwait
When sending a message through a network, **mailx** waits for the mail server to finish before returning to your session. Normally, it just submits the message to the server and then returns immediately. The default is **nosendwait**.

showto
When displaying a header summary, displays the recipient's name instead of the author's for messages where you are the author. The default is **noshowto**.

sign Contains a string that is inserted into a message when you use the input mode **~a** subcommand. **mailx** interprets *n* and *t* in this string as the newline and tab characters, respectively. The default is **nosign**.

Sign Contains a string that is inserted into a message when you use the input mode **~A** subcommand. The default is **noSign**.

toplines
Gives the number of header lines that the **top** subcommand is to display. The default is 5.

Files

mailx uses the following files:

/etc/mailx.rc
System-wide startup file.

$MAILRC
Personal startup file. By default, **MAILRC** has the value **$HOME/.mailrc**.

$HOME/mbox
Default location to save read messages. You can choose a different file by assigning the file name to the environment variable **MBOX.**

$MAILDIR
Directory containing system mailboxes. By default, this is **/usr/mail**. The system programmer must create the **MAILDIR** directory if it does not already exist. See *z/OS UNIX System Services Planning* for information about electronic mail.

If you use a system mailbox directory other than **/usr/mail**, identify it in the $MAIL environment variable in **/etc/profile**. See the section on customizing **/etc/profile** in *z/OS UNIX System Services Planning*.

$HOME/dead.letter
Default location to save partial letters.

Localization

mailx uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0
- Successfully sent. (However, this does not guarantee that the mail was successfully received.)
- 0 is returned if **-e** is specified and mail was found.

1 Returned if **–e** is specified and mail was not found or an error occurred. Also returned to indicate failure due to any of the following:
- There is no mail to read.
- Inability to create temporary file name or temporary file.
- Receipt of user interrupt while message was being composed.
- Inability to determine the user's identity.

2 Failure due to any of the following:
- Missing *number* after **–h**
- Missing *address* after **–r**
- Missing *subject* after **–s**
- Missing *user* after **–u**
- Incorrect command-line option
- Use of interactive options when not using command interactively

Portability

POSIX.2, X/Open Portability Guide, UNIX System V.

UNIX System V has a compatible **mailx** utility, whereas Berkeley Software Distribution (BSD) has a similar utility, known as **Mail**.

The **–F**, **–r**, and **–U** options; the **Copy**, **echo**, **followup**, **Followup**, **Save**, **Unread**, and **version** subcommands; and the **allnet**, **conv**, **mailserv**, **onehop**, **replyall**, **sendmail**, and **sendwait** variables are extensions of the POSIX standard.

Related information

echo, **ed**, **sh**, **vi**

make — Maintain program-generated and interdependent files

Format

make [**–EeinpqrstuVvx**] [**–k**|**–S**] [**–c** *dir*] [**–f** *file*] ...
[*macro definition* ...] [**–D** *macro definition* ...] [*target* ...]

Description

make helps you manage projects containing a set of interdependent files, such as a program with many source and object files, or a document built from source files, macro files, and so on. **make** keeps all such files up to date with one another. If one file changes, **make** updates all the other files that depend on the changed file.

Note: This implementation of **make** features the `.POSIX` special target to provide maximum portability. When you specify this target, **make** processes the makefile as specified in the POSIX standard. For details, see the description of `.POSIX` in "Targets" on page 438.

In a double-byte locale, environment variable values, here-documents, and the command line may all contain environment values.

Options

–c *dir* Attempts to change into the specified directory when **make** starts up. If **make** cannot change to the directory, an error message is printed. This is useful for recursive makefiles when building in a different directory.

–D *macro definition*
Define *macro* on the command line before reading any *makefile.* Use the same form as a normal macro definition (*macro=string*). If you use this option, **make** assigns the value to the macro before reading the makefile; any definition of the same macro contained in the makefile supersedes this definition.

Note: **make** uses any macros defined in this way before reading any makefile, including the startup file. This allows you to define a startup file by providing a value for **MAKESTARTUP** on the command line:

```
make –D MAKESTARTUP=$HOME/project/startup.mk
```

–E Suppresses reading of the environment. If you do not specify either **–E** or **–e**, **make** reads the environment before reading the makefile.

–e Reads the environment *after* reading the makefile. If neither **–E** nor **–e** are specified, **make** reads the environment *before* reading the makefile, except for the **SHELL** environment variable, which you must explicitly export. This option does not affect the value of **MAKEFLAGS**.

–f *file* Uses *file* as the source for the makefile description. **make** ignores the makefiles specified as prerequisites to the `.MAKEFILES` target. If you specify a minus sign (-) in place of *file*, **make** reads the standard input. (In other words, **make** expects you to enter the makefile from the terminal or to redirect it from a file.) You can use more than one **–f** option.

–i Tells **make** to ignore all errors and continue making other targets. This is equivalent to the `.IGNORE` attribute or macro.

–k Makes all independent targets, even if an error occurs. Ordinarily, **make** stops after a command returns a nonzero status. Specifying **–k** tells **make** to ignore the error and continue to make other targets, as long as they are not related to the target that received the error. **make** does not attempt to update anything that depends on the target that was being made when the error occurred.

–n Displays the commands that **make** would execute to update the chosen targets, but does not actually execute any recipe lines unless they have a plus sign (+) command prefix. **make** displays recipe lines with an at sign (@) command prefix on standard output (stdout). For more information about recipe lines, see *z/OS UNIX System Services Programming Tools*.

With group recipes, **make** displays the commands it uses to update a given target, but it also executes the commands.

Note: z/OS **make** supports group recipes, but traditional implementations of **make** do not. A group recipe signifies a collection of command lines fed as a unit to the command interpreter. By contrast, **make** executes commands in a normal recipe one by one. For more information about group recipes, see *z/OS UNIX System Services Programming Tools*.

If **make** finds the string `$(MAKE)` in a recipe line, it expands it, adds **–n** to the `MAKEFLAGS`, and then executes the recipe line. This enables you to see what happens when recursive calls are made to **make**. The output correctly shows line breaks in recipes that are divided into several lines of text using the \<newline> sequence.

–p Prints the makefile after it has been processed to include macro and target definitions. This display is in human-readable form useful for debugging, but you cannot use it as input to **make**.

–q Checks whether the target is up to date. If it is up to date, **make** exits with a status of `0`; otherwise, it exits with a status of `1` (typically interpreted as an error by other software). No commands are run when **–q** is specified.

–r Does not read the startup file. Various control macros and default rules will not be defined.

–S Ends **make** if an error occurs during operations to bring a target up to date (opposite of **–k**). This is the default.

–s Specifies that recipe commands, warning messages, or touch messages (see the **–t** option) not be displayed. This is equivalent to the `.SILENT` attribute or macro.

–t Touches the target to mark them as up-to-date, but only executes commands to change a target if the target has a plus sign (+) command prefix. **make** does not touch up-to-date targets or targets that have prerequisites but not recipes. **make** displays a message for each touched target file indicating the file name.

–u Forces an unconditional update: **make** behaves as if all the prerequisites of the given target are out of date.

–V Prints the version number of **make** and a list of built-in rules.

–v Causes **make** to display a detailed account of its progress. This includes what files it reads, the definition and redefinition of each macro, metarule and suffix rule searches, and other information.

–x Exports all macro definitions to the environment. This happens just before **make** begins making targets (but after it has read the entire makefile).

Targets

A *target* is normally a file that you want to ensure is up to date with the files on which it is dependent (the prerequisites). For example, you may want to check to see if *a* is based on the most recent version of the corresponding source code. If it is not, then have the source code recompiled to get an up-to-date version. In this case, the compiled program file is the target and the corresponding source files are *prerequisites* (that is, the files on which a target is dependent).

make updates all targets that are specified on the command line. If you do not specify any target, **make** updates the targets in the first rule of the makefile. A target is out of date if it is older than any of its prerequisites (based on modification times) or if it does not exist. To update a target, **make** first recursively ensures that all the target's prerequisites are up to date, processing them in the order in which they appear in the rule. If the target itself is out of date, **make** then runs the recipe associated with the target. If the target has no associated recipe, **make** considers it up to date.

make also supports another form of targets, known as *special targets.* .

Special target directives are called targets because they appear in the target position of rules; however, they are really keywords, not targets. The rules they appear in are really *directives* that control the behavior of **make**.

The special target must be the only target in a special rule; you cannot list other normal or special targets.

Some special targets are affected by some attributes. Any special target can be given any attribute, but often the combination is meaningless and the attribute has no effect.

`.BRACEEXPAND`
This target may have no prerequisites and no recipes associated with it. If set, the target enables the outdated brace expansion feature used in older

versions of **make**. Older **make**s would expand a construct of the following form, beginning with each token in the token list:

```
string1{token_list}string2
```

Older **make**s would append *string1* to the front of each token in the list, and *string2* to the end of each token in the list. A more productive means for achieving the same result with modern versions of **make** relies on macro expansion with prefix and suffix modifiers:

```
$ (TOKEN_BASE:^"prefix:+"suffix")
```

The double quotes are required. Brace expansion is an outdated feature available in past versions of **make**.

.CYCLECHECK

This special target cannot have any prerequisites or recipes associated with it. If set, it determines how **make** treats circular dependencies (see Circular dependencies).

You can specify one of five attributes with this target. If you specify more than one attribute, an error message results. The five attributes are:

.SILENT

make remains silent about any within-rule and between-rule circular dependencies, removes the offending dependency from the list of prerequisites, and continues.

.WARNTARG

make issues warnings for named targets with circular dependencies. If the name of the dependency is the same as the named target, it is removed from the list of prerequisites and **make** continues. This is the default behavior if `.CYCLECHECK` is not specified or is specified with no attributes.

.WARNALL

make issues warnings for all within-rule circular dependencies regardless of whether the target is being built or not and for all between-rule circular dependencies for the named targets. The offending dependency is removed from the list of prerequisites and **make** continues.

.FATALTARG

make treats all circular dependencies for named targets as fatal errors. It issues an error message and exits.

.FATALALL

make treats all within-rule circular dependencies as fatal errors regardless of whether the target is being built or not. It also treats all between-rule circular dependencies for named targets as fatal errors. **make** issues an error message and exits.

For example, to set the circular dependency check to **make**'s default, use the rule:

```
.CYCLECHECK .WARNTARG:
```

.DEFAULT

This target has no prerequisites, but it does have a recipe. If **make** can apply no other rule to produce a target, it uses this rule if it has been defined.

.ERROR **make** runs the recipe associated with this target whenever it detects an error condition.

.EXPORT
All prerequisites associated with this target that correspond to macro names are exported to the environment at the point in the makefile at which this target appears.

.GROUPEPILOG
make adds the recipe associated with this target after any group recipe for a target that has the `.EPILOG` attribute.

.GROUPPROLOG
make adds the recipe associated with this target after any group recipe for a target that has the `.PROLOG` attribute.

.IMPORT
make searches in the environment for prerequisite names specified for this target and defines them as macros with their value taken from the environment. If the prerequisite `.EVERYTHING` is given, **make** reads in the entire environment (see **–e** and **–E** options).

.INCLUDE
make reads one or more additional makefiles (specified in the prerequisite list), as if their contents had been inserted at this point. If the prerequisite list contains more than one file, **make** reads them in order from left to right.

make uses the following rules to search for extra makefiles:

- If a relative file name is enclosed in quotes, or is not enclosed with angle brackets (< and >), **make** looks in the current directory. If the file isn't present, **make** then looks for it in each directory specified by the `.INCLUDEDIRS` special target.
- If a relative name is enclosed with angle brackets (< and >), **make** make only searches in directories specified by the `.INCLUDEDIRS` special
- If an absolute path name is given, **make** looks for that file and ignores the list associated with the `.INCLUDEDIRS` special target.

.INCLUDEDIRS
The list of prerequisites specified for this target defines the set of directories to search when including a makefile.

.MAKEFILES
The list of prerequisites is the set of files to try to read as the user makefile. These files are made in the order they are specified (from left to right) until one is found to be up to date. This is the file that is used.

.NOAUTODEPEND
Disables the autodependency feature when building libraries. When this special target is used, only library members that have been explicitly given as dependents are considered prerequisites.

.POSIX **make** processes the makefile as specified in the POSIX.2POSIX.2 draft standard. This target may have no prerequisite and no recipes associated with it. This special target must appear before the first non-comment line in the makefile. If this special target is present, the following facilities are disabled:

- All recipe lines are run by the shell, one shell per line, regardless of the setting of **SHELLMETAS**.
- Metarule inferencing is disabled.

- Conditionals are disabled.
- Dynamic prerequisites are disabled.
- Group recipes are disabled.
- Disables brace expansion (set with the **.BRACEEXPAND** special target).
- **make** does not check for the string *$ (MAKE)* when run with the **–n** options specified.

.REMOVE
make uses the recipe of this target to remove any intermediate files that it creates if an error is encountered before the final target is created. This .REMOVE target only deletes files that satisfy all of the following criteria:

- The file didn't exist when **make** began running.
- The file is named as an intermediate target, produced by invoking a metarule that was produced by transitive closure.
- The file is not explicitly named in the makefile.
- The generated target doesn't have the .PRECIOUS attribute.
- The file is a prerequisite of a rule that is actually used.

.SOURCE
The prerequisite list of this target defines a set of directories to check when trying to locate a target file name. **make** defaults to creating target files in the same directory that it finds the source file.

.SOURCE.x
Same as .SOURCE, except that **make** searches the .SOURCE.x list first when trying to locate a file matching a target with a name that ends in the suffix **.x**.

.SUFFIXES
mk appends the prerequisite list of this target to the set of suffixes used when trying to infer a prerequisite for making a target using suffix rules. If you specify no prerequisites, **make** clears the list of suffixes, effectively disabling suffix rules from that point on.

A name of the form *library(member)* indicates a member of a library. The *library* portion is a target with the .LIBRARY attribute, and the *member* portion is a prerequisite of the library target.

A name of the form library((entry)) indicates the library module that contains the given entry point. Once again, the library portion is a target with the .LIBRARY attribute. **make** regards the library member that contains the entry point *entry* as a prerequisite of the library target.

Makefiles

A *makefile* is a text file that describes the dependencies between various files. It normally contains a list of targets and identifies the prerequisites on which each depends. It also contains a series of instructions, called *recipes*, which describe the actions to be taken if a given target is out of date with its prerequisites.

By default, if you do not specify the **–f** option, **make** looks for a file in your current directory named **makefile**. If it does not find this file, it searches your current directory for a file named **Makefile**. If **make** finds either file, it uses this file as your makefile.

You can change the default makefiles with the .MAKEFILES special target. This target is already specified in the **startup.mk** file. See "Targets" on page 438 for more information.

Makefile contents

Comments begin with the pound (#) character and extend to the end of the line. make discards all comment text.

Inside makefiles, you can split long lines over several lines of text. To do this, put a backslash (\) at the very end of the line. You can use this technique to extend comments as well as recipe lines and macro definitions, for example.

If a rule or macro definition must contain a # character, use \#; otherwise, **make** mistakes the # for the beginning of a comment. Also, if a macro definition must contain a single $ character, use $$.

File names that contain a colon must always be enclosed in quotes, as in:

```
"a:target" : "a:prereq"
```

You can use a target that has prerequisites but no recipes to add the given prerequisites to that target's list of prerequisites. You can preface any recipe line with a command prefix immediately after the tab character –, @, + or all three. The method of entering tab characters using an ISPF editor is discussed in *z/OS UNIX System Services User's Guide*.

- – indicates that **make** is to ignore nonzero exit values when it runs this recipe line.
- @ indicates that **make** is not to display the recipe line before running it.
- + tells **make** to always run this line, even when **–n**, **–p**, or **–t** is specified.

Group recipes begin with [in the first non-white-space position of a line, and end with] in the first non-white-space position of a line. Recipe lines in a group recipe need not have a leading tab. **make** executes a group recipe by feeding it as a single unit to a shell. If you immediately follow the [at the beginning of a group recipe with one of –, @ or +, they apply to the entire group in the same way that they apply to single recipe lines.

Macro definitions

Macro definitions can appear on the command line or in makefiles. Macro definitions on the command line overrule definitions in makefiles; makefile definitions never overrule command-line definitions. Macro definitions on the command line may not have any white space between the macro name and the = character.

Macro definitions may take several forms. *macro* = *string* is the usual form. If *string* contains macro references, **make** does not expand them when the macro is defined, but when the macro itself is expanded.

```
macro := string
```

expands macros inside *string* before assigning a value to *macro*.

```
macro += string
```

adds *string* to the previous value of *macro*.

You can use any amount of white space on both sides of macro operators. **make** defines the name *macro* to have the value *string* and replaces it with that value whenever it is used as `$(`*macro*`)` or `${`*macro*`}` within the makefile. It is possible to specify a `$(`*macro_name*`)` or `${`*macro_name*`}` macro expansion, where *macro_name* contains more `$(....)` or `${...}` macro expansions itself.

Typically, **make** does not include white space at the beginning and end of *string* in the definition of *macro*; however, it never strips white space from macros imported from the environment.

If you want to include white space in a macro definition specified on the **make** command line, you must enclose the definition in quotes.

make resolves macro definitions in the following order:
1. Macro definitions in the built-in rules
2. Macro definitions on the command line associated with the **–D** option
3. Macro definitions in the startup file
4. Contents of the environment
5. Macro definitions in the makefiles (in the order they appear)
6. Macro definitions on the command line without the **–D** option

If you specify the **–e** options, **make** reads the makefiles before reading the contents of the environment. If you specify the **–E** option, **make** does not read the contents of the environment.

If a macro is already defined when **make** encounters a new definition for it, the new definition replaces the old one. For example, a macro definition for *name* on the command line overrides a definition for *name* in the makefile. You can use the **–v** option to display macro assignments, as **make** performs them.

make supports macro expansions of the form:

```
$(macro_name:modifier_list:modifier_list:...)
```

Possible modifiers are:

^"*string***"**
: Prefix tokens

+"*string***"**
: Suffix tokens

b
: File portion of all path names, without suffix

d
: Directory portion of all path names

f
: File portion of all path names, including suffix

l
: All characters mapped to lowercase

s/*pat***/***string***/**
: Simple pattern substitution (you can use any character to separate the pattern from the substitution text)

suffix=*string*
: Suffix replacement

t"*separator***"**
: Tokenization with given *separator*

u
: All characters mapped to uppercase

You can specify macro modifiers in either uppercase or lowercase. For example, the macro assignment:

```
test = D1/D2/d3/a.out f.out d1/k.out
```

produces the following expansion:

```
$(test:d)                 →→ D1/D2/d3 . d1
$(test:b)                 →→ a f k
$(test:f)                 →→ a.out f.out k.out
${test:db}                →→ D1/D2/d3/a f d1/k
${test:s/out/in}          →→ D1/D2/d3/a.in f.in d1/k.in
$(test:f:t"+")            →→ a.out+f.out+k.out
$(test:t"+")              →→ D1/D2/d3/a.out+f.out+d1/k.out
$(test:u)                 →→ D1/D2/D3/A.OUT F.OUT D1/K.OUT
$(test:l)                 →→ d1/d2/d3/a.out f.out d1/k.out
$(test:^"/rd/")           →→ /rd/D1/D2/d3/a.out /rd/f.out /rd/d1/k.out
$(test:+".Z")             →→ D1/D2/d3/a.out.Z f.out.Z d1/k.out.Z
```

Runtime macros can take on different values for each target.

$@ The full target name. When building a normal target, this macro evaluates to the full name of the target. When building a library, it expands to the name of the archive library. For example, if the target is:

```
mylib(member)
```

$@ expands to:

```
mylib
```

$% The full target name. When building a normal target, this macro evaluates to the full name of the target. When building a library, it expands to the name of the archive member. For example, if the target is:

```
mylib(member)
```

$% expands to:

```
member
```

$& The list of all prerequisites.

$? The list of all prerequisites that are newer than the target.

$^ The list of all prerequisites taken from the list specified on the rule line of the recipe where the $^ appears.

$< In inference rules, it evaluates to the single prerequisite that caused the execution of the rule. In normal rules it evaluates the same as $?.

$> The name of the library if the current target is a library member.

**$*** The target name with no suffix ($(%:db)) or the value of the stem in a metarule.

The constructs $$@, $$%, $$>, and $$* can appear in a prerequisite list as dynamic prerequisites. $$@ stands for the target currently being made. For example:

```
fred : $$@.c
fred : fred.c
```

are equivalent. The construct can be modified, as in:

```
fred.o : $$(@:b).c
```

The runtime macros can be modified by the letters D and F to indicate only the directory portion of the target name or only the file portion of the target name.

(The working directory is represented by a dot.) If **define.h** is the only prerequisite that is newer than the target, the macros `$?D` and `$?F` expand to dot (`.`) and to `define.h`.

If you are building a library, `$$%` stands for the name of the archive member being made. If you are building a normal target, `$$%` stands for the name of the target currently being made.

`$$*` stands for the name of the current target being made, but with no suffix.

If you are building a library, `$$>` stands for the name of the archive library being made. If you are not building a library, `$$>` is not valid.

Rules

The general format of a rule is:

```
targets [attributes] ruleop [prerequisites]
[;recipe]
{<tab> recipe}
```

where the items enclosed in square brackets are optional. (This is just a documentation convention; you do not actually enter the square brackets.) The parts of the rule are described as follows:

targets One or more target names.

attributes
A list, possibly empty, of attributes to apply to the list of targets.

ruleop An operator token, usually a colon (`:`), that separates the target names from the prerequisite names and may also affect the processing of the specified targets.

prerequisites
A list of zero or more names on which the specified targets depend.

recipe A command to execute to update targets. May follow on the same line as the prerequisites, separated from them by a semicolon. If such a recipe is present, **make** takes it as the first in the list of recipe lines defining how to make the named targets. Additional recipe lines may follow the first line of the rule. Each subsequent recipe line must begin with a tab character.

The possible rule operators are listed as follows:

`targets : prereqs`
Is a simple rule definition. For explicit targets, at most one simple rule may have a recipe, in contrast with the `::` rule operator, whose description follows.

`targets :! prereqs`
Executes the recipe for the associated targets once for each recently changed prerequisite. In simple rules, the recipe is executed only once, for all recently changed prerequisites at the same time. The `$<` macro expands to the current recently changed prerequisites if it appears in rules with this rule operator.

`targets :^ prereqs`
Inserts the specified prerequisites before any other prerequisites already associated with the specified targets.

targets :– prereqs
Clears the previous list of prerequisites before adding the new prerequisites.

targets :: prereqs
If no prerequisites are specified, the targets are always remade. Otherwise it is used for multiple rules applying to the same targets. Each rule can specify a different set of prerequisites with a different recipe for updating the target. Each rule is treated independently; the target is remade for each rule with recently changed prerequisites, using the corresponding recipe.

targets : | prereqs
Can only be used in metarules. It tells **make** to treat each metadependency as an independent rule. For example:

```
%$0 : | archive/%.c rcs/%.c /srcarc/RCS/%period.c
recipe...
```

is equivalent to

```
%$0 : archive/$.c
  recipe:
%$0 : rcs/%.c
  recipe:
%$0 : /srcarc/rcs/%.c
  recipe:
```

Circular dependencies

There are two types of circular dependencies: within-rule and between-rule.

A *within-rule* circular dependency occurs when the target's name is included in the list of prerequisites for that target. For example,

```
c.o : a.o b.o c.o
```

is a within-rule circular dependency. **make** detects a within-rule circular dependency when it is parsing the makefile to build the dependency tree.

A *between-rule circular dependency* occurs when you have two targets, each of which includes the other's name in its prerequisite list. For example,

```
a.o : b:o
b:o : a.o
```

is a between-rules circular dependency. **make** detects a between-rule circular dependency when it is processing the dependency tree built during the parse phase.

Typically, **make** only detects circular dependencies for those targets actually being built. When a circular dependency is encountered, **make** issues a warning message, removes the offending prerequisite from the list, and continues parsing the makefile. You can use the `.CYCLECHECK` special target to alter. **make**'s treatment of circular dependencies.

Inference rules

With inference rules you can specify general rules for building files rather than creating a specific rule for each target.

make provides two forms of inference rules: suffix rules and metarules. It includes suffix rules to ensure compatibility with older makefiles. Metarules, however, provide a more general mechanism for specifying **make**'s default behavior. They provide a superset of the functionality of suffix rules.

make searches all metarules before using suffix rules.

make uses the inference rules to infer how it can bring a target up to date. A list of inference rules defines the commands to be run. The default **startup.mk** file contains a set of inference rules for the most common targets. You can specify additional rules in the makefile.

When **make** finds no explicit target rule to update a target, it checks the inference rules. If **make** finds an applicable inference rule with an out-of-date prerequisite, it runs on that rule's recipe. See “Targets” on page 438 for information about the `.DEFAULT` special target).

Metarules

Metarules have one target with a single percent symbol that matches an arbitrary string called the stem; The `%` in a dependency stands for the stem.

The inference rule to update a target matching pattern *p1%s1*, where *p1* and *s1* are prefix and suffix strings of the target, having a prerequisite *p2%s2*, where `%` is the stem from the target, is specified as a rule:

```
p1%s1 : p2%s2 ; recipe....
```

Either the prefix or suffix string may be empty.

Transitive closure

Metarules provide a mechanism that allows several metarules to chain together to eventually create the target. This mechanism is called *transitive closure*. For example, if you have metarules:

```
%.o : %.c
        ... rule body....
```

and:

```
%.c : %.y
        ... rule body ...
```

When you specify:

```
make file.o
```

make uses the first metarule to look for **file.c**. If it can't find an explicit rule to build **file.c**, it again looks through the metarules and finds the rule that tells it to look for **file.y**.

make allows each metarule to be applied only once when performing transitive closure to avoid a situation where it loops forever. (For example, if you have the rule:

```
% : %.c
        ... rule body ...
```

the command:

```
make file
```

causes **make** to look for **file.c**. If the metarules were not restricted and **file.c** did not exist, then **make** would look for **file.c.c**, and then **file.c.c.c**, and so on. Because each metarule is applied only once, this can't happen.)

Transitive closure is computed once for each metarule head the first time the pattern matches a target. When transitive closure is computed, all the computed rules are added to the rule set for that metarule head. For example, if you have the rules:

```
% : %.o
        recipe 1...
%.o : %c
        recipe 2...
```

and you are making *file*, this target matches successfully against `%` causing transitive closure to be computed for `%`. As a result of this computation, a new rule is created:

```
% : %.c
   recipe 2...
   recipe from .REMOVE target for %.o, if not .PRECIOUS
   recipe 1...
```

which is executed if **file.o** doesn't exist. When the computation for the rule head has been done, it is marked as *transitive closure computed*. Since all possible new rules have been added to the rule set the first time the computation is done, it is not necessary to do it again: Nothing new is added. The term *transitive closure* is adapted from the mathematical set theory.

Note: In set theory, if you have a set composed of pairs (*a,b*) and (*b,c*), then the set would be transitively closed if (*a,c*) is also in the set.

The best way to understand how this works is to experiment with little **make** files with the **–v** flag specified. This shows you in detail what rules are being searched, when transitive closure is calculated, and what rules are added.

Order of rule generation

Since transitive closure allows **make** to generate new rules, it is important to understand the order in which this is done:

1. **make** searches for explicit rules in the order in which they appear, so explicit rules always take precedence.
2. **make** reads metarules in the order in which they appear in the makefile. The first rule that appears in the makefile is the first one checked.
3. New explicit metarules (as distinct from metarules generated by transitive closure) replace old ones. In other words, if your makefile contains an explicit rule like this one, it replaces the default rule in **startup.mk**:

   ```
   %$0 : %.c
           rule1
   ```

   If you use the **–v** option, **make** prints a warning when it replaces a metarule.
4. When transitive closure is calculated, the new metarules generated are added to the end of the list of possible metarules. Thus, **make** always finds the explicit rules first, so they take precedence over generated rules. You can use the **–v** option to see what rules **make** generates and the order in which they appear.

5. **make** performs two passes through the rules. On the first pass it tries to find a match with an explicit rule in the makefile; if this does not succeed, **make** performs a second pass to find a match with an existing file.

Suffix rules

make treats targets that begin with a period and contain no slashes or percent signs as suffix rules. If there is only one period in the target, it is a single suffix inference rule. Targets with two periods are double-suffix inference rules. Suffix rules do not have prerequisites but do have commands associated with them.

When **make** finds no explicit rule to update a target, it checks the suffix of the target (*.s1*) to be built against the suffix rules. **make** examines a prerequisite based on the basename of the target with the second suffix (*.s2*) appended, and if the target is out of date with respect to this prerequisite, **make** runs the recipe for that inference rule.

Metarules take precedence over suffix rules.

If the target to be built does not contain a suffix and there is no rule for the target, **make** checks the single suffix inference rules. The single suffix inference rules define how to build a target if **make** finds a rule with one of the single suffixes appended. A rule with one suffix *.s2* defines how to build *target* from *target.s2*. **make** treats the other suffix (*.s1*) as null.

For a suffix rule to work, the component suffixes must appear in the prerequisite list of the `.SUFFIXES` special target. You can turn off suffix rules by placing the following in your makefile:

```
.SUFFIXES:
```

This clears the prerequisites of the `.SUFFIXES` target, which prevents suffix rules from being enacted. The order that the suffixes appear in the `.SUFFIXES` rule determines the order in which **make** checks the suffix rules.

The search algorithm used for suffix rules depends on whether the `.POSIX` special target is specified. When `.POSIX` is specified, the following steps describe the search algorithm for suffix rules:

1. Extract the suffix from the target. If that target does not have a suffix, go to step 6.
2. Is it in the `.SUFFIXES` list? If not, quit the search.
3. If it is in the `.SUFFIXES` list, look for a double suffix rule that matches the target suffix.
4. If there is a match, extract the base name of the file, add on the second suffix, and determine if the resulting file exists. If the resulting file does not exist, keep searching the double suffix rules.

   If the resulting file does exist, use the recipe for this rule.
5. If a successful match is not made, the inference has failed.
6. If the target did not have a suffix, check the single suffix rules in the order that the suffixes are specified in the `.SUFFIXES` target.
7. For each single suffix rule, add the suffix to the target name and determine if the resulting file name exists.
8. If the file name exists, execute the recipe associated with that suffix rule. If the file name doesn't exist, continue trying the rest of the single suffix rules. If a successful match is not made, the inference has failed.

When the .POSIX special target is not specified, **make** handles suffix rules in the same manner as traditional implementations of **make**. The following steps describe the search algorithm for suffix rules in this situation.

1. Extract the suffix from the target. If that target does not have a suffix, go to step 8.
2. Is it in the .SUFFIXES list? If not, then quit the search.
3. If it is in the .SUFFIXES list, look for a double suffix rule that matches the target suffix.
4. If you find one, then extract the base name of the file, add on the second suffix and see if the resulting file exists. If it does, go to step 7. If not, continue with step 5.
5. Is there an inference rule for the resulting file? If yes, run the recipe associated with that rule (which should describe how to make the file exist) and go to step 7.
6. Search for the next double-suffix rule that matches the target suffix and return to step 4. If the double-suffix rules are exhausted, then the inference has failed.
7. Use the recipe for the target rule.
8. If the target did not have a suffix, then check the single-suffix rules in the order that the suffixes are specified in the .SUFFIXES target.
9. For each single-suffix rule, add the suffix to the target name and see if the resulting file name exists.
10. If the file exists, then run the recipe associated with that suffix rule. If it doesn't exist, continue trying the rest of the single-suffix rules.
11. If a successful match is not made, then the inference has failed.

make also provides a special feature in the suffix rule mechanism for archive library handling. If you specify a suffix rule of the form:

```
.suf.a:
        recipe
```

the rule matches any target having the LIBRARY attribute set, regardless of what the actual suffix was. For example, if your makefile contains the rules:

```
.SUFFIXES:  .a .c
     echo adding $< to library $@
```

then if mem$0 exists, then the following command:

```
make "mylib(mem.o)"
```

causes:

```
adding mem.o to library mylib
```

to be printed.

Attributes

make defines several target attributes. Attributes can be assigned to a single target, a group of targets, or to all targets in the makefile. Attributes affect what **make** does when it needs to update a target. You can associate attributes with targets by specifying a rule of the form:

attribute_list : *targets*

This assigns the attributes in *attribute_list* to the given targets. If you do not specify any targets, the attributes apply to every target in the makefile. You can also put attributes inside a normal rule, as in:

```
targets attribute_list : prerequisites
```

The recognized attributes are:

.EPILOG
Insert shell epilog code when running a group recipe associated with any target having this attribute set.

.IGNORE
Ignore an error when trying to make any target with this attribute set.

.LIBRARY
Target is a library.

.PRECIOUS
Do not remove this target under any circumstances. Any automatically inferred prerequisite inherits this attribute.

.PROLOG
Insert shell prolog code when running a group recipe associated with any target having this attribute set.

.SETDIR
Change the working directory to a specified directory when making associated targets. The syntax of this attribute is `.SETDIR=`*path*, where *path* is the path name of desired working directory. If *path* contains any **:** characters, the entire attribute string must be quoted, not just the path name.

.SILENT
Do not echo the recipe lines when making any target with this attribute set, and do not issue any warnings. You can use any attribute with any target, including special targets.

Control macros

make defines a number of control macros that control **make**'s behavior. When there are several ways of doing the same thing, control macros are usually the best. A control macro that has the same function as a special target or attribute also has the same name.

Macros that are said to be *defined internally* are automatically created by **make** and can be used with the usual `$(`*name*`)` construct. For example, `$(PWD)` can be used to obtain the current directory name.

Recognized control macros are:

DIRSEPSTR
Contains the characters used to separate parts in a path name and can be set by the user. **make** uses the first character in this string to build path names when necessary.

.EPILOG
If assigned a nonnull value, the `.EPILOG` attribute is given to every target.

GROUPFLAGS
Specifies option flags to pass to `GROUPSHELL` when **make** invokes it to run a group recipe.

GROUPSHELL
Gives the path name of the command interpreter (shell) that **make** calls to process group recipes.

GROUPSUFFIX
Specifies a string for **make** to use as a suffix when creating group recipe files to be run by the command interpreter.

.IGNORE
If this is assigned a nonnull value, **make** assigns the .IGNORE attribute to every target.

INCDEPTH
This is the current depth of makefile inclusion. It is set internally.

MAKE This is set by the startup file and can be changed by the user. The standard startup file defines it as:

```
$(MAKECMD) $(MFLAGS)
```

The MAKE macro is not used by **make** itself, but the string $(MAKE) is recognized when using the **–n** option for single-line recipes.

MAKECMD
This is the name with which **make** was invoked.

MAKEDIR
This is the full path name of the initial directory in which **make** began execution.

MAKEFLAGS
The MAKEFLAGS macro contains all the options (flags) and macros specified in the MAKEFLAGS environment variable plus all of the options and macros specified on the command line, with the following exceptions.

- Specifying **–c**, **–f**, or **–p** in the environment variable results in an error
- These same options specified on the command line do not appear in the MAKEFLAGS macro.

Options in the MAKEFLAGS environment variable may have optional leading dashes and spaces separating the options. These are stripped out when the MAKEFLAGS macro is constructed.

Note: make always reads the MAKEFLAGS environment variable before reading the makefile. The **–E** and **–e** options do not affect this.

MAKESTARTUP
This has the default value:

```
/etc/startup.mk
```

To change this value, you can set the MAKESTARTUP environment variable before running **make**. You can also specify a value for this control macro on the command line if you use the **–D** option:

```
make –DMAKESTARTUP=$HOME/project/startup.mk
```

Because **make** processes command-line macros after reading the startup file, setting this macro on the command line does not have the desired effect.

MFLAGS This is the same as MAKEFLAGS, except that it includes the leading switch character.

NULL This is permanently defined to be the null string.

.PRECIOUS
If this is assigned a nonnull value, **make** assigns the .PRECIOUS attribute to every target.

.PROLOG
If this is assigned a nonnull value, **make** assigns the .PROLOG attribute to every target.

PWD This is the full path name of the working directory in which **make** is executing.

SHELL Specifies the full path name of the command interpreter that **make** calls to process single-line recipes, when necessary. **make** passes recipe lines to this shell only if they contain one or more of the characters given in SHELLMETAS; otherwise, it runs them directly. By default, the value of the SHELL environment variable does not affect the value of this macro; however, you can use the .IMPORT special target to assign the environment variable's value to this macro. You can also use the .EXPORT special target to assign this macro's value to the SHELL environment variable.

SHELLFLAGS
Specifies option flags to pass to the shell when invoking it to runs a single-line recipe.

SHELLMETAS
Specifies a list of metacharacters that can appear in single recipe lines. If **make** finds any metacharacter, it invokes the recipe using the shell specified by SHELL; otherwise, it runs the recipe without the shell.

.SILENT
If this is assigned a nonnull value, **make** assigns the .SILENT attribute to every target.

Making libraries

A library is a file containing a collection of object files. To make a library, you specify it as a target with the .LIBRARY attribute and list its prerequisites. The prerequisites should be the object members that are to go into the library.

make tries to handle the old library construct format in a sensible way. When it finds lib(member), it declares the *lib* portion as a target with the .LIBRARY attribute and the *member* portion as a prerequisite of the *lib* target. To make the library properly, old makefile scripts using this format must name the *lib* as a target and must try to bring it up to date. The same thing happens for any target of the form *lib((entry))*. These targets have an additional feature in that the *entry* target has the .SYMBOL attribute set automatically.

Conditional expressions

Specify the conditional expression as follows:

```
.IF expression
... if text ...
.ELSE
... else text ...
.END
```

or:

```
.IF expression
... if text ...
.ELSIF expression2
```

```
... elsif text ...
.ELSE
... else text ...
.END
```

The .ELSE or .ELSIF portion is optional, and you can nest the conditionals (that is, the text may contain another conditional). The .IF, .ELSE, .ELSIF, and .END conditionals must start in the first column of the line. *expression* or *expression2* can have one of three forms:

```
string
```

is true if the given string is nonnull,

```
string == string
```

is true if the two strings are equal, and:

```
string != string
```

is true if the two strings are not equal. Typically, one or both strings contain macros, which **make** expands before making comparisons. **make** also discards white space at the start and end of the text portion before the comparison. This means that a macro that expands to nothing but white space is considered a null value for the purpose of the comparison. If a macro expression needs to be compared with a null string, compare it to the value of the macro $(NULL).

The text enclosed in the conditional construct must have the same format that it would have outside the conditional. In particular, **make** assumes that anything that starts with a tab inside the conditional is a recipe line. This means that you cannot use tabs to indent text inside the conditional (except, of course, for recipe lines, which always begin with tabs).

Files

make uses the following file:

/etc/startup.mk
The default startup file containing default rules.

Environment variables

make uses the following environment variables:

MAKEFLAGS
Contains a series of **make** options that are used as the default options for any **make** command. You can specify the options with or without leading minus signs (-) and blanks between them. It can also include macro definitions of the form usually found on the command line.

MAKESTARTUP
Contains the path name of the **make** stamp file. By default, **make** uses the file **/etc/startup.mk** as its startup file. To use a different file, set this environment variable before running **make**.

SHELL
Contains a name of a command interpreter. To assign this value to the **SHELL** control macro, use the .IMPORT special target. You can also use the .EXPORT special target to assign the value of the **SHELL** macro to the environment variable.

Localization

make uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

If a command in a recipe line fails (exits with a nonzero status), **make** returns the exit status of that command. Because most commands use exit status values between `0` and `10`, **make** uses exit status values below `10` only for failures that do not run recipe lines.

0 Successful completion

1 Returned if you specified **–q** and file is not up to date

2 Failure due to any of the following:
- Unknown command-line option
- Missing argument to option, such as no file name for **–f**.

126 Recipe command was not executable.

127 Recipe command was not found.

129–254
make was interrupted by a signal; the error code is the signal number ORed with 128. For example, `SIGINT` is frequently signal 1; the return code from **make** is 128|1, or 129.

255 Failure due to any of the following:
- Macro cannot be redefined
- Macro variables not assigned with `:=`
- Special target cannot be a prerequisite
- Too many makefiles specified
- Configuration file not found
- No makefile present
- Missing `.END` for `.IF`
- No target
- Inability to return to directory
- Too many open files
- Open failed
- File not found
- Inability to change directory
- No more memory
- Line too long
- Circular macro detected
- Unterminated pattern string
- Unterminated replacement string
- Token separator string not quoted
- Unterminated separator string
- Expansion too long
- Suffix too long

- Unmatched quote
- `.IF .ELSE ... END` nesting too deep
- `.ELSE` without `.IF`
- Unmatched `.END`
- Inference rules resulting in circular dependency
- No macro name
- Write error on temp file
- Target not found, and cannot be made
- Inability to make *NAME*
- `<+` diversion unterminated
- `<+` diversion cannot be nested
- `<+` missing before `+>`
- Incomplete rule recipe group detected
- Inability to mix single and group recipe lines
- Unmatched `]` found
- Macro or rule definition expected but not found
- Name too long
- Inability to determine working directory
- Only one *NAME* attribute allowed in rule line
- Multiple targets not allowed in `%` rules
- Special target must appear alone
- Duplicate entry in target list
- Syntax error in `%` rule, missing `%` target
- Duplicate entry in prerequisite list
- Missing targets or attributes in rule
- Multiply defined recipe for target
- Empty recipe for special target
- Imported macro *NAME* not found in environment
- No `.INCLUDE` files specified
- Include file *NAME*, not found
- *NAME* ignored on special target
- Attributes possibly ignored
- Inability to find member defining `SYMBOL((`*NAME*`))`
- Incorrect library format
- Inability to touch library member
- `SHELL` macro not defined
- Too many arguments
- Inability to export *NAME*
- Inability to open *file*
- Circular dependency detected
- Inability to stat `/`
- Inability to stat `.`
- Inability to open `..`
- Read error in `..`
- Metarule too long: "*rule*"

Usage notes

1. The length of a single makefile script line cannot exceed 32768 characters.
2. The length of an argument string cannot exceed 32768 characters.
3. The length of a macro name is truncated after 256 characters.
4. When the `.SETDIR` special target is used, **make** checks the file attributes of targets and prerequisites on every pass through a rule. This can significantly increase the number of system accesses.
5. In a double-byte environment, any character interpreted by **make** can be a double-byte character, including those in macro definitions and targets.

6. In a double-byte locale, if **make** encounters an incorrect double-byte sequence, it ends with an error message.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The following features of **make** are enhancements to POSIX.2:

- The options: **–c***dir*, **–D** *macro definition*, **–E**, **–u**, **–V**, **–v**, and **–x**.
- The **–n** option has enhanced functionality not covered by the standard; for more information, see the **–n** option and the `POSIX` special target for **make**.
- The runtime macros: **$&**, $^ , **$>**.
- The dynamic prerequisites: **$$%**, **$$>**, **$$***, **$$@**.
- All macro expansions.
- Macro assignments of the following form:

```
macroname  :=  stringassigned
macroname  +=  stringassigned
```

- Brace expansion.
- Backslash continuation.
- The quoting mechanism, as in the following example:

```
"a:target" :  "a:prerequisite"
```

- All rule operators except the colon (:).
- Conditionals.
- Metarules.
- All **make** attributes *except* `.IGNORE`, `.PRECIOUS`, `.SILENT` (referred to in POSIX.2 as special targets).
- All **make** special targets *except* `.DEFAULT`, `.POSIX`, `.SUFFIXES` (referred to in POSIX.2 as special targets).
- All **make** macros *except* **SHELL** (referred to in POSIX.2 as control macros).

Related information

c89, cc, c++, makedepend

S. I. Feldman, "Make—Program for Maintaining Computer Programs," *Software—Practice and Experience* 9 (no. 4, April 1979):225–65 [Bell Labs, Murray Hill, NJ]

makedepend — Generate source dependency information

Related information

Format

makedepend [**–S** *directory*] [**–W m,***option*[,*option*]...]... *sourcefile* [*(sourcefiles)*]...
makedepend [**–S** *directory*]
makedepend [**–W m,a**]
makedepend [**–W m,c89** | **–W m,cc**]
makedepend [**–W m,file***(MakeFile)* | **–W m,f***(MakeFile)*]
makedepend [**–W m,list***(FileName)* | **–W m,lis** *(FileName)*]
makedepend [**–W m,o***(ObjSuffix)*]
makedepend [**–W m,p***(ObjPrefix)*]
makedepend [**–W m,s***(String)*]

makedepend [**–W m,showinc** | **–W m,show**]
makedepend [**–W m,type**(*c*|*C(t1,t2,...)*) | **–W m,t**(*c*|*C(t1,t2,...)*)]
makedepend [**–W m,V**(*OSVvRr*) | **–W m,V**(*zOSVvRr*)]
makedepend [**–W m,w**(*Width*)]

For z/OS UNIX **makedepend [c89|cc|c++options]**:
makedepend [**+-**]
makedepend [**–D** *name*[=*value*]]
makedepend [**–I***dir1*[,*dir2*]...]
makedepend [**–0, –O** (**–1**), **–2**, **–3**]
makedepend [**–U***name*]
makedepend [**–W***phase*,*option*[,*option*]...]

Description

Guideline: As of z/OS V1R11, consider using the z/OS XL C/C++ -qmakedep compiler option instead of the **makedepend** tool. The -qmakedep compiler option improves the accuracy of source dependency information and is intended to replace the stand-alone **makedepend** tool. For more information about -qmakedep, see *z/OS XL C/C++ User's Guide*.

The **makedepend** tool is used to analyze source files and determine source dependencies. **makedepend** calls files, which are directly or indirectly included by a source file, "dependencies." If the **makedepend W m,-list** option is specified, this tool produces a listing file with the following topics:

- The list of compiler options and variables applied to all C source
- The list of compiler options and variables applied to all C++ source
- The list of **makedepend** options applied
- The list of include and source search paths
- Messages
- Message summary, and
- Statistics (in other words, total number of source files processed, number of ignored sources files, and so forth).

Options

–S *directory*
Specifies the directory or directories where you can locate the source files. The default location for source files is the current directory, "./".

–W m,a
Instructs **makedepend** to append the source dependencies to the end of the makefile rather than replacing any existing ones. If **–W m,a** is not specified, then **makedepend** will erase any source dependencies after the marker line and write the new determined source dependencies instead. If there are no existing makefiles, then this option is ignored.

–W m,c89 | –W m,cc
Instructs **makedepend** to use either the **c89** or the **cc** compiler mode for the c source files. The **c89** mode is the default. The **c89/cc** mode is overridden if the **c++ [+-]** option, described below, is specified.

–W m,file(*MakeFile*) | **–W m,f**(*MakeFile*)
Specifies the name of the makefile to which **makedepend** writes the determined source dependencies. If this option is specified on the **makedepend** command line, then the string value of the *MakeFile* is used

as the name for the makefile. Otherwise, **makedepend** will search in the current directory for a file named "makefile". If no "makefile" exists, then **makedepend** searches for a file named "Makefile". If no "Makefile" exists, then **makedepend** creates a new file with the name "makefile" in the current directory and writes the default marker string (see **–W m, s***(String)* below) at the beginning of the new file. If file (./) is specified, the option is ignored silently.

–W m,list*(FileName)* | **–W m,lis** *(FileName)*
Instructs **makedepend** to generate a listing file with the specified *FileName* name. The name *depend.1st* is the default file name if *FileName* is not specified with the **–W m,list** option. If **–W m,list***(./)* is specified, the default listing file name (*depend.lst*) is used. If the **–W m,list** option is not specified, listings are not generated.

–W m,o*(ObjSuffix)*
Specifies a suffix (file name extension) for the object file names in the source file dependencies. If the environment variable **{_OSUFFIX}** is defined, then its value will be the default. If it is not defined, the default suffix is **o**.

–W m,p*(ObjPrefix)*
Prefixes object file names in the source dependencies with a path name. The default object file name prefix is an empty string.

–W m,s*(String)*
Specifies a new string literal to be used as a marker in the output makefile. All source dependencies are placed after that marker. The default marker string value is "# DO NOT DELETE THIS LINE, **makedepend** depends on it." If the **–W m,s***(String)* is specified on the **makedepend** command line, then the marker line and anything after it will be erased from the output makefile, the new marker string literal will be written instead, and the newly determined source dependencies will be written after the new marker line. If both **–W m,a** and **–W m,s***(String)* are specified on the **makedepend** command line, then **–W m,s***(String)* will be ignored if a makefile already exists.

–W m,showinc | **–W m,show**
Instructs makedepend to report on the include files for each source file. The include files are reported in the includes topic of the listing file. If the **–W m,showinc** option is specified, the list option is automatically turned on. If the **–W m,showinc** option is not specified, the include file list will not be reported.

–W m,type*(c|C(t1,t2,...))* | **–W m,t***(c|C(t1,t2,...))*
Instructs **makedepend** to treat source files with any file name type that belong to the set {*t1,t2,...*} as either c source files if the c is used with the type, or as C++ source files if the C is used. Default types are as follows:

- Any source file with a file name extension of c will be treated as a c source file. If the **–W m,type***(c(t1,t2,...))* option is specified on the **makedepend** command line, then any source file with a file name extension that belongs to the set {*c, t1, t2,...*} will be treated as a c file. Notice that the types {*t1,t2,...*} that are specified with the **–W m,type** option are added to the default c file name extension type.
- Any source file with a file name extension of C, cpp, or cxx will be treated as a C++ source file. If the **–W m,type***(C(t1,t2,...))* option is specified on the **makedepend** command line, then any source file with a file name extension that belongs to the set {*C, CPP, cpp, CXX, cxx, t1,*

t2,...} is treated as a C++ file. Notice that the types {*t1,t2,...*} that are specified with the **–W m,type** option are added to the default {*C,CPP,cpp,CXX,cxx*} file name extension types.

- If both –W m,type(c(...)) and –W m,type(C(...)) options are specified on the **makedepend** command line with conflicting file name types, then whichever option is specified last becomes the overriding value, including the default file types. For example, when both **–W m,type***(c(t1,t2))* and **–W m,type***(C(c,t1,t3)* are specified, only files with extension t2 will be treated as c files and files with extensions {*c, C, cpp, Cpp, cxx, CXX, t1, t3*} will be treated as C++ files. When **–W m,type***(c(cpp,t1,t2))* and **–W m,type***(C(t1,t2))* options are specified, files with extensions {*c, cpp*} will be treated as c source files and files with extensions {*C, CPP, cxx, CXX, t1, t2*} will be treated as C++ source files.

For C source files, if the environment variables **{_CSUFFIX}** pt **{_CSUFFIX_HOST}** are defined, the variable value updates the default value. The default C source file extension is c.

For C++ source file, if the environment variables **{_CXXSUFFIX}** and **{_CXXSUFFIX_HOST}** are defined, its value updates the default value. The default C++ source file extensions are {*C, CPP, cpp, CXX, cxx*}. For example, if **{_CXXSUFFIX}** is defined as {*cdd*} and the default C++ source file extensions are {*C, CPP, cpp, CXX, cxx*}, then the resulting set would be {*C, CPP, cpp, CXX, cxx, cdd*}.

–W m,V*(OSVvRr)* | **–W m,V***(zOSVvRr)*
Specifies the compiler version that will be used, where *v* and *r* represent the compiler's version and release respectively. The default version is the current C/C++ compiler version if {_CVERSION} is not defined. If {_CVERSION} is defined, then its value is used as the default compiler version. This option is used to set the **_COMPILER_VER_** macro.

–W m,w*(Width)*
Sets the maximum line width of the output source dependencies lines. The default value is 78.

The following options correspond to the z/OS UNIX **c89,cc,c++** compiler options.

–+ Specifies that all source files are to be recognized as C++ source files. All *file.s, file.o,* and *file.a* files will continue to be recognized as assembler source, object, and archive files respectively. However, any C *file.c* or *file.i* files will be processed as corresponding C++ file.C or *file.i* files, and any other file suffix which would otherwise be unrecognized will be processed as a *file.C* file.

–D *name***[**=*value***]**
Defines a C or C++ macro for use in compilation. If only *name* is provided, a value of 1 is used for the macro it specifies.

–I*dir1***[**,*dir2***]...**

Note: The **–I** option is an uppercase **i**, not a lowercase **L**.
–I specifies the directories to be used during compilation in searching for include files (also called header files). Absolute pathnames specified on **#include** directives are searched exactly as specified. The directories specified using the **–I** option or from the usual places are not searched.

If absolute pathnames are not specified on #include directives, then the search order is as follows:

1. Include files enclosed in double quotes (") are first searched for in the directory of the file containing the #include directive. Include files enclosed in angle-brackets (< >) skip this initial search.
2. The include files are then searched for in all directories specified by the **–I** option, in the order specified.
3. Finally, the include files are searched for in the usual places. (See Usage Note 1 on page 463 for a description of the usual places.)

You can specify an MVS data set name as an include file search directory. Also, MVS data set names can explicitly be specified on **#include** directives. You can indicate both by specifying a leading double slash (//). For example, to include the include file DEF that is a member of the MVS PDS ABC.HDRS, code your C or C++ source as follows:

```
#include <//'abc.hdrs(def)'>
```

MVS data set include files are handled according to z/OS XL C/C++ compiler conversion rules (see Usage Note 1 on page 463).. When specifying an **#include** directive with a leading double slash (in a format other than **#include<//'dsname'>** and **#include<//dd:ddname>**), the specified name is paired only with MVS data set names specified on the **–I** option. That is, when you explicitly specify an MVS data set name, any hierarchical file system (HFS) directory names specified on the **–I** option are ignored.

–0, –O (–1), –2, –3
Specifies the level of compiler optimization (including inlining) to be used. The level **–1** (number one) is equivalent to **–O** (letter capital O). The level **–3** gives the highest level of optimization. The default is –0 (level zero), no optimization and no inlining, when not using IPA (Interprocedural Analysis).

–U*name*
Undefines a C or C++ macro specified with *name*. This option affects only macros defined by the **–D** option, including those automatically specified by **c89/cc/c++**.

–W*phase,option***[**,*option***]...**
Specifies options to be passed to the steps associated with the compile, assemble, or link-editing phases of **c89/cc/c++**. The valid phase codes are:

0 Specifies the compile phase (used for both non-IPA and IPA compilation).

c Same as phase code **0**.

I Enables IPA (Interprocedural Analysis) optimization.

Note: I is an uppercase **i**, not a lowercase **L**.

Unlike other phase codes, the IPA phase code **I** does not require that any additional options be specified, but it does allow them. In order to pass IPA suboptions, specify those suboptions using the IPA phase code. For example, to specify that an IPA compile should save source line number information, without writing a listing file, specify:

```
c89 -W I,list file.c
```

To specify that an IPA link-edit should write the map file to **stdout**, specify:

```
c89 -W I,map file.o
```

Note: c89/cc/c++ options other than the ones listed are ignored by **makedepend**.

Any compiler option can be passed to **makedepend** through the **–W** option. For more information about the compiler options, see *z/OS XL C/C++ User's Guide*.

Examples

1.
```
makedepend file1.c file2.c
```

Imagine you are compiling two files, file1.c and file2.c, and each includes the header file header.h. The header.h file includes the files def1.h and def2.h. When you run the command **makedepend** *file1.c file2.c*, **makedepend** parses file1.c and consequently, header.h, and then def1.h and def2.h. It then decides that the dependencies for this file are:

- `file1.o: header.h def1.h def2.h`
- `file2.o: header.h def1.h def2.h`

2. Imagine you are compiling a file, file1.c, and it includes the header file header.h. The header.h file includes the files def1.h and def2.h. When you run the command **makedepend** *file1.c*, **makedepend** parses file1.c and consequently, header.h, and then def1.h and def2.h. It then decides that the dependencies for this file are:

```
file1.o: header.h def1.h def2.h
```

Environment variables

makedepend uses the following environment variables.

{_ACCEPTABLE_RC}
Used by **c89/cc/c++** to determine the maximum allowed return code (result) of any step (compile, assemble, IPA link, prelink, or link-edit). If the result is between zero and this value (inclusive), then it is treated internally by **makedepend** exactly as if it were a zero result. The default value is 4.

{_CLASSLIB_PREFIX}
Provides a prefix for the data sets used during the compilation and execution phases. For **makedepend**, the focus is the {_CLASSLIB_PREFIX}.SCLBH.+ data set that contains the z/OS C/C++ Class Library include files.

{_CSUFFIX}
Used by **c89/cc/c++** to recognize a C source file. The default value is c.

{_CSUFFIX_HOST}
Used by **c89/cc/c++** to recognize a C source file. The default value is C.

{_CXXSUFFIX}
Used by **c++** to recognize a C++ source file. The default is C. This variable is only supported by the **c++** command.

{_CXXSUFFIX_HOST}
Used by **c++** to recognize a C++ source data set. The default is CXX. This variable is only supported by the **c++** command.

{_CSYSLIB}
Used for system library data set concatenation, which resolves **#include** directives during compilation.

{_INCDIRS}
Provides directories used by **c89/cc/c++** as a default place to search for include files during compilation (after searching **{_INCDIRS}** and before searching **{_CSYSLIB}**).

{_INCLIBS}
The directories used by **c89/cc/c++** as a default place to search for include files during compilation (after searching **{_INCDIRS}** and before searching **{_INCLIBS}** and **{_CSYSLIB}**).

{_OSUFFIX}
Provides a suffix by which **c89/cc/c++** recognizes an object file.

{_CVERSION}
The version of the C/C++ compiler to be invoked by **c89/cc/c++**. The setting of this variable allows **c89/cc/c++** to control which C/C++ compiler program is invoked. It also sets default values for other environment variables. The format of this variable is the same as the result of the Language Environment C/C++ Run-Time Library function _librel(). The default value is the result of the C/C++ Run-Time library _librel() function. Actual variable names are: _C89_CVERSION, _CC_CVERSION, _CXX_CVERSION

{NO_CMDOPTS}
Controls how the compiler processes the default options set by **c89**. Setting this variable to 1 reverts the compiler to the behavior that was available prior to z/OS V1R5, when the compiler was unable to distinguish between the **c89** defaults and the user-specified options. Setting this variable to 0 (zero) results in the default behavior where the compiler is now able to recognize **c89** defaults. The default value is: 0 (zero). Actual variable names are: _C89_NO_CMDOPTS, _CC_NO_CMDOPTS, _CXX_NO_CMDOPTS

Localization

makedepend uses the LC_ALL localization environment variable, which specifies the locale to be used to override any values for locale categories specified by LANG or certain LC_ variables.

See Appendix F, “Localization,” on page 997 for more information.

Usage notes

1. MVS data sets may be used as the usual place to resolve C and C++ **#include** directives during compilation.

   Such data sets are installed with Language EnvironmentLanguage Environment. When it is allocated, searching for these include files can be specified on the **–I** option as *//DD:SYSLIB*. (See the description of environment variable {_CSYSLIB} for information.

   When include files are MVS PDS members, z/OS XL C/C++ uses conversion rules to transform the include (header) file name on a **#include** preprocessor directive into a member name. If the "*//'dataset_prefix*.+'" syntax is not used for the MVS data set which is being searched for the include file, then this transformation strips any directory name on the **#include** directive, and then takes the first 8 or fewer characters up to the first dot (**.**).

If the "//'*dataset_prefix*.+'" syntax is used for the MVS data set which is being searched for the include file, then this transformation uses any directory name on the **#include** directive, and the characters following the first dot (.), and substitutes the "+" of the data set being searched with these qualifiers.

In both cases the data set name and member name are converted to uppercase and underscores (_) are changed to at signs (@).

If the include (header) files provided by Language EnvironmentLanguage Environment are installed into the hierarchical file system in the default location (in accordance with the **{_INCDIRS}** environment variable), then the compiler will use those files to resolve **#include** directives during compilation. **c89/cc/c++** by default searches the directory **/usr/include** as the usual place, just before searching the data sets just described. See the description of environment variables **{CSYSLIB}**, **{_INCDIRS}**, and **{_INCLIBS}** for information about customizing the default directories to search.

2. Feature test macros control which symbols are made visible in a source file (typically a header file). **c89/cc/c++** automatically defines the following feature test macros along with the errno macro, according to whether or not **cc** was invoked.
   - Other than **cc**
     - –D "errno=(*__errno())"
     - –D _OPEN_DEFAULT=1
   - **cc**
     - –D "errno=(*__errno())"
     - –D _OPEN_DEFAULT=0
     - –D _NO_PROTO=1

   c89/cc/c++add these macro definitions only after processing the command string. Therefore, you can override these macros by specifying **–D** or **–U** options for them on the command string.
3. For options that have option-arguments, the meaning of multiple specifications of the options is as follows:
   –D All specifications are used. If the same name is specified on more than one **–D** option, only the first definition is used.
   –I All specifications are used. If the same directory is specified on more than one **–I** option, the directory is searched only the first time.
   –U All specifications are used. The name is not defined, regardless of the position of this option relative to any **–D** option specifying the same name.
   –W All specifications are used. All options specified for a phase are passed to it, as if they were concatenated together in the order specified.

Exit values

0 Successful completion
4 Warning error detected

Related information

c89, **cc**, **c++**, **make**

man — Display sections of the online reference manual

Format

man [**–wx**] [**–M** *path*] [*section*] *entry ...*
man –k [**–M** *path*] *keyword ...*

Description

man displays help information about both shell commands and the z/OS UNIX set of TSO/E commands. You can use it to search help files having the specified keywords associated with them.

Options

–k Searches a precomputed database of syntax lines for information about keywords.

–M *path*
Searches the directories indicated by *path* for help files. If **–M** is not specified, **man** uses the path specified in the MANPATH environment variable if set; otherwise **man** searches **/usr/man/%L**. The value of the LANG environment variable is substituted for %L in this directory and in the directories specified by MANPATH. All help files are found by searching similarly structured file trees rooted at one or more places. See "Files" on page 467 for a description of what files and directories **man** should find in each directory that it searches.

–w Displays only the filename of the file containing the help file.

–x Displays what files **man** is searching to find the help file. **–x** also displays any errors that **man** encounters while extracting man pages from online book files. See "BookServer exit values" on page 467.

section Is a number (0–9) representing a section of the online help. When you specify a section number, **man** searches only that section for entry, instead of searching all sections. The online help available for z/OS UNIX contains one section:

1 Commands

To find a given entry, **man** checks each directory in MANPATH for a file with a specific name. For each section number requested, **man** searches MANPATH for the following files in this order:

1. **catn/entry.n** in each directory in MANPATH
2. **entry.n** in **/var/man/LANG** (the **man** "cache")
3. **mann/*.book** in each directory in MANPATH
4. **mann/entry.n** in each directory in MANPATH

If no section number is specified then **man** searches all sections in order from 1 to 9, then 0. The first entry found by **man** is the one displayed.

If output is to the terminal, then **man** invokes a pager command to filter and display the manual pages. If MANPAGER is defined, it is used. If not, then if PAGER is defined, it is used; otherwise, **man** defaults to using the command:

```
pg –e –p '(Page %d)'
```

If you are running in a double-byte locale, set MANPAGER or PAGER to invoke a command which supports double-byte characters, such as the **more** command. **pg** does not support double-byte characters.

Examples

To find out which utilities do comparisons, issue:

```
man –k compare
```

You can use the **man** command to view manual descriptions of the z/OS UNIX set of TSO/E commands. To do this, you must prefix all commands with **tso**. For example, to view a description of the z/OS UNIX variation of the MOUNT command, you would enter:

```
man tsomount
```

You can also use the **man** command to view manual descriptions of commands that support subcommands. To do this, you must prefix all subcommands with the name of the command. For example, to view a description of the **dbx alias** subcommand, you would enter:

```
man dbxalias
```

The same applies for the **pdbx** subcommands. For example, enter:

```
man pdbxcont
```

to display information about the **cont** subcommand.

To view an online manual description for the tcsh **ls-F** built-in command, you must type **ls-F** without the dash. So, to see the man page you would issue:

```
man lsF
```

To view an online manual description for the tcsh **@ (at)** built-in command, you must type **at** with tcsh in front of it. So, to see the man page you would issue:

```
man tcshat
```

Environment variables

man uses the following environment variables:

MANPATH
: Contains a list of paths to search for man pages.

MANPAGER, PAGER
: Contains an output filtering command for use when displaying man pages on a terminal.

  If you are running in a double-byte locale, verify that this variable is set to a command which supports double-byte characters, such as the **more** command.

TMPDIR
: Identifies the directory where temporary files reside.

Localization

man uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Files

man uses the following files:

/usr/man/%L/man[0–9]/*.book
BookManager® book files containing man pages.

/var/man/%L/entry.[0–9]/*.bookname
Cached man pages extracted from book files.

/usr/man/%L/cat[0–9]/ * .[0–9]
Subdirectories containing formatted help files.

/usr/man/%L/whatis
Database used by **–k** option.

Exit values

0 Topic not found.

1 Topic contents exceeded the buffer length.

-1 No errors.

BookServer exit values

If the **-x** option was specified and **man** encounters errors while extracting man pages from online book files, these exit values are displayed.

112105 The bookread component of BookServer could not locate or read the partitioned dataset of the code page translation tables. Check the bookread configuration as described in the z/OS program directory and the BookServer program directory.

100000-199999
An error occurred while opening the bookread session.

200000-299999
An error occurred while opening the book.

300000-399999
An error occurred while translating the topicid to unicode.

400000-499999
An error occurred while positioning to the topic within the book file.

500000-599999
An error occurred while reading a line of the topic.

600000-699999
An error occurred while translating the text of the book from the internal book code page to the display code page errors.

700000-799999
An error occurred while closing the book file.

800000-899999
An error occurred while closing the session.

900000-999999
An error occurred while positioning to the top of the book file.

1000000-1099999
An error occurred while looking up the CONTENTS topic ID.

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

The elements of the environment variable MANPATH are separated by colons.

The **–M** option, the **–x** option, the **–w** option, the MANPAGER environment variable, the default pager, and the ability to specify *section* on the command line are all extensions to the POSIX standard.

Related information

help, **more**

mesg — Allow or refuse messages

Format

mesg [**y**] [**n**]

Description

mesg determines whether other users can send messages to your terminal with **talk**, **write**, or similar utilities.

Options

y Specifies that other people can send you messages.

n Specifies that other people cannot send you messages.

Examples

1. To let other people send you messages, issue:
   ```
   mesg y
   ```
2. To tell the system not to let other people send you messages, issue:
   ```
   mesg n
   ```
3. To display the current setting without changing it, issue:
   ```
   mesg
   ```

The terminal is determined by the first of standard input, output, or error which is directed to a terminal.

Localization

mesg uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Receiving messages is currently allowed

1 Receiving messages is not currently allowed

2 Failure due to any of the following:
- Unknown command-line option
- Unknown argument
- An error accessing the terminal

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

Related information

talk, **write**

---

mkcatdefs — Preprocess a message source file

Format

mkcatdefs [**–h**] **MsgFile** [**SourceFile ...**]

Description

mkcatdefs preprocesses a message source file for input to the **gencat** utility.

SourceFile is a message file (usually with a **.msf** extension) containing symbolic identifiers. If you do not specify a **SourceFile**, **mkcatdefs** reads from the standard input (stdin). **mkcatdefs** produces two outputs:

- **MsgFile.h**, which contains statements that equate your symbolic identifiers with set numbers and message numbers that **mkcatdefs** assigns. You must include this header file in your application in order to refer to the messages.
- Message source data, with numbers instead of symbolic identifiers, is sent to standard output. This output is suitable as input to the **gencat** utility. You should either save standard output to a file using redirection, or pipe the output of **mkcatdefs** to the **gencat** utility.

Options

–h Suppresses the generation of a **MsgFile.h** file. This flag must be the first argument to **mkcatdefs**.

Extended description

The format of **SourceFile** is defined as follows: The fields of a message source line must begin in column 1 and are separated by a single blank character. Any other blank characters are considered as part of the subsequent field.

$quote
See **gencat**.

$set *symbolic_name*
The symbolic_name denotes the set identifier that will be used in an application program to reference this set of messages. This name can be up to 255 characters long and can contain any alphanumeric character and the

underscore character, but must begin with a non-numeric character. Any string following the set identifier is treated as a comment.

$ *comment*
See **gencat**.

Symbolic_Name *message_text*
The Symbolic_Name denotes a message identifier that will be used in an application program to reference this message. This name can be up to 255 characters long and can contain any alphanumeric character and the underscore character, but must begin with a non-numeric character. There must be a single blank character separating the symbolic_name from the message_text. If no quote character is defined, then any blank characters after the separating blank character are considered part of the message text. See **gencat** for more information about how to specify *message_text*.

Examples

To process the **comp1.msf** and **comp2.msf** message source files and put the output into the **comp.msg** file, enter:

```
mkcatdefs comp comp1.msf comp2.msf >comp.msg
```

The source message file looks similar to the following:

```
$ This is the message source file for COMP1
$
$quote " Use double quotation marks to delimit message text
$set MSFAC1  Message set for component comp1
$
SYM_FORM "Symbolic identifiers can only contain alphanumeric \
characters or the _ (underscore character)\n"
SYM_LEN  "Symbolic identifiers cannot be more than 65 characters long\n"
5 "You can mix symbolic identifiers and numbers\n"
```

The generated **comp.h** file looks similar to the following:

```
#ifdef  _H_COMP_MSG
#include <limits.h>
#include <nl_types.h>
/*
 Time stamp: 1994 137 19:09 UTC
*/
/* The following was generated from comp1.msf. */
/* definitions for set MSFAC1 */
/* The following was generated from comp2.msf. */
/* definitions for set MSFAC2 */
#endif
```

mkcatdef creates the **comp.msg** message catalog source file for **gencat** with numbers assigned to the symbolic identifiers:

```
$timestamp 1994 137 19:09 UTC
$quote " Use double quotation marks to delimit message text
$delset 1
$set 1
1 "Symbolic identifiers can only contain alphanumeric \
characters or the _ (underscore character)\n"
2 "Symbolic identifiers cannot be more than 65 characters long\n"
5 "You can mix symbolic identifiers and numbers\n"
```

The assigned message numbers are noncontiguous because the source file contained a specific number. **mkcatdefs** always assigns the previous number plus 1 to a symbolic identifier.

Restriction: mkcatdefs inserts a **$delset** command before a **$set** command in the output message source file. This means you cannot add, delete, or replace single messages in an existing catalog when piping to the **gencat** utility. You must enter all messages in the set.

mkdir — Make a directory

Format

mkdir [**–p**] [**–m** *mode*] *directory ...*

Description

The **mkdir** command creates a new directory for each named *directory* argument. The mode for a directory created by **mkdir** is determined by taking the initial mode setting of 777 (a=rwx) or the value of **–m** if specified and applying the **umask** value to it.

Options

–m *mode*

Lets you specify permissions for the directories. The *mode* argument can have the same value as the *mode* for **chmod**; see **chmod** for more details.

You can also set the sticky bit on for directories. For more information, see **chmod**. The **umask** value is applied to the *mode* value to determine the new directory's actual mode setting.

Note: A superuser or the file owner can use a **chmod** command or chmod() function to change two options for an executable file. The options are set in two file mode bits:

- *Set-user-ID* (S_ISUID) with the setuid option
- *Set-group-ID* (S_ISGID) with the setgid option

If one or both of these bits are on, the effective UID, effective GID, or both, plus the saved UID, saved GID, or both, for the process running the program are changed to the owning UID, GID, or both, for the file. This change temporarily gives the process running the program access to data the file owner or group can access.

In a new file, both bits are set off. Also, if the owning UID or GID of a file is changed or if the file is written in, the bits are turned off. In shell scripts, these bits are ignored.

If the RACF profile named FILE.GROUPOWNER.SETGID exists in the UNIXPRIV class, then the set-group-ID bit for a directory determines how the group owner is initialized for new objects created within the directory:

- If the set-gid bit is on, then the owning GID is set to that of the directory.
- If the set-gid bit is off, then the owning GID is set to the effective GID of the process.

–p Creates intermediate directory components that don't already exist. For example, if one of the *directory* arguments is **dir/subdir/subsub** and **subdir** doesn't already exist, **mkdir** creates it. Such intermediate directories are created with mode bits determined in the following way: Take a default mode setting of 777 (`a=rwx`), apply the process's setting to it, and then

turn on the user write and user execute permissions (u+wx). The **–m** mode specification on the command line is not used for computing the mode of intermediate directories.

Localization

mkdir uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Missing *mode* after **–m**
- Incorrect *mode*
- Incorrect command-line option
- Missing directory name
- Inability to create the directory

Messages

Possible error messages include:

Path not found
The preceding structure (parent directory) of the named *directory* does not exist.

Access denied
The requested directory already exists or is otherwise inaccessible.

Cannot create directory
Some other error occurred during creation of the directory.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

rm, **rmdir**,

mkfifo — Make a FIFO special file

Format

mkfifo [**–m** *mode*] *file* [**–p**]

Description

mkfifo creates one or more FIFO special files with the given names.

Options

–m *mode*
Lets you specify file permissions for the files. The *mode* argument can have the same value as the *mode* argument for **chmod**; see **chmod** for more details.

–p Creates intermediate directory components that do not already exist. For example, if one of the file arguments is **dir/subdir/file** and if **subdir** does not exist already, this option creates it. Such intermediate directories are created with mode bits determined in the following way: Take a default mode setting 777 (a=rwx), apply the umask setting of the process to it, and then turn on user read, write, and user execute permissions (u+rwx).

The **–m** *mode* specification on the command line is not used for computing the mode of intermediate directories. The resulting mode settings permit the file owner to access the new files without concern for any umask setting that may be in place.

Localization

mkfifo uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- A missing *mode* after **–m**
- An incorrect mode:
- An incorrect command-line option
- A missing filename
- Inability to create the desired file

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–p** option is an extension of the POSIX standard.

Related information

chmod, **create**, **mkdir**

mknod — Make a FIFO or character special file

Format

mknod *pathname* [**b c**] *major minor*
mknod *pathname* **p**

Description

mknod creates a FIFO special file or a character special file with the given path name. It is located in the directory **/usr/sbin**.

Operands

b Indicates block special files. **b** is accepted for compatibility with other UNIX implementations.

Restriction: Block special files are not supported on z/OS.

c Indicates character special files (for example, terminals and other devices). **c** can only be used by a superuser.

major minor
major gives the major device type; *minor*, the minor device type. You can specify device types in decimal, hexadecimal, or octal.

mknod differentiates between octal and decimal as follows:
- Any number that starts with 0 but not 0x is octal.
- Any number that starts with 0x is hexadecimal.
- Any number that does not start with 0x or 0 is decimal.

p Creates a FIFO special file (that is, a named pipe).

Localization

mknod uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to create the desired file
- Incorrect *major* or *minor* number

2 Failure due to any of the following:
- Too few command-line arguments
- A missing *major* or *minor* device number

Portability

UNIX systems. Within POSIX, **mknod** has been superseded by **mkfifo** for pipes. The POSIX family of standards has not yet designed an alternative to **mknod** for special files.

Related information

mkfifo

more — Display files on a page-by-page basis

Format

more [**–BceiSsU**] [**–A** | **–u**] [**–n** *number*] [**–P** *prompt*] [**–p** *command*] [**–t** *tag*] [**-W** *option*[,*option*]...] [*file ...file ...*]

more [**–BceiSsU**] [**–A** | **–u**] [**–n** *number*] [**–P** *prompt*] [**–t** *tag*] [**-W** *option*[,*option*]...] [**+***command*] [*file ...file ...*]

Description

more displays files one page at a time. It obtains the number of lines per page from the environment or from the **–n** option. If standard output (stdout) is not a terminal device, the number of lines per page is infinite. If stdout is not a terminal device, all input files are copied to stdout in their entirety, without modification.

more displays the files specified by *file ...file ...* (that is, a list of file names) one at a time. When **more** finishes displaying one file, it begins displaying the next one in the list. If you give – as one of the filenames, **more** reads the standard input at that point in the sequence.

more allows paging forwards and backwards (if possible) and searching for strings.

Options

–A Displays all characters, including unprintable ones. Typically, unprintable characters are displayed in a format which is printable, such as octal. However, with **–A**, the actual glyph (graphical character) is displayed. Also, by using this option, ANSI escape sequences for display modes are processed. This option cannot be used with **–u**.

Note: The character in the upper left corner of the screen is always displayed in normal mode.

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–c Displays one page at a time starting at the top of the screen, and clears the screen before displaying a new file. **more** may ignore this option if the terminal doesn't support such operations.

–e Exits immediately after displaying the last line of the last file. Typically, if **stdout** is a terminal device, **more** stops after displaying the last line of the last file and prompts for a new command. If the command that displays text causes **more** to reach the end of the file again, **more** exits.

–i Ignores case during searches.

–n *number*
Specifies the number of lines per page. This overrides any values obtained from the environment. Use this option when you need to override the curses screen length or LINES setting to work with your terminal. This option will give incorrect results if used while in the OMVS shell (or another dumb terminal) and specifying *number* to be something other than the current number of screen lines.

–P *string*
Sets the prompt that appears at end of each page of text to *string*. The default prompt is [*filename*]. **more** typically displays the prompt in standout mode.

–p *command*
Initially executes the **more** command on each file. If it executes successfully and *command* is a positioning command such as a line number or a regular expression search, **more** displays the resulting page; otherwise **more** displays the first page of the file. If both the **–t** and **–p** options are specified, the **–t** option is processed first.

+*command*
Initially executes the **more** command on each file. If it executes successfully and *command* is a positioning command such as a line number or a regular expression search, **more** displays the resulting page; otherwise **more** displays the first page of the file. If both the **–t** and **–p** options are specified, the **–t** option is processed first.

–S Displays the prompt in normal mode rather than standout (reverse video) mode.

–s Replaces consecutive empty lines with a single empty line.

–t *tag* Searches for the named *tag* and displays the page of text containing it. See **ctags** for more information.

–U Allows **more** to refresh the display screen for each new line.

–u Displays all backspaces as `^H`.

Typically, character-backspace_(underscore) displays *character* as underlined and character-backspace-character displays *character* as boldfaced. **–u** also displays all carriage returns as `^M`. This option cannot be used with **–A**.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

Interactive commands

more also supports the following interactive commands.

Interactive command	Action
[*n*]**b** [*n*]**Ctrl-B** [*n*]**PgUp**	Moves backward *n* lines, with a default of one page. If *n* is more than the page size, **more** displays only the final page.
[*n*]**d** [*n*]**Ctrl-D**	Scrolls forward *n* lines, with a default of one half of the page size. If you specify *n*, it becomes the new default for subsequent `d` and `u` commands.
[*n*]**f** [*n*]**Ctrl-F** [*n*]**PgDn**	Moves forward *n* lines, with a default of one page. At end-of-file, **more** continues with the next file in the list, or exits if the current file is the last one in the list.
[*n*]**G**	Goes to the *n*th line in the file. If you do not specify *n*, **more** advances to the end of the file.
[*n*]**g**	Goes to the *n*th line in the file, with the default being the first line of the file.
h	Displays a summary of interactive commands.
[*n*]**j** [*n*]**SPACE** [*n*]**ENTER** [*n*]**↓**	Scrolls forward *n* lines, with a default of one line for **j**, **ENTER** and **↓**, and a default of one page for **SPACE**. This command displays the entire *n* lines even if *n* is more than the page size. At end-of-file, these commands cause **more** to begin displaying the next file in the list, or to exit if the current file is the last one in the list.
[*n*]**k** [*n*]**↑**	Scrolls backward *n* lines, with a default of one line. This command displays the entire *n* lines even if *n* is more than the page size.

Interactive command	Action
m*letter*	Marks the current position with the lowercase *letter*. When you view a new file, all previous marks are lost.
[*n*]**N**	Repeats the previous search, but in the opposite direction. If you specify *n*, **more** repeats the search *n* times.
[*n*]**n**	Repeats the previous search. If you specify *n*, **more** repeats the search *n* times. For example if there are eight occurrences of *pattern* in the file and /*pattern* found the second occurrence then a follow-up command of `5n` finds and sets the current position to the 7th occurrence of *pattern*.
q **:q** **ZZ**	Exits **more**.
R	Refreshes the screen and discards any buffered input.
r **Ctrl-L**	Refreshes the screen.
[*n*]**s**	Skips forward *n* lines (with a default of one line) and displays one page beginning at that point. If *n* would cause less than one page to be displayed, **more** displays the last page in the file.
[*n*]**u** [*n*]**Ctrl-U**	Scrolls backward *n* lines, with a default of one half of the page size. If you specify *n*, it becomes the new default for subsequent `d` and `u` commands.
v	Invokes an editor to edit the current file. **more** uses the editor named by the environment variable **EDITOR**. The default editor is **vi**. If the editor is **ex** or **vi**, the text conversion that is specified on the **more** command (for example, the **-B** or **-W** option) is used.
'*letter*	Returns to the position marked with *letter*.
''	Returns to the position from which you last issued a movement command of greater than one page or the beginning of the file if you have issued no such commands. **Note: ''** indicates two **single** quotes, not one double quote.
[*n*]**/**[**!**]*pattern*	Searches forward in the file for the *n*th line containing *pattern*. *n* defaults to one if not specified. If *pattern* is the null regular expression (**/**) **more** uses the previous *pattern*. If the character **!** precedes *pattern*, **more** searches for lines that do not contain *pattern*.
[*n*]**?**[**!**]*pattern*	Searches backward in the file for the *n*th line containing *pattern*. The search begins at the line immediately before the top line displayed. *n* defaults to one if not specified. If *pattern* is the null regular expression (**?**), **more** uses the previous *pattern*. If the character **!** precedes *pattern*, **more** searches for lines that do not contain *pattern*.
:e [*filename*]`newline`	Stops viewing the current file and views *filename* instead. If you do not specify *filename*, **more** returns to the beginning of the current file. If *filename* is **#**, **more** returns to the last file viewed before the current one. The text conversion that is specified on the **more** command (for example, the **-B** or **-W** option) is used.
[*n*]**:n**	Views the next file from the list given on the command line. If you specify *n*, **more** views the *n*th next file from the list.
[*n*]**:p**	Views the previous file from the list given in the command line. If you specify *n*, **more** views the *n*th previous file from the list.
:t *tagname*	Goes to *tagname*.
:w *filename*	Writes the contents of the current file to the file *filename*. The text conversion that is specified on the **more** command (for example, the **-B** or **-W** option) is used.
!<*shell command***>**	Escape to shell and execute *shell command*.

Interactive command	Action
=	Displays, where possible, the name of the file currently being viewed, its number (relative to the total number of files specified in the command line), the current line number, the current byte number, the total bytes to display and what percentage of the file has been displayed.
Ctrl-G	Displays, where possible, the name of the file currently being viewed, its number (relative to the total number of files specified in the command line), the current line number, the current byte number, the total bytes to display and what percentage of the file has been displayed.
Home	Goes to the first line in the file.
End	Goes to the last line in the file.

Examples

1. To display a text file one page at a time starting at line 12:

   ```
   more +12g myTextFile
   ```

2. To display a text file containing UTF-8 characters one page at a time, assuming that:
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are displaying an untagged public text file or a read-only text file):

   ```
   more -W filecodeset=1208,pgmcodeset=IBM-1047 myutf8File
   ```

3. To display a text file containing EBCDIC characters one page at a time, assuming that automatic conversion has been enabled but the text file is incorrectly tagged as ASCII:

   ```
   more -B myMisTaggedFile
   ```

Environment variables

more uses the following environment variables:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

COLUMNS
Contains the maximum number of columns to display on one line.

EDITOR
Contains the name of the editor that the **v** command invokes.

LINES
Contains the number of lines in a page. This value takes precedence over value from **TERM**. However, the **–n** value takes precedence over the **LINES** value.

MORE
Contains a list of options as they would appear on the command line. This variable takes preference over the **TERM** and **LINES** variables.

TERM Contains the name of the terminal type.

Usage notes

more is designed for raw-mode terminals. It can be used with 3270 terminals with certain restrictions. Line-mode terminals require a user to press Enter to allow the keys typed to be processed. However, the Enter key has a special meaning to **more**. Specifically, it causes **more** to scroll down a single line. Therefore, when attempting to use **more** while in line-mode, each time a user presses "Enter" to process any command, this causes the screen to scroll down a single line at a time.

Localization

more uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

>0 Failure due to any of the following:
- *filename* is not a text file
- **–n** option too large
- Syntax error in regular expression
- Inability to create a file
- Inability to open input file
- Insufficient memory
- Incorrect command
- Inability to access the terminal
- Missing *string* after **-p** option
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

Portability

POSIX.2 User Portability Extension, UNIX systems.

The **–A**, **–B**, **–P**, **–S**, **–U**, and **–W** options and the **:w** and **!** commands are extensions of the POSIX standard. The **Home**, **End**, **PgDn**, **PgUp**, ↓, and ↑ commands are extensions to traditional implementations of **more**, available only on terminal types which support these keys.

Related information

cat, **vi**

mount — Logically mount a file system

Format

mount [**–t** *fstype*] [**–rv**] [**–a yes | include,***sysname1,... sysnameN*
| exclude, | no | unmount] [**–o** *fsoptions*] [**–d** *destsys*] [**–s nosecurity | nosetuid**] **–f** *fsname pathname*[**-w***n*]

mount –q [**–d** *destsys*][**–v**] *pathname*

File tag specific option:

mount [**–c** *ccsid*,**text | notext**]

Description

The **mount** shell command, located in `/usr/sbin`, is used to mount a file system or list all mounts over a file system.

Rule: You must have mount authority before you can issue the **mount** command. See the section on mount authority in *z/OS UNIX System Services Planning*.

Options

–a yes | include,*sysname1,...,sysnameN* **| exclude,***sysname1,...,sysnameN* **| no | unmount**
The **-a** option specifies the AUTOMOVE attribute of the file system in a sysplex environment where systems are exploiting the shared file system capability.

–a yes allows the system to automatically move logical ownership for a specified file system as needed. This is the default.

–a no prevents ownership movement in some situations.

–a unmount unmounts the file system in some situations.

–a include,*sysname1,...,sysnameN* specifies a list of systems, in priority order, to which the file system's ownership can be moved. **include** can be abbreviated to **i**.

–a exclude,*sysname1,...,sysnameN* specifies a list of systems, in priority order, to which the file system's ownership cannot be moved. **exclude** can be abbreviated to **e**.

See *z/OS UNIX System Services Planning* for details about the behavior of the AUTOMOVE options.

–d *destsys*
Specifies the name of the system in a shared file system environment that will be the logical owner of the mount. Note, if **–q** is specified, the **mount –q** output will only list mounts that are owned by *destsys*.

–f *fsname*
Names the file system to be mounted. All file system names must be unique. File system names are case sensitive. However, if the file system type is HFS, or if the type was not specified on the command and the file system is zFS*fsname* is translated to uppercase. The file system name has a maximum length of 44 characters; any additional characters are truncated. Options **–q** and **–f** are mutually exclusive, but one must be specified.

-w*n* Specifies the amount of time the mount will wait in seconds for async mounts to complete. If *n* is specified as a 0 the wait will be indefinite. This

option flag is tolerated on any form of the mount command and is ignored if not appropriate (no wait needs to be done).

–o *fsoptions*
Specifies an option string to be passed to the file system type. NFS, for example, uses this to identify the remote server and the object on that server. The format and content are specified by the physical file system that is to perform the logical mount. You can specify lowercase or uppercase characters. Enclose the string in single quotes.

Refer to the following for the appropriate file system-specific options to specify for *fsoptions*:

- For HFS-specific options, see the BPXPRMxx section in *z/OS MVS Initialization and Tuning Reference*.
- For zFS-specific options, see Mount, in *z/OS Distributed File Service zFS Administration*.
- For NFS-specific options, see Mount processing parameters, in *z/OS Network File System Guide and Reference*.
- For TFS-specific options, see Mounting the TFS, in *z/OS UNIX System Services Planning*.

–q Prints a list of path names for the mount points of file systems mounted over a another file system, including that system. Options **–q** and **–f** are mutually exclusive, but one must be specified. If **–v** is not specified, only path names for mount points are printed. Note that the output of **mount –q** can be used by the **unmount** utility as input. See "Examples" on page 483.

If `-q` and `-v` are specified then the output consists of a 6-character mode, followed by the file system name, followed by the file system mount point path name. The 6-character mode can be interpreted as shown in Table 17.

Table 17. Output of the mount -q and -v options

Column	Flags	Description
1	– R	Read/write Read-only
2	– S	SETUID supported SETUID not supported
3	– E	File system not exported File system exported by DFS
4	– U	Security checks enforced No security checks enforced
5	– A U	Noautomove Automove Unmount
6	– C	Owning system or sysplex-aware Client

–r Specifies mounting a file system read-only.

–s nosecurity | nosetuid
Specifies that a file system is unsecured. Setuid, setgid, APF and program controlled attributes are ignored when you use **nosetuid**. To additionally disable authorization checking, use **nosecurity**. Minimum unique abbreviations can be used for the option arguments.

Note: When a file system is mounted with the NOSECURITY option enabled, any new files or directories that are created are assigned an owner of UID 0, no matter what UID issued the request.

–t *fstype*
Identifies the file system type. *fstype* may be entered in mixed case but will be treated as upper case. If this option is not specified, the default is **–t** HFS.

–v Verbose output. Includes additional information, if available, on output. If **–v** is specified on the **mount** command and the mount fails, the file system name that had the mount failure will be included in the failure information.

pathname specifies the path name for the mount point.

File tag specific option

–c *ccsid*,**text** | **notext**
Specifies the file tag that will be implicitly set for untagged files in the mounted file system.

ccsid Identifies the coded character set identifier to be implicitly set for the untagged file. *ccsid* is specified as a decimal value from 0 to 65535. However, when text is specified, the value must be between 0 and 65535. Other than this, the value is not checked as being valid and the corresponding code page is not checked as being installed.

For more information about file tagging, see *z/OS UNIX System Services Planning*.

text Specifies that each untagged file is implicitly marked as containing pure text data that can be converted.

notext Specifies that none of the untagged files in the file system are automatically converted during file reading and writing.

Examples

1. The output of **mount –q** can be used for the input of **unmount**. For example:
   ```
   mount -q /ict/hfsfir
   ```
   can be used as input:
   ```
   unmount $(mount -q /ict/hfsdir)
   ```
2. To mount an HFS file system over `/u/wjs` with a sync interval of 120 seconds:
   ```
   mount -f omvs.hfs.user.wjs -o 'SYNC(120)' /u/wjs
   ```
3. To display a list of path names for all mount points under `/u`:
   ```
   mount -q /u
   ```

Usage notes

1. Systems exploiting shared file system will have I/O to an OMVS couple data set. Because of these I/O operations to the CDS, each mount request requires additional system overhead. You will need to consider the affect that this will have on your recovery time if a large number of mounts are required on any system participating in shared file system.
2. The **–a unmount** is not available to automounted file systems.

3. The file system name is treated as uppercase when the file system type is not specified (-t option).

File system recovery and mount

File system recovery in a shared file system environment takes into consideration file system specifications such as **–a yes | no | unmount** and whether or not the file system is mounted read-only or read/write.

Generally, when an owning system fails, ownership over its **–a yes** mounted file system is moved to another system and the file is usable. However, if a file system is mounted read/write and the owning system fails, then all file system operations for files in that file system will fail. This is because data integrity is lost when the file system owner fails. All files should be closed (BPX1CLO) and reopened (BPX1OPN) when the file system is recovered. (The BPX1CLO and BPX1OPN callable services are discussed in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.)

For file systems that are mounted read-only, specific I/O operations that were in progress at the time the file system owner failed may need to be submitted again. Otherwise, the file system is usable.

In some situations, even though a file system is mounted with the **–a yes** option, ownership of the file system may not be immediately moved to another system. This may occur, for example, when a physical I/O path from another system to the volume where the file system resides is not available. As a result, the file system becomes "unowned" (the system will issue message BPXF213E when this occurs). This is true if the file system is mounted either read/write or read-only. The file system still exists in the file system hierarchy so that any dependent file systems that are owned by another system are still usable.

However, all file operations for the unowned file system will fail until a new owner is established. The shared file system support will continue to attempt recovery of **–a yes** mounted file systems on all systems in the sysplex that are enabled for shared file system. Should a subsequent recovery attempt succeed, the file system transitions from the unowned to the active state.

Applications using files in unowned file systems must close (BPX1CLO) those files and reopen (BPX1OPN) them after the file system is recovered.

File systems that are mounted with the **–a no** option will become unowned when the file system owner exits the sysplex. The file system will remain unowned until the original owning system restarts or until the unowned file system is unmounted. Because the file system still exists in the file system hierarchy, the file system mount point is still in use.

An unowned file system is a mounted file system that does not have an owner. The file system still exists in the file system hierarchy. As such, you can recover or unmount an unowned file system.

File systems associated with a 'never move' PFS will be unmounted during dead system recovery. For example, TFS is a 'never move' PFS and will be unmounted, as well as any file systems mounted on it, when the owning system leaves the sysplex.

As stated in “Usage notes” on page 483, **–a unmount** is not available to automounted file systems. However, during dead system recovery processing for an automounted file system (whose owner is the dead system), the file system will be unmounted if it is not being referenced by any other system in the sysplex.

Exit values

0 Successful completion

Related information

chmount, **unmount**

mv — Rename or move a file or directory

Format

mv [**–fiMUv**] [**–F** *format* | **B** | **T** | **X**] [**–P** *params*] [**-W seqparms=***params*] [**–Z**] [[**–O u** | **c=***codeset*] *file1 file2*

mv [**–ACfiMUv**] [**–F** *format* | **B** | **T** | **X**] [**–S** *suffix*] [**–Z**] [**–O u** | **c=***codeset*] *file ...file ... directory*

mv –Rr [**–fi**] [**–Z**] [**–O u** | **c=***codeset*] *directory1 directory2*

Description

mv renames files or moves them to a different directory. If you specify multiple files, the target (that is, the last path name on the command line) must be a directory. **mv** moves the files into that directory and gives them names that match the final components of the source path names. When you specify a single source file and the target is not a directory, **mv** moves the source to the new name, by a simple rename if possible.

You can also use **mv** to move files to and from MVS data sets. If you specify more than one file to be moved, the target (last path name on command line) must be either a directory or a partitioned data set. If the target is an MVS partitioned data set, the source cannot be a UNIX directory.

mv does not support the moving to or from generation data groups (GDGs). To use those MVS data sets, user must specify the real data set name. **mv** also does not support copying to a temporary PDSE.

When moving records, the string " \n" is moved the same way as the string "\n": both are read back as "\n", where "\n" indicates that z/OS XL C++ will write a record containing a single blank to the file (the default behavior of z/OS XL C/C++). All other blanks in your output are read back as blanks, and any empty (zero-length) records are ignored on input. However, if the environment variable _EDC_ZERO_RECLEN is set to Y before calling **mv**, an empty record is treated as a single newline and is not ignored. Also, if _EDC_ZERO_RECLEN is set to Y, a single newline is written to the file as an empty record, and a single blank will be represented by " \n".

A file can be moved by any user who has write permission to the directory containing the file, unless that directory has its sticky bit turned on. If the file is in a directory whose sticky bit is turned on, only the file owner or a superuser can move the file.

You can move:
- One file to another file in the working directory
- One file to a new file on another directory
- A set of directories and files to another place in your file system
- A UNIX file to an MVS data set
- An MVS data set to a file system
- An MVS data set to an MVS data set

Options

–A Specifies that all suffixes (from the first period till the end of the target) be truncated. **–A** has precedence over **–M** and **–C** options. **–S** will be turned off if **–A** is the last option specified.

–B Specifies that the data to be moved contains binary data. When you specify **–B**, **mv** operates without any consideration for <newline> characters or special characteristics of DBCS data (this type of behavior is typical when moving across a UNIX system). **–B** is mutually exclusive with **–F**, **–X**, and **–T**. You will get an error if you specify more than one of these options.

–C Specifies truncating the file names to 8 characters to meet the restriction in the MVS data set member.

–F *format*
Specifies whether the file is to be treated as binary, text, or record file format when moved; for text files, specifies the end-of-line delimiter. Also sets the file format to *format* only if the source is an MVS data set and the target is a UNIX file. Only **cp** sets the file format for UNIX to UNIX operations. For text files, when moving from UNIX to MVS, the end-of-line delimiter will be stripped. When moving from MVS to UNIX, the end-of-line delimiter will be added. (Code page IBM-1047 is used to check for end-of-line delimiters). Record file formats are treated as if they were binary files.

–F is mutually exclusive with **–B**, **–X**, and **–T**. If you specify one of these options with **–F**, you will get an error. If **–F** is specified more than once, the last **–F** specified will be used.

For *format*, you can specify:
not Not specified
bin Binary data
rec Record. (File data consists of records with prefixes. The record prefix contains the length of the record that follows. From the shell command perspective, files with this format will be treated as if they were binary files.)

Or the following text data delimiters:
nl Newline character
cr Carriage return
lf Line feed
crlf Carriage return followed by line feed
lfcr Line feed followed by carriage return
crnl Carriage return followed by a new line character

–f Does not ask if you want to overwrite an existing UNIX destination file; it automatically behaves as if you answered yes. If you specify both **–f** and **–i**, **mv** uses the option that appears last on the command line.

–i When moving to a UNIX target, always prompts before overwriting an existing file, but does not overwrite the file if you do not have permission. If you specify both **–f** and **–i**, **mv** uses the option that appears last on the command line.

–M Specifies that some characters of the file name are translated when moving between a UNIX file and a data set member. Characters are translated as follows:

- _ (underscore) in UNIX is translated to @ in MVS dataset members and vice versa.
- . (period) in UNIX is translated to # in MVS dataset members and vice versa.
- – (dash) in UNIX is translated to $ in MVS dataset members and vice versa.

–P *params*

Specifies the parameters needed to create a sequential data set if one does not already exist. You can specify the RECFM, LRECL, BLKSIZE, and SPACE in the format that the **fopen()** function uses.

`SPACE=(units,(primary,secondary)` where the following values are supported for units:

- Any positive integer indicating BLKSIZE
- CYL (mixed case)
- TRK (mixed case). For example:

```
SPACE=(500,(100,500)) units, primary, secondary
SPACE=(500,100) units and primary only
```

For information about how to specify these parameters, see *z/OS XL C/C++ Programming Guide*.

Note:

1. The fopen() argument LRECL specifies the length, in bytes, for fixed-length records and the maximum length for variable-length records.
2. BLKSIZE specifies the maximum length, in bytes, of a physical block of records.
3. RECFM refers to the record format of a data set and SPACE indicates the space attributes for MVS data sets.

–R (UNIX to UNIX only)

Moves a directory and all its contents (files, subdirectories, files in subdirectories, and so on). For example:

```
mv –R dir1 dir2
```

moves the entire contents of **dir1** to **dir2/dir1**. **mv** creates any directories that it needs.

–r (UNIX to UNIX only)

Is identical to **–R**.

–S *d=suffix*|*a=suffix*

- *d=suffix*

  Removes the specified suffix from a file.

- *a=suffix*

  Appends the specified suffix to a file.

–S has precedence over **–M** and **–C**. It also turns off the **–A** option (if **–S** is the last specified option).

–T Specifies that the data to be moved contains text data. See "Usage notes" on page 494 for details on how to treat text data. This option looks for IBM-1047 end-of-line delimiters, and is mutually exclusive with **–F**, **–X**, and **–B**. You will get an error if you specify more than one of these options.

Note: **–T** is ignored when moving across UNIX file systems.

–U Keeps file names in uppercase when moving from MVS data set members to UNIX files. The default is to make file names lowercase.

–v Verbose

-W seqparms=*params*

Specifies the parameters needed to create a sequential data set if one does not already exist. You can specify the RECFM, LRECL, BLKSIZE, and SPACE in the format that the fopen() function uses.

`SPACE=(units,(primary,secondary)` where the following values are supported for units:

- Any positive integer indicating BLKSIZE
- CYL (mixed case)
- TRK (mixed case). For example:

```
SPACE=(500,(100,500)) units, primary, secondary
SPACE=(500,100) units and primary only
```

For information about how to specify these parameters, see *z/OS XL C/C++ Programming Guide*.

Note: The fopen() arguments: LRECL specifies the length, in bytes, for fixed-length records and the maximum length for variable-length records. BLKSIZE specifies the maximum length, in bytes, of a physical block of records. RECFM refers to the record format of a data set and SPACE indicates the space attributes for MVS data sets.

This option is the same as **-P** *params*.

–X Specifies that the data to be moved is an executable. Cannot be used in conjunction with **–F**, **–T**, or **–B**.

-Z Specifies that error messages are not to be displayed when setting ACLs or the file tag on the target. The return code will be zero. **mv** will try to preserve the ACLs, if possible. The ACLs are not preserved if a file system does not support ACLs, or if you are moving files to MVS. For more information about file tagging, see Automatic conversion and file tagging behavior for mv.

–O u | c=*codeset*

Allow automatic conversion on source and target files.

–O u If the target exists and is not empty or already tagged, **mv** will not change the target's tag in order for the target to be a candidate for automatic conversion.

For new targets and existing, untagged, empty files, this option has no effect and **mv** behaves the same as the default. For a description of the default behavior, see Automatic conversion and file tagging behavior for mv.

When using **mv** to move from a UNIX file to an MVS data set, if the source is a tagged text file, then it might be a candidate for automatic conversion.

When using **mv** to move executables from or to MVS, automatic conversion is disabled for both source and target.

–O c=*codeset*
For a detailed description of the behavior of this option on **mv**, see Automatic conversion and file tagging behavior for mv.

codeset can be a code set name known to the system or the numeric coded character set identifier (CCSID). If a code set name exists, the numeric CCSID associated with that name is used. Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names.

To prevent the corruption of text files, **mv** will fail if it cannot set the tag to text or code set.

Attention: If automatic conversion is not set properly or the source is not tagged properly, the target might end up with a tag code set that does not match the file content.

Note: If you do not specify **–F | B | T** or **X**, **mv** will first check the format of the MVS data set indicated and then try to determine the type of file.

Automatic conversion and file tagging behavior for mv

The following tables describe the behavior of file tagging and automatic conversion for various source and target scenarios depending on whether the **–O** option is specified on the **mv** command.

Table 18. Automatic conversion and file tagging behavior for mv: Moving files to files

	Default (without -O option)			
	If the target file system supports setting file tags...	**If the target file system does not support setting file tags (such as NFS)...**	**With -O u option**	**With -O c=*codeset* option**
File tagging	Target file is tagged the same as the source file.	• An existing target's tag is unchanged. • A new target is created with a tag according to the file system's attributes (The MOUNT parameter can specify TAG).	The target's tag is not changed. The source or target file is a candidate for automatic conversion when its txtflag is tagged TEXT.	The target's txtflag is set to TEXT and its code set is set to *codeset*.

Table 18. Automatic conversion and file tagging behavior for mv: Moving files to files (continued)

	Default (without -O option)			
	If the target file system supports setting file tags...	**If the target file system does not support setting file tags (such as NFS)...**	**With -O u option**	**With -O c=*codeset* option**
Automatic conversion	Disabled for source and target files	Allowed for source and target files		

Table 19. Automatic conversion and file tagging behavior for mv: Moving files to MVS data sets

	Default (without -O option)	**With -O u option**	**With -O c=*codeset* option**
If the SOURCE is text or binary:			
File tagging	Not applicable for target data set		
Automatic conversion	Disabled for source file	Allowed for source file **Note:** The source file is a candidate for automatic conversion when its txtflag is tagged TEXT.	Disabled for source file
If the SOURCE is executable:			
File tagging	Not applicable for target data set		
Automatic conversion	Disabled for source file		

Limits and requirements

General requirements are as follows:

1. To specify an MVS data set name, precede the name with double slashes (//). For example, to specify the fully qualified data set names 'turbo.gammalib' and 'turbo.gammalib(pgm1)', write:

   ```
   "//'turbo.gammalib'"
   "//'turbo.gammalib(pgm1)'"
   ```

   The same goes for data set names that are not fully qualified:

   ```
   //turbo
   ```

2. For PDS (partitioned data set) or PDSE (partitioned data set extended), to avoid parsing by the shell, the name should be quoted or minimally, the parenthesis should be escaped. For example, to specify 'turbo(pgm1)', you can use quotes:

   ```
   "//turbo(pgm1)"
   ```

   or escape the parenthesis:

   ```
   //turbo\(pgm1\)
   ```

As indicated, a fully qualified name must be single-quoted (as is done within TSO). To prevent the single quotes from being interpreted by the shell, they must be escaped or the name must be placed within regular quotation marks. See the 'turbo.gammalib' examples.

3. If you specify a UNIX file as source and the MVS data set (target) does not exist, a sequential data set will be created. If the partitioned data set exists, the UNIX file will be moved to the partitioned data set member.
4. If source is an MVS data set and target is a UNIX directory, the UNIX directory must exist.
5. You cannot have a UNIX directory, partitioned data set, or sequential data set as source if the target is a partitioned data set.
6. To move all members from a partitioned data set, you can specify the partitioned data set as source and a UNIX directory as target.

MVS data set naming limitations are as follows:

- Data set names can only contain uppercase alphabetic characters (A-Z). Lowercase characters will be converted to uppercase during any moves to MVS data sets.
- Data set names can contain numeric characters 0–9 and special characters @, #, and $.
- Data set names cannot begin with a numeric character.
- A data set member name cannot be more than 8 characters. If a file name is longer than 8 characters or uses characters that are not allowed in an MVS data set name, the file is not moved. You can use the **–C** option to truncate names to 8 characters.

Limitations: UNIX to MVS data set. The limitations are as follows:

1. If you specify a sequential MVS data set that is in undefined record format, the file is moved as binary.
2. If you specify a PDSE that is in undefined record format, the first file successfully moved determines in what format files will be moved. Note that PDSE does not allow mixture. So if the first successfully moved file is an executable, the PDSE will have program objects only and all other files will fail. However, if the first file is data, then all files are moved as binary.
3. If you specify a PDS that is in undefined record format, UNIX executables are saved as PDS load modules. All other files are moved as binary.
4. If you specify an MVS data set that is either in variable length or fixed record length and you have not set the file format, text files are moved as text, binaries as binary, and executables as binary. (IBM-1047 end-of-line delimiters are detected in the data)
5. If you set the file format, the set value is used to determine if data is binary, text, or record file format.

Limitations: MVS data set to UNIX. The limitations are as follows:

1. If an UNIX file does not exist, one is created using 666 mode value, whether the data to be copied is binary or text:

   ```
   666 mode value:  owner(rw-)  group(rw-)  other(rw-)
   ```

   If the data to be copied is a shell script or executable residing in a PDS or PDSE with undefined record format, the UNIX file is created using 777 mode value:

   ```
   777 mode value:  owner(rwx)  group(rwx)  other(rwx)
   ```

2. If a UNIX file exists and the file format is set, **mv** moves the file as that format. Otherwise,
   - Load modules (PDS) are stored as UNIX executables and program objects (PDSE) are moved since they are the same as executables;
   - Data within data sets of undefined record format are moved as binary if the data is not a program object or load module;
   - Data found within data sets of fixed length or variable record length are moved as text. (IBM-1047 end-of-line delimiters are detected in the data

Limitations: MVS to MVS. The limitations are as follows:

1. Options **–A**, **–C**, **–f**, and **–S** are ignored.
2. If target and source are in undefined record format (and neither is a sequential data set), **mv** will attempt to move the data as a load module. If that fails, then **mv** will move the data as binary.
3. If target and source are in undefined record format and either is a sequential data set, **mv** moves the data as binary.
4. If the source has a fixed or variable record length and the target is in undefined record format, **mv** moves the data as binary.
5. If the source is in undefined record format and the target has a fixed or variable record length, **mv** moves the data as binary.
6. If both source and target are in fixed or variable record length, **mv** moves the data as text.

Limitations: Moving executables into a PDS. The limitations are as follows:

1. A PDS cannot store load modules that incorporate program management features.
2. **c89**, by default, produces objects using the highest level of program management.
3. If you plan on moving a load module to a PDS, you can use a prelinker which produces output compatible with linkage editor. Linkage editor generated output can always be stored in a PDS.

The following table is a quick reference for determining the correct use of options with **mv**.

Table 20. Options allowed for mv: File to File and File ... (multiple files) to directory

Source/Target	Options Allowed	Options Ignored	Options Failed
UNIX file/UNIX file	Ffi	ABCMPSTUX	
UNIX file/Sequential data set	BFiPT	ACfMSU	X
UNIX file/PDS or PDSE member	BFiTX	ACfMPSU	
Sequential data set/UNIX file	BFfiTU	ACMPS	X
Sequential data set/sequential data set	BFiPT	ACfMSU	X
Sequential data set/PDS or PDSE member	BFiT	ACfMPSU	X
PDS or PDSE member/UNIX file	BFfiTUX	ACMPS	

Table 20. Options allowed for mv: File to File and File ... (multiple files) to directory (continued)

Source/Target	Options Allowed	Options Ignored	Options Failed
PDS or PDSE member/sequential data set	BFiPT	ACfMSU	X
PDS or PDSE member/PDS or PDSE member	BFiTX	ACfMPSU	
UNIX file/UNIX directory	Fi	ABCFMPSTUX	
PDSE or PDSE member/UNIX directory	BFfiMSTUX	ACP	
UNIX file/partitioned data set	ABCFiMSTX	fPU	
PDS or PDSE member/partitioned data set	BFiTX	ACfMPSU	
UNIX directory/UNIX directory	fi	ABCFMPSTUX	
Partitioned data set/UNIX directory	ABCFfiMSTUX	P	

The tables that follow indicate the kind of moves allowed using **mv**.

Table 21. Moves allowed for mv: File to File

Source	Target	Allowed
UNIX file, sequential data set, or partitioned data set member	UNIX file, sequential data set, or partitioned data set member	Yes
UNIX directory (dir)	UNIX directory (dir2 exists)	Yes (Results will be found in dir2/dir1/ ..).
UNIX directory (dir)	UNIX directory (dir2 does not exist)	Yes (Results will be found in dir2/...).
Partitioned data set	UNIX directory (dir). Results in each member of data set are moved to dir.	Yes
UNIX directory	Partitioned data set	No
Partitioned data set	Partitioned data set	No
UNIX file, UNIX directory, or partitioned data set member	UNIX directory	Yes
Partitioned data set member	Partitioned data set (must exist)	Yes

Table 22. Moves allowed for mv: File... (multiple files) to directory

Source	Target	Allowed
Any combination of UNIX file or partitioned data set member	UNIX directory or partitioned data set	Yes

Table 22. Moves allowed for mv: File... (multiple files) to directory (continued)

Source	Target	Allowed
Any combination of UNIX directory, partitioned data set, sequential data set	Partitioned data set	No
Sequential data set	UNIX directory	No
Any combination of UNIX directory, UNIX file, partitioned data set, partitioned data set member	UNIX directory	Yes

Examples

1. To specify **–P** *params* for a nonexisting sequential target:

   ```
   mv -P "RECFM=U,space=(500,100)" file "//'turbo.gammalib'"
   ```

   This **mv** command is equivalent to:

   ```
   mv -W "seqparms='RECFM=U,space=(500,100)'" file "//'turbo.gammalib'"
   ```

2. To move file **f1** to a fully qualified sequential data set `'turbo.gammalib'` and treat it as a binary:

   ```
   mv -F bin f1 "//'turbo.gammalib'"
   ```

3. To move all members from a fully qualified PDS `'turbo.gammalib'` to an existing UNIX directory `dir`:

   ```
   mv "//turbo.gammalib'" dir
   ```

4. To drop .c suffixes before moving all files in UNIX directory `dir` to an existing PDS `'turbo.gammalib'`:

   ```
   mv -S d=.c dir/* "//'turbo.gammalib'"
   ```

Usage notes

For **UNIX to MVS**:

1. To move from UNIX to a partitioned data set, you must allocate the data set before doing the **mv**.
2. If an MVS data set does not exist, **mv** will allocate a new sequential data set of variable record format.
3. For text files, all <newline> characters are stripped during the move. Each line in the file ending with a <newline> character is moved into a record of the MVS data set. If text file format is specified or already exists for the source file, that file format will be used for end-of-line delimiter instead of <newline>. Note that **mv** looks for IBM-1047 end-of-line delimiters in data.

   You cannot move a text file to an MVS data set that has an undefined record format:

   - For an MVS data set in fixed record format, any line moved longer than the record size will cause **mv** to fail with a displayed error message and error code. If the line is shorter than the record size, the record is padded with blanks.
   - For an MVS data set in variable record format: Any line moved longer than the largest record size will cause **mv** to fail with a displayed error message and error code. Record length is set to the length of the line.
4. For binary files, all moved data is preserved:

- For an MVS data set in fixed record format, data is cut into chunks of size equal to the record length. Each chunk is put into one record. The last record is padded with blanks.
- For an MVS data set in variable record format, data is cut into chunks of size equal to the largest record length. Each chunk is put into one record. The length of the last record is equal to length of the data left.
- For an MVS data set in undefined record format, data is cut into chunks of size equal to the block size. Each chunk is put into one record. The length of the last record is equal to the length of the data left.

5. For load modules, the partitioned data set specified must be in undefined record format otherwise the executable will not be moved.
6. If more than one file name is the same, the file is overwritten on each subsequent move.
7. If a UNIX file name contains characters that are not allowed in an MVS data set, it will not be moved. If the UNIX file name has more than 8 characters, it cannot be moved to an MVS data set member. (See the **–ACMS** options for converting file names.)
8. You are not allowed to move files into data sets with spanned records.
9. PDSE cannot have a mixture of program objects and data members. PDS allows mixing, but it is not recommended.
10. Special files such as external links and FIFO will not be moved to MVS data sets. However, you can move character special files to MVS data sets.
11. If a file is a symbolic link, **mv** will move the resolved file, not the link itself.
12. UNIX file attributes are lost when moving to MVS. If you want to preserve file attributes, you should use the **pax** utility.

For **MVS to UNIX**:

1. If the target UNIX file exists, the new data overwrites the existing data. The mode of the file is unchanged (except the S_ISUID and S_ISGID bits are turned off).
2. If the specified UNIX file does not exist, it will be created using a 666 mode value whether the data is binary or text (this is subject to **umask**). If the data to be moved is a shell script or executable, the UNIX file will be created with a 777 mode value (also subject to **umask**).
3. For an MVS data set in variable record format RECFM(VB) or undefined record format RECFM(U), trailing blanks are preserved when moving from MVS to UNIX. For an MVS data set in fixed record format, trailing blanks are not preserved when moving from MVS to UNIX.
4. When you move MVS data sets to text files in the z/OS UNIX file system, a <newline> character is appended to the end of each record. If trailing blanks exist in the record, the <newline> character is appended after the trailing blanks. If the file format option is specified or the target file has the file format set, that file format is used as the end-of-line delimiter instead of a <newline> character.
5. When you move MVS data sets to UNIX binary files, the <newline> character is not appended to the record.
6. You cannot use **mv** to move data sets with spanned record lengths.
7. Due to an z/OS XL C/C++ run-time restriction, when moving a file from a file system to an MVS sequential data set with the same name and case, you need to prefix the file in the file system with "./". For example:

```
mv ./SMPL.DATA  "//''SMPL.DATA''"
```

Localization

mv uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

mv uses the following environment variable when moving records to or from MVS data sets:

_EDC_ZERO_RECLEN
If set to Y before calling **mv**, an empty record is treated as a single newline character and is not ignored. Also, a single newline is written to the file as an empty record, and a single blank will be represented by "\n". If you do not set this environment variable when moving records, then the string "\n" is moved the same way as the string "\n": both are read and written as "\n", where "\n" indicates that z/OS XL C/C++ will write a record containing a single blank to the file (the default behavior of z/OS XL C/C++). All other blanks in the output are read back as blanks, and any empty (zero-length) records are ignored on input.

Exit values

0 Successful completion

1 Failure due to any of the following:
- The argument had a trailing / but was not a directory
- Inability to find file
- Inability to open input file for reading
- Inability to create or open output file for output
- Read error on an input file
- Write error on an output file
- Input and output files identical
- Inability to unlink input file
- Inability to rename input file
- Unrecoverable error when using the **–r** option, such as:
  - Inability to access a file
  - Inability to read a directory
  - Inability to remove a directory
  - Inability to create a directory
  - A target that is not a directory
  - Source and destination directories identical

2 Failure due to any of the following:
- Incorrect command-line option
- Too few arguments on the command line
- A target that should be a directory but isn't
- No space left on target device
- Out of memory to hold the data to be moved
- Inability to create a directory to hold a target file

Messages

Possible error messages include:

cannot allocate target string
mv has no space to hold the name of the target file. Try to free some memory to give **mv** more space.

filename?
You are attempting to move a file, but there is already a file with the target name and the file is read-only. If you really want to write over the existing file, type `y` and press <Enter>. If you do not want to write over the existing file, type `n` and press <Enter>.

source *name* **and target** *name* **are identical**
The source and the target are actually the same file (for example, because of links). In this case, **mv** does nothing.

unreadable directory *name*
mv cannot read the specified directory—for example, because you do not have appropriate permissions.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–R** and **–r** options are extensions of the POSIX standard.

Related information

cp, **cpio**, **rm**

newgrp — Change to a new group

Format

newgrp [**–l**] [*group*]

newgrp [**–**] [*group*]

tcsh shell: **newgrp** [-] *group*

Description

newgrp lets you change to a new group. You stay logged in and your working directory does not change, but access permissions are calculated according to your new real and effective group IDs. If an error occurs, your session might be ended, and you must log in again.

After the group IDs are changed, a new shell is initialized within the existing process, effectively overlaying the current shell from which **newgrp** was invoked. The new shell is determined from the initial program value of the OMVS segment of your user profile.

newgrp does not change the value of exported shell variables, and all others are either set to their default or are unset.

If you did not specify any arguments on the command line, **newgrp** changes to the default group specified for your user ID in the system user database. It also sets the list of supplementary groups to that set in the systems group database.

If you specify a group, **newgrp** changes your real and effective group ID to that group. You are permitted to change to that group only if your user ID is a member of that group, as specified in the system group database.

group can be a group name from the security facility group database, or it can be a numeric group ID. If a numeric group exists as a group name in the group database, the group ID number that is associated with that group is used.

On systems where the supplementary group list also contains the new effective group ID or where the previous effective group ID was actually in the supplementary group list:

- If the supplementary group list also contains the new effective group ID, **newgrp** changes the effective group ID.
- If the supplementary group list does not contain the new effective group ID, **newgrp** adds it to the list (if there is room).

On systems where the supplementary group list does not normally contain the effective group ID or where the old effective group ID was not in the supplementary group list:

- If the supplementary group list contains the new effective group ID, **newgrp** removes it from the list.
- If the supplementary group list does not contain the old effective group ID, **newgrp** adds it to the list (if there is room).

newgrp in the tcsh shell, as in the z/OS shell, allows you to change to a new group.

Options

–l Starts the new shell session as a login session. This implies that it can run any shell profile code.

– Is the obsolete version of **–l**.

Localization

newgrp uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Usage notes

1. The RACF profile FILE.GROUPOWNER.SETGID in the FACILITY class sets the group of a new file from the process creating the file instead of from the Directory group information.
2. **newgrp** allows you to change your default group in case RACF list of group checking is not enabled.

3. **newgrp** is not supported from an address space running multiple processes because it would cause all processes in the address space to have their security environment changed unexpectedly. If you are using the OMVS interface, you must be using the NOSHAREAS parameter before you issue the **newgrp** command. Also, if you are running in an environment with the _BPX_SHAREAS environment variable set to YES, you must unset it and start a new shell before issuing **newgrp**. For example:

   ```
   unset _BPX_SHAREAS; sh
   ```

Exit values

If **newgrp** succeeds, its exit status is that of the shell. Otherwise, the exit status is:

>0 Failure because **newgrp** could not obtain the proper user or group information or because it could not run the shell, and it ends the current shell.

Portability

POSIX.2 User Portability Extension, UNIX systems.

Related information

export, **fc**, **sh**, **tcsh**

nice — Run a command at a different priority

Format

nice [**–n** *number*] *command-line* **nice** [**–***number*] *command-line*

tcsh shell: **nice** [+*number*] [*command*]

Description

nice runs a command at a different priority than usual. Normally, **nice** lowers the current priority by 10.

The *command-line* must invoke a single utility command, without using compound commands, pipelines, command substitution, and other special structures.

In the tcsh shell, **nice** sets the scheduling priority for the tcsh shell to *number*, or, without *number*, to 4. With *command*, **nice** runs *command* at the appropriate priority. The greater the number, the less cpu the process gets. The super-user may specify negative priority by using:

```
nice -number ...
```

command is always executed in a subshell, and the restrictions placed on commands in simple if statements apply. See “tcsh — Invoke a C shell” on page 689.

Options

–n *number*

Lowers the current priority by *number*. On systems supporting higher priorities, a user with appropriate privileges can use **nice** to increase priority by specifying a negative value for *number*. For example,

```
nice –n –3 command
```

runs the command with an increased priority of 3.

–number
Is an obsolete version of **–n** *number*.

Localization

nice uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

If **nice** invokes the *command-line*, it exits with the exit status returned by *command-line;* otherwise its exit status is one of the following:

1-125 An error occurred in the **nice** utility.

126 **nice** could not invoke *command-line*.

127 **nice** could not find the utility specified in *command-line*.

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

Related information

nohup, **renice**, **tcsh**

nl — Number lines in a file

Format

nl [**–b***type*] [**–d***xy*] [**–f***type*] [**–h***type*] [**–i***n*] [**–l***n*] [**–n***fmt*] [**–p**] [**–s***sep*] [**–v**[*n*]] [**–w**[*n*]] [*file*]

Description

nl is a filter that numbers lines in a single file. If you do not specify *file* on the command line, the standard input is used.

The input is displayed as a stream of text lines, possibly divided into logical pages by separators. In turn, each page consists of a *header*, *body*, or *footer*, in that order. Any missing part is assumed to be empty. Using the default page delimiter character of \ and :, lines consisting entirely of the following combinations are logical page part delimiters and are not numbered.

Input line
Starts
\:\:\: Page header

\:\: Page body
\: Page footer

Options

–b*type* Specifies the numbering type for each page body. The numbering type is one of the following options:

a Numbers all lines

n Does not number any lines

pregexp
Numbers only those lines that contain the basic regular expression *regexp*. See Appendix C, "Regular expressions (regexp)," on page 971 for more information about **regexp**.

t Numbers only those lines that are not empty. An empty line consists of only a newline character.

The default body numbering type is *t*.

–d*xy* Changes the default delimiter characters to characters *x* and *y*. If only *x* is specified, only the first delimiter character is changed. The default delimiter characters are \ and :.

–f*type* Specifies the page footer numbering *type* (see the **–b** option). The default *type* is **n**.

–h*type* Specifies the page header numbering *type* (see the **–b** option). The default *type* is *n*. (The lines are not numbered.)

–i*n* Sets the line increment to *n* rather than the default value of *l*.

–l*n* When the page numbering *type* is (all), blank lines are treated specially. Every *n*th consecutive blank line is numbered. If you do not specify this option, *n* defaults to 1 and every blank line is numbered.

–n*fmt* Specifies the line numbering format, which must be one of the following:

n Right-aligned line number, padded to *width* (see **–w**) on the left with spaces (the default format).

rz Right-aligned line number, padded on left with zeroes.

ln Left-aligned line number, padded on right with spaces.

–p Specifies continuous page numbering across page boundaries. By default, **nl** restarts numbering (as in the next option) at each new page.

–s*sep* The string *sep* is printed to separate the line number from the text of the line being numbered. When this option is not specified, this separator is a single tab character.

–v*n* Starts numbering for each new page at *n*. If you do not specify this option, page numbering starts at 1.

–w*n* Sets the width of the line number in the output to *n*. If you do not specify *n*, the default is 6.

Examples

The following command numbers every second consecutive blank line, using page delimiters of ~!:

```
nl –l2 –ha –ba –fa –n  rz –v10 –i10 –d~! file
```

Localization

nl uses the following localization environment variable:
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Messages

0 Successful completion

1 Failure due to any of the following:
- Incorrect command-line argument
- More than one file name was specified
- Unable to open the file
- Incorrect regular expression in **–b**, **–f**, **–h**
- Incorrect numbering type
- Badly formed number in a command-line option

Portability

POSIX.2, X/Open Portability Guide.

Related information

awk, **pr**

See Appendix C, "Regular expressions (regexp)," on page 971 for more information about **regexp**.

nm — Display symbol table of object, library, or executable files

Format

nm [**–AaefgMnoPprsuv**] [**–t** *format*] *file ...*

Description

nm displays the symbol table associated with an object, archive library of objects, or executable files.

By default, **nm** lists the symbols in file in alphabetical order by name and provides the following information about each:
- File or object name (if you specified **–A**)
- Symbol name
- Symbol type. Not all of these symbol types are available on all systems. For instance, not all systems support the ability to determine different segment information.

  A Absolute symbol, global

  a Absolute symbol, local

  B Uninitialized data (bss), global

  b Uninitialized data (bss), local

  D Initialized data (bbs), global

d Initialized data (bbs), local

F File name

l Line number entry (see the **–a** option)

N No defined type, global. This is an unspecified type, compared to the undefined type `U`.

n No defined type, local. This is an unspecified type, compared to the undefined type `U`.

S Section symbol, global

s Section symbol, local

T Text symbol, global

t Text symbol, local (static)

U Undefined symbol

- Symbol value
- Symbol size, if applicable

Options

–A Prefixes each line with the file name or archive member.

–a Displays all symbols, including line number entries on systems that support them.

–e Displays only global (external) and static symbols.

–f Displays full output. This is the default because output is not suppressed.

–g Displays only global symbols.

-M Inserts three columns in the output before each symbol name. The format of these columns is as follows:

```
rmode amode compiler_options
```

The rmode and amode column will display one of the following:

```
24  24 bit mode
31  31 bit mode
64  64 bit mode
ANY  ANY mode
MIN  MIN mode
---  Undetermined or not/applicable
```

The compiler options field shows a character for each compiler option determined to be in effect or a dash if none are in effect:

I Symbol is compiled with IPA. Note that IPA is not seen when running **nm** against an executable because that information is no longer available.

X Symbol is compiled with XPLINK.

–n Is equivalent to **–v**.

–o Displays output in octal (same as **–t o**).

–P Displays output in a portable POSIX-compliant format, with blanks separating the output fields.

- If you specified **–A** and *file* is not a library, the format is:

  ```
  file: name type value size.
  ```

- If you specified **–A** and *file* is a library, the format is:

  ```
  file [object_file] : name type value size
  ```

  where *object_file* is the object file in the library that contains the symbol that is being described.
- If you did not specify **–A**, the format is:

  ```
  name type value size
  ```
- If you did not specify the **–t** option, **nm** displays *value* and *size* in hexadecimal.
- If you did not specify **–A** and the command line contains more than one file, or *file* is a library, **nm** displays a line preceding the list of symbols for each specified file or each object file in a specified library. If *file* is a library, this line has the following format:

  ```
  file[object_file]:
  ```

  If *file* is not a library, the format is:

  ```
  file:
  ```

–p Does not sort output.

–r Reverses sort order.

–s Includes symbol size for each symbol.

–t *format*
Defines the numeric value formatting base. The format is one of `d`, `o`, or `x`, for decimal, octal, or hexadecimal, respectively. If this option is not used, numbers are displayed in decimal.

–u Displays only undefined symbols.

–v Sorts output by value.

–x Displays information in hexadecimal (same as **–t x**).

Localization

nm uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLECT**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

`0` Successful completion

`1` Failure due to any of the following:
- Invalid command-line option
- Missing file name
- Unknown symbol table type
- Invalid library file
- End-of-file found in library
- Bad record in the library
- Out of memory

If a file does not contain a symbol table, **nm** displays a warning and goes to the next file, but this is not considered an error.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–a**, **–e**, **–f**, **–n**, **–o**, **–p**, **–r**, **–s**, and **–x** options are not part of the POSIX standard.

The **–a**, **–n**, **–p**, **–r**, **–s**, and **–t d**, options are not part of the X/OpenX/Open standard.

Related information

ar, **size**, **strip**

nohup — Start a process that is immune to hang ups

Format

nohup *command-line*

tcsh shell: **nohup** *command*

Description

nohup invokes a utility program using the given *command-line*. The utility runs normally; however, it ignores the SIGHUP signal.

If the standard output is a terminal, **nohup** appends the utility's output to a file named `nohup.out` in the working directory. This file is created if it does not already exist; if it cannot be created in the working directory, it is created in your home directory.

If the standard error stream is a terminal, **nohup** redirects the utility's error output to the same file as the standard output.

nohup simply runs a program from an executable file. *command-line* cannot contain such special shell constructs as compound commands or pipelines; however, you can use **nohup** to invoke a version of the shell to run such a command line, as in:

```
nohup sh –c 'command*'
```

where *command* can contain such constructs.

In the tcsh shell, with *command*, **nohup** runs command such that it will ignore hang up signals. Commands can set their own response to hang ups, overriding **nohup**. Without an argument (allowed only in a shell script), **nohup** causes the tcsh shell to ignore hang ups for the remainder of the script. See “tcsh — Invoke a C shell” on page 689.

Localization

nohup uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**

- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

126 **nohup** found the utility program but could not invoke it.
127 An error occurred before **nohup** invoked the utility, or **nohup** could not find the utility program.

Otherwise, the exit status is the exit status of the utility program that is invoked.

Portability

POSIX.2, X/Open Portability Guide, UNIX Systems

Related information

exec, **hup**, **nice**, **sh**, **tcsh**

---

obrowse — Browse a z/OS UNIX file

Format

obrowse -r *xx* [file...]

Description

Use **obrowse** to browse a file in the z/OS UNIX file system.This command uses the TSO/E OBROWSE command and must be run in the foreground. The 3270 passthrough mode is used to invoke the TSO/E OBROWSE command under OMVS.

You can specify any number of files; the TSO/E OBROWSE command is invoked once for each file. If you do not specify a file name, the main entry panel is displayed. From that panel, you can enter the directory name and file name of an existing file you want to browse. If you are browsing fixed-length records, you must also indicate the record length.

The file name can be absolute or relative. Avoid using single quotation marks or parentheses within the file name.

Options

-r *xx* Sets the record length to be browsed for fixed length text files. *xx* is length. If **-r** *xx* is specified, the file is processed as fixed length records. This lets you convert a variable length file to fixed length for viewing.

Environment variables

BPXWISHISPF
By default, starting in V1R11, the ISPF browse dialog service is used when browsing z/OS UNIX files. Specify BPXWISHISPF=NO if you want **obrowse** to use the original dialog service.

Usage notes

1. You cannot use **obrowse** if you used **rlogin** or **telnet** to access the shell.

2. **obrowse** passes the effective UID of its process to the TSO session. If the EUID does not match the EUID of the TSO process, the OBROWSE TSO command will attempt to set the effective UID of the TSO process to that of the shell command prior to loading the file.

Exit values

0 The TSO/E OBROWSE command was invoked once for each file specified.

1 Failure because **obrowse** could not access at least one file because single quotation marks or parentheses were used in the file name.

2 Failure because **obrowse** was not able to set 3270 passthrough mode.

od — Dump a file in a specified format

Format

od [**–v**] [**–A** *addr_fmt*] [**–j** *num* [**bkm**]] [**–N** *num*] [**–T**] [**–t** *type_string*] [*file ...*]
od [**–bcDdhOoSsTvXx**] [*file*] [[**+**]*offset*[**.**][**b**]]

Description

od (octal dump) dumps a file to the standard output in a format specified by command-line options. The default format is octal words. You can use combinations of options to generate multiple formats with the requested representation of each byte vertically aligned. The file seek address (in octal) precedes each line of new data.

od recognizes two syntaxes. The first one conforms to POSIX. If you choose the first form, **od** displays files from the list *file* one at a time. If no *file* appears on the command line, **od** reads the standard input.

For a summary of the UNIX03 changes to this command, see Appendix N, “Shell commands changed for UNIX03,” on page 1039.

Options

The first form of **od** accepts the following options:

–v Displays all lines. Typically, **od** does not display multiple lines that differ only in the address. It displays the first line with a single * under it. to show that any subsequent lines are the same.

–A *addr_fmt*
Specifies the format that **od** uses to display the address field. *addr_fmt* can be **d** (decimal), **o** (octal), **x** (hexadecimal), or **n** (do not display address). The default is **–A o**.

–j *num*
Skips *num* bytes from the beginning of the file. If you precede *num* with `0X` or `0x`, **od** interprets it as hexadecimal. If you precede it with `0`, **od** interprets it as octal; otherwise, **od** assumes that it is decimal. You can also append **b**, **k**, or **m** to *num* to indicate 512-byte blocks, kilobytes, or megabytes instead of bytes. If *num* is hexadecimal, any appended **b** is considered to be the final hexadecimal digit rather than 512-byte block.

Be careful with this option when working with double-byte characters. If byte *num*+1 (the starting byte, after skipping *num* bytes) is not the first byte of a character, **od** proceeds as though it is, resulting in a

misinterpretation of that and subsequent characters. This misinterpretation continues until **od** encounters a <newline>. Then it is once again synchronized with the first byte of a double-byte character.

–N *num*
Processes a maximum of *num* bytes. Be careful with this option when working with double-byte characters. If **od** is processing a double-byte character when it encounters the *num*th byte and this byte is not the last byte of the character, **od** displays ??? instead of the character.

–T Enables automatic conversion for tagged files. This option is mutually exclusive with **–t a**. For more information about automatic conversion and file tagging, see *z/OS UNIX System Services Planning*.

–t *type_string*
Specifies the output format. *type_string* can contain the following format characters:

a Named characters from the ISO 646 character set. Data is interpreted as if it was coded in the ISO 646 character set.

c Characters. **od** displays nonprintable characters as backslash sequences and displays printable double-byte characters properly.

A printable double-byte character is displayed in the first byte position, and the remaining positions to the end of the character display ** to indicate the double-byte character. Nonprintable double-byte characters are displayed using a 3-digit octal number to represent each byte.

Also, incorrect double-byte sequences are displayed with ??? for each incorrect byte.

d Signed decimal. A one-digit number may follow **d** telling **od** how many bytes to use. This must correspond to the size of a *char* (1-byte character), a *short* (2 byte short), an *int* (4 byte integer), a *long* (4 bytes long, which is currently the same as integer on z/OS), or a *long long* (8 byte integer). The default size is the size of an *int*. A symbolic size character can follow **d**, rather than the number of bytes. These have the following meaning:
C Corresponds to number of bytes in a *char*
S Corresponds to number of bytes in a *short int*
I Corresponds to the number of bytes in an *int*
L Corresponds to the number of bytes in a *long int*
LL Corresponds to the number of bytes in a *long long int*

f Hexadecimal floating-point. A one-digit number can follow **f**, telling **od** how many bytes to use. This must correspond to the size of a *float*, *double*, or *long double*. The default size is the size of a *double*. A symbolic size character can follow **f**, rather than the number of bytes. These have the following meaning:
F Corresponds to size of *float*
D Corresponds to size of *double*
L Corresponds to size of *long double*

F IEEE binary floating-point. A one-digit number can follow **F**, telling **od** how many bytes to use. This must correspond to the size of a *float*, *double*, or *long double*. The default size is the size of a *double*. A symbolic size character can follow **F**, rather than the number of bytes. These have the following meaning:
F Corresponds to size of *float*

D Corresponds to size of *double*
L Corresponds to size of *long double*

o Octal. A one-digit number can follow **o**, telling **od** how many bytes to use. This must correspond to the size of a *char* (1 byte character), a *short* (2 byte short), an *int* (4 byte integer), a *long* (4 byte long, which is currently the same as integer on z/OS), or a *long long* (8 byte integer). The default size is the size of an *int*. A symbolic size character can follow **o**, rather than the number of bytes. These have the following meaning:
C Corresponds to number of bytes in a *char*
S Corresponds to number of bytes in a *short int*
I Corresponds to the number of bytes in an *int*
L Corresponds to the number of bytes in a *long int*
LL Corresponds to the number of bytes in a *long long int*

u Unsigned decimal. A one-digit number can follow **u**, telling **od** how many bytes to use. This must correspond to the size of a *char* (1 byte character), a *short* (2 byte short), an *int* (4 byte integer), a *long* (4 byte long, which is currently the same as integer on z/OS), or a *long long* (8 byte integer). The default size is the size of an *int*. A symbolic size character can follow **u**, rather than the number of bytes. These have the following meaning:
C Corresponds to number of bytes in a *char*
S Corresponds to number of bytes in a *short int*
I Corresponds to the number of bytes in an *int*
L Corresponds to the number of bytes in a *long int*
LL Corresponds to the number of bytes in a *long long int*

x Hexadecimal. A one-digit number can follow **x**, telling **od** how many bytes to use. This must correspond to the size of a *char* (1 byte character), a *short* (2 byte short), an *int* (4 byte integer), a *long* (4 byte long, which is currently the same as integer on z/OS), or a *long long* (8 byte integer). The default size is the size of an *int*. A symbolic size character can follow **x**, rather than the number of bytes. These have the following meaning:
C Corresponds to number of bytes in a *char*
S Corresponds to number of bytes in a *short int*
I Corresponds to the number of bytes in an *int*
L Corresponds to the number of bytes in a *long int*
LL Corresponds to the number of bytes in a *long long int*

Multiple format characters can appear in one *type_string* and multiple **–t** options can appear on the command line. If there is no **–t** option, the default is `–t oS`.

Restriction: –t a is mutually exclusive with the **–T** option.

The second form of **od** is the historical (Berkeley Software Distribution) implementation of the command. If you use this form, you can specify only a single input *file*. If you do not give a *file* argument, **od** reads the standard input. You can supply an offset, but you must precede it with a plus sign (+) to distinguish it from a file name if no file is given. Giving an offset causes a seek to a position in the file where output begins. If the offset ends in a period (`.`), **od** considers it to be decimal; otherwise, **od** considers it octal. If you follow the offset with a `b`, **od** multiplies it by the block size of 512 bytes. The format of the offset determines the format of the address; that is, if it is interpreted as decimal, the addresses are displayed in decimal.

Restriction: The **od** command does not work on a file whose file name starts with either a digit or a plus (+) sign, unless the **–A**, **–N**, **–j**, or **–t** options are used.

The second form of **od** accepts the following options:

–b Bytes in octal format
–c Bytes as characters
–D Unsigned decimal longs (4 bytes)
–d Unsigned decimal words (2 bytes)
–h Bytes in hexadecimal format
–O Unsigned octal longs
–o Unsigned octal words
–S Signed decimal longs
–s Signed decimal words
–T Enables automatic conversion for tagged files. This option is mutually exclusive with **–t a**. For more information about automatic conversion and file tagging, see *z/OS UNIX System Services Planning*.
–v Displays all lines. Typically, **od** does not display multiple lines that differ only in the address. It displays the first line with a single * under it. to show that any subsequent lines are the same.
–X Unsigned hexadecimal longs
–x Unsigned hexadecimal words

Localization

od uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_NUMERIC**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion
1 Failure due to any of the following:
- Inability to open the input file
- Badly formed offset
- Seek or read error on the input file

2 Failure due to any of the following:
- Incorrect command-line argument
- The wrong number of command-line arguments
- Incorrect format character
- Incorrect size modifier for format character

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The options to operate on longs (**–OSXD**) and the hexadecimal byte (**–h**) are extensions to the POSIX standard.

The **–T** option is an extension to the POSIX standard.

Related information

dd

oedit — Edit files in a z/OS UNIX file system

Format

oedit [**–r** *xx*] [*file...*]

Description

Use **oedit** to edit a file in the z/OS UNIX file system. This command uses the TSO/E OEDIT command and must be run in the foreground. The 3270 passthrough mode is used to invoke the TSO/E OEDIT command under OMVS.

You can specify any number of files; the TSO/E OEDIT command is invoked once for each file. If you do not specify a file name, the Edit Entry panel is displayed. From that panel, you can enter the directory name and file name of an existing file, or you can specify a directory name and file name for a new file. The Edit Entry panel also lets you specify an edit profile and an initial edit macro.

The file name can be absolute or relative. Avoid using single quotation marks or parentheses within the file name. Avoid using spaces or single quotation marks within path names.

Options

–r *xx* Set the record length to be edited for fixed length text files. *xx* is the record length.

If **–r** *xx* is specified, the file will be processed as variable length but loaded into the editor as fixed length records and saved as fixed length records. This lets you convert a variable length file to fixed length. If any lines are longer than the specified record length, the edit session will not load the file and will issue the customary message that a line is too long.

Usage notes

1. **oedit** attempts to load the file into a VB255 session. If this is an ISPF that supports wide edit (such as ISPF 4.1) and any line exceeds 235 characters, the width for the new session is the length of the longest line plus 25% to allow for some expansion.
2. The COPY command cannot copy in files that have records wider than the edit session.
3. **oedit** attempts to open an existing file as read/write. If this fails, it will attempt opening the file read-only to allow the user to view the file. Changes made in this mode cannot be saved to the file. If changes are made, the edit session must be ended using the ISPF CANCEL primary command. However, you can use the ISPF CREATE and REPLACE primary commands to save all or part of the changed file to another file before you CANCEL the edit session.
4. **oedit** passes the effective UID of its process to the TSO session. If the EUID does not match the EUID of the TSO process, the OEDIT TSO command will attempt to set the effective UID of the TSO process to that of the shell command prior to loading the file.
5. You cannot use **oedit** if you used **rlogin** or **telnet** to access the z/OS shell.

6. The TSO region size must be large enough to hold the size of the file to be edited.
7. Two ISPF variables are available to edit macros:
   - HFSCWD this variable contains the path name for the directory in which the file being edited resides.
   - HFSNAME this variable contains the name of the file being edited.

Environment variables

BPXWISHISPF
By default, starting in V1R11, the ISPF edit dialog service is used when editing z/OS UNIX files. Specify BPXWISHISPF=NO if you want **oedit** to use the original dialog service.

BPXWPERM
Specifies the default open permissions used by **oedit**. Permissions are specified in octal format. The supplied permissions are not validated and the number is used as the file mode on an open() call. If the file already exists, the permissions are not changed. If the environment variable is not set, **oedit** works as before, using 0700 as the default permissions.

Exit values

0 The TSO/E OEDIT command was invoked for each specified file.
1 Failure because **oedit** could not access at lease one file because single quotation marks or parentheses were used in the file name.
2 Failure because **oedit** could not set the 3270 passthrough mode.

---

pack — Compress files by Huffman coding

Format

pack [**–**] [**–Bf**] [**–o** *file*] *file ...*

The **pack** utility is fully supported for compatibility with older UNIX systems. However, the **compress** utility should be used instead because it may provide greater functionality and is considered the standard for portable UNIX applications as defined by POSIX.2 IEEE standard 1003.2-1992.

Description

pack compresses files using a Huffman minimal redundancy code on a byte basis. Each file is compressed in place; the resulting file has a **.z** extension appended to the file name, but keeps the same owner and permissions. For example, **abc** is compressed into **abc.z**. The times of last access and last modification are also preserved.

Packed files can be identified by **file** and uncompressed by **unpack** (which unpacks the file in place) or **pcat** (which unpacks to the standard output).

Normally **pack** reports the degree of compression achieved in each file (the report is printed on **stdout**). This number can be negative for small files with little redundancy if the **–f** option is used.

pack does not pack files if:

- The file appears to have already been packed.
- The file name is too long; an error occurs if **.z** is appended.

- The file has links or is a directory.
- The packed file would be larger than the existing file (this includes empty files).
- The destination file already exists, or there is an error in processing.

Options

– Displays more detail on size, overhead and entropy (information rate). If this option is used several times on the command line. it acts as a toggle, inverting the detailed-report flag at each mention.

-B Disables the automatic conversion of tagged files.

–f Forces compression when it typically would not occur. Without this option, **pack** does not compress a file if its size is not reduced by compression, the file is already compressed, or the file has more than one link.

–o *file* Specifies a different output file so that compressed output is written to *file* rather than overwriting the original input file. Several input and output files may be specified. For example,

```
pack –o out1 in1 –o out2 in2
```

packs file **in1** into **out1** and file **in2** into **out2**. The input files are not changed.

Localization

pack uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Environment variables

pack uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when the **-B** option is specified. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

Exit values

0 Successful completion

1 An error occurred due to one of the following:
- A problem related to manipulating (opening, closing, renaming) the file, or a single file could not be packed properly
- Could not turn off automatic conversion

n Indicates that n files could not be packed properly. For example, if three out of six files could not be packed properly, the exit status is 3.

file: **no saving**
The file is too small or uniform to benefit from packing. The file can still be packed using the **–f** option.

file: **already packed**
The file appears to be a packed file. It can still be packed by specifying the **–f** option.

file: **has links**
The file has more than one link. You can override it with the **–f** option.

file: **directory**
pack cannot modify directories.

file: **empty**
The file is empty.

file: **can't pack in place**
The file is too large to pack in place. Use the **–o** option to specify an output file.

Interrupt
If you press BREAK while **pack** is running, it does not stop immediately; if it did, it would leave you with a corrupted file. Thus **pack** just displays this message to show that the BREAK has been received and it stops as soon as it is safe to do so.

Other messages, such as those about inaccessibility of files, are self-explanatory. The exit status is the number of *file* arguments that could not be processed.

Portability

X/Open Portability Guide, UNIX System V.

The **–B** and **–o** options are extensions of the POSIX standard.

Related information

file, **pcat**, **unpack**

passwd — Change user passwords or password phrases

Format

passwd [**–u** *userid*]

Description

passwd changes the login password or password phrase for the user ID specified. If *userid* is omitted, the login name associated with the current terminal is used. You are prompted for the new password or password phrase, which may be truncated to the length defined as the maximum length for the passwords.

Users can change the password or password phrase for another user if they know the user ID and current password or password phrase.

Examples

1. To change your password or password phrase, issue:

   ```
   passwd
   ```

   You will be prompted for the old password or password phrase and the new password or password phrase.
2. To change the password or password phrase for user ID Steve, issue:

   ```
   passwd -u steve
   ```

   You will be prompted for the old password or password phrase and the new password or password phrase.

Exit values

0 The password or password phrase was changed.

1 Failure due to any of the following:
- The user specified does not exist.
- The current password or password phrase is incorrect.
- The new password or password phrase does not meet the installation-exit requirements.

2 The new password or password phrase was not entered the same way twice.

4 Error obtaining user login name.

---

paste — Merge corresponding or subsequent lines of a file

Format

paste [**–Bs**] [**–d** *list*] [**-W** *option*[,*option*]...] *file ...*

Description

paste concatenates lines of all the specified input files onto the standard output. If you specify – (dash) instead of a file, **paste** uses the standard input. Typically, an output line consists of the corresponding lines from all the input files. **paste** replaces the newline character at the end of each input line (except the one from the last file on the command line) with a tab character, or characters specified by the **–d** option.

Options

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–d *list* Specifies a list of characters to be used one at a time instead of the tab character to replace the newline at the end of input lines. In a double-byte locale, *list* can contain double-byte characters. **paste** uses *list* circularly; when it exhausts the characters in *list*, it returns to the first character in the list. If you also specify the **–s** option, **paste** returns to the first character of *list* after processing each file. Otherwise, it returns to the first character after each line of output.

list can contain any of the following standard C escapes such as `\n`, `\t`, `\r`, `\b`, `\\`, and `\0`, where `\0` indicates that no separator is to be used.

–s Concatenates all lines from each input file together on the single output

line. If the **–s** option is not specified and the end of the file is detected on any (but not all) of the input files, **paste** behaves as though empty lines have been read from those files.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

Examples

1. To display the **ls** output in three tab-separated columns:

   ```
   ls | paste - - -
   ```

2. To concatenate lines in two text files containing UTF-8 characters, assuming that
   - The text files are untagged and you do not want to tag them or enable automatic conversion, and
   - You cannot alter the tag (for example, you are displaying untagged public text files or read-only text files)

   then issue:

   ```
   paste -W filecodeset=UTF-8,pgmcodeset=IBM-1047 myUtf8File01 myUtf8File02
   ```

3. To concatenate lines in three text files containing EBCDIC characters, assuming that automatic conversion has been enabled but the text files are incorrectly tagged as ASCII:

   ```
   paste -B myMisTaggedFile01 myMisTaggedFile02 myMisTaggedFile03
   ```

4. If file A contains:

   ```
   a
   b
   c
   ```

   and file X contains

   ```
   x
   y
   z
   ```

   then the command:

   ```
   paste A X
   ```

   produces:

   ```
   a      x
   b      y
   c      z
   ```

   and the command:

   ```
   paste –s A X
   ```

   produces:

   ```
   a      b      c
   x      y      z
   ```

Localization

paste uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Environment variables

paste uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Too many files specified
- Inability to open a file
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

2 Failure due to any of the following:
- Incorrect command-line option
- Missing input files

Messages

Possible error messages include:

Too many files at *name*
You specified more files than **paste** can handle. The name given in the error message is the name of the first file that **paste** could not open. The number of files that **paste** can open depends on the number of files that other processes have open.

Portability

POSIX.2, X/Open Portability Guide, UNIX System V.

The **–B** and **-W** options are extensions of the POSIX standard.

Related information

cut

---

patch — Change a file using diff output

Format

patch [**–bceflNnRsv**] [**–B** *prefix*] [**–D** *symbol*] [**–d** *dir*] [**–F** *n*] [**–i** *patchfile*] [**–o** *outfile*] [**–p** *n*] [**–r** *rejectfile*] [*file*]

Description

patch reads a patchfile that contains output from **diff** describing changes from an old text file to a new text file. **patch** then applies those changes to another text *file*. Typically, you use **patch** if you are keeping parallel versions of a file. When you

make a set of changes to one file, you can use **patch** to incorporate those same changes in other versions of the file.

Options

–B *prefix*
Saves a copy of the original *file* in a backup file. The backup file name is the name of the original file preceded by the string *prefix*. If there is already a file with this name, **patch** overwrites it. When applying more than one patch to the same file, **patch** copies only the original for the first patch. When you also specify **–o** *outfile*, **patch** does not create *prefixfile*, but if *outfile* already exists, it creates *prefixoutfile*.

–b Saves a copy of the original *file* in a backup file. The backup file name is the name of the original file plus the suffix `orig`. If there is already a file with that name, **patch** overwrites it. When applying more than one patch to the same file, **patch** only creates *file* `orig`. When you also specify **–o** *outfile*, **patch** does not create *file*-`.orig`, but if *outfile* already exists, it creates *outfile*`.orig`.

–c Interprets the patchfile as a *context* diff file (the output of **diff** when **–c** or **–C** is specified). You cannot use this option with **–e** or **–n**.

–D *symbol*
Marks changes with the C preprocessor construct:

```
#ifdef symbol
      ...
#endif
```

When you compile the resulting (patched) file, you get the original file if *symbol* is not defined, and the changed file if *symbol* is defined.

–d *dir* Changes the current directory to *dir* before processing the patch.

–e Interprets the patchfile as an **ed** script (the output of **diff** when **–e** is specified). You cannot use this option with **–c** or **–n**.

–F *n* Specifies the number of lines of a context diff to ignore when searching for a place to install a patch.

–f Forces processing without requesting additional information from the user.

–i *patchfile*
Reads the patchfile information from the file *patchfile* . If you do not specify *patchfile*, **patch** reads the information from the standard input.

–l Matches any sequences of blanks in the patchfile to any sequence of blanks in the input *file*. In other words, **patch** considers two lines equivalent if the only difference between the two is their spacing.

–N Ignores any patches that have already been applied. By default, **patch** rejects already-applied patches.

–n Interprets the patchfile as *normal* **diff** output. You cannot use this option with **–c** or **–e**.

–o *outfile*
Writes patched output to *outfile* instead of to the original file. When you specify more than one patch to a single file, **patch** applies the patches to intermediate versions of the file created by previous patches, resulting in multiple, concatenated versions of the file being written to *outfile*.

–p *n* Deletes *n* components from the beginning of all path names found in the

patch file. If a path name is an absolute path name (that is, starts with a slash), **patch** treats the leading slash as the first component of the path, and **patch –p** 1 deletes the leading slash. Specifying **–p** 0 tells **patch** to use the full path names given in the *patchfile*. If you do not specify this option, **patch** only uses the basename (the final path component).

–R Reverses the sense of the patch script. In other words, **patch** behaves as if the patch script shows the changes that make the new version into the old version. You cannot use **–R** if the patchfile is in **ed** script format.

With **–R**, **patch** attempts to reverse each change recorded in the script before applying the change. **patch** saves rejected differences in reversed format (which means that you can check the rejections to see if **patch** made the reversals correctly).

–r *rejectfile*
Records rejects in the file *rejectfile*, instead of the default reject file name.

–s Tells **patch** to remain silent until an error occurs. Normally, **patch** writes information about the results of the patching process to standard error (**stderr**).

–v Displays the version number of **patch** and then exits.

If you do not specify either the **–b** or **–B** option, **patch** attempts to change the original *file* directly. If you do not specify **–c**, **–e**, or **–n**, **patch** looks at the format of the **diff** output and tries to determine which type of output the patch file contains.

If you do not specify a file to be patched and the *patchfile* is not in context format, **patch** prompts you for the name of the file you want to patch.

If the *patchfile* is in context format, **patch** tries to determine the file name on its own. The first two lines of a context patch file give the names of the old and new files that **diff** compared. If only one of the files exists, **patch** patches that file; if neither exists or both do, **patch** checks for a line starting with a string `Index:` before asking you for the name of the file to patch. If both files exist but one of them is empty, the empty file will automatically be patched.

After **patch** has determined the file to patch, it checks for a source control system (SCCS) subdirectory in the current directory; if one exists, it tries to obtain an editable version of that file by performing the source code control system (SCCS) command **get –e**. If **patch** cannot determine the file to patch, it prompts you for the name of the file to use.

With a context format *patchfile*, **patch** can recognize when line numbers given in the *patchfile* do not match line numbers in the file being patched. Thus, it can patch a file with line counts that do not match the old file that was used by **diff**. To do this, it takes these steps:

1. For each section to be changed, **patch** starts with the line number found in the patch file, plus or minus any adjustment that must be made for the previous section.
2. If the line at this location does not match the line in the patch file, **patch** scans forward and backward for a line that does match. If it finds a matching line, **patch** proceeds to make the required changes. **patch** also remembers the adjustment it had to make to find the matching line, and uses this adjustment in the next section to be changed.

3. If **patch** cannot find a line matching the one in the patch file, it tries to find the line using the lines given as context. It ignores the first and last two lines of the context and goes searching again. If it finds a match this time, it makes the change and remembers the adjustment.
4. If a search ignoring the first and last lines of the context fails, **patch** searches one more time, ignoring the first two and last two lines of the context. If it finds a match, it makes the changes and remembers the adjustment.
5. If **patch** still cannot find a match, it writes the unmatching portion to the *reject file*. It then tries to process the next section of changes. Thus, the reject file contains the sections that **patch** is not able to change. Line numbers on sections in the reject file may be different than those in the patchfile, because **patch** adjusts them using the adjustment that **patch** calculated for preceding sections.

To some extent, **patch** tries the same process if the patch file is in normal format rather than context format. Because the patch file does not contain the context information, **patch** has less to work with and probably creates more rejects. **patch** always writes the **rejectfile** in context format, regardless of the format of the *patchfile*.

By default, the reject file has the same name as the original *file*, plus the suffix `.rej`. You can use **–r** to specify a different reject file on the command line. If the reject file already exists, **patch** overwrites it.

If you do not specify **–R**, **patch** starts out with the assumption that the patch file could be normal or reversed. Therefore if the first change is rejected, **patch** tries the reverse change to see if that one works. If the reverse change is also rejected, **patch** continues with other changes in the file, trying both forward changes and reverses until one of them works. If the one that works is a forward change, **patch** attempts only forward changes for the rest of the file. If the one that works is a reverse change, **patch** issues a message to this effect and ask if it should treat all the changes as reverse ones. However, if the **–R** option is specified on the command line, it is assumed to hold for all changes in the patch file.

The patch file can contain output from several **diff** comparisons. **patch** treats each collection of changes as a separate patch file, and with each, **patch** may prompt you for the name of the file you want to patch.

Localization

patch uses the following localization variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

`0` Successful completion
`1` There were one or more rejects
`>1` An error occurred

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

The **–B**, **–F**, **–f**, **–s**, and **–v** options are not extensions to the POSIX standard.

Related information

diff, **ed**

---

pathchk — Check a path name

Format

pathchk [**–p**] *pathname ...*

Description

pathchk checks one or more path names (specified by *pathname*) for validity and portability (based on the underlying file system). A path name is valid if you can use it to create or access a file without causing a syntax error. A path name is portable if the file system does not truncate the name when it tries to use it. **pathchk** writes an error message indicating the error detected and the erroneous path name if any path name is longer than PATH_MAX bytes or contains any of the following:

- A component longer than NAME_MAX bytes
- Any component in a directory that is not searchable
- Any character in any component that is not valid

Options

–p Instead of using the previous criteria, writes an error message if *pathname*:

- Is longer than _POSIX_PATH_MAX bytes
- Contains any component longer than _POSIX_NAME_MAX bytes
- Contains any character in any component that is not in the portable filename character set

Localization

pathchk uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 All path names passed the check
1 An error occurred
2 Unknown command-line option

Portability

POSIX.2, X/Open Portability Guide.

pax — Interchange portable archives

Format

pax [**–cdEnvz**][**-H**|**-L**][**–f** *archive*] [**–o** *type*] [**–s** *substitute*] ... [*pattern ...*]

pax –r [**–cdEiknquvz**] [**-H**|**-L**] [**–f** *archive*] [**–o** *options ...*] [**–p** *string ...*] [**–s** *substitute ...*] [**–V** *volpat*] [*pattern ...*]

pax –w [**–dEituvXz**] [**-H**|**-L**] [**-W** *seqparms=parms*] [**–b** *blocksize*] [[**–a**] [**–f** *archive*]] [**–o** *options ...*] [**–s***substitute ...*] [**–V** *volpat*] [**–x** *format*] [*pathname ...*]

pax –r –w [**–CdDEiklLMntuvX**] [**-H**|**-L**][**–o** *options ...*] [**–p** *string ...*] [**–s** *substitute ...*] [*pathname ...*] *directory*

The **pax** interchange format (**-x pax**), which is a standard UNIX format, stores all file attributes that extended USTAR (**-o** *saveeext*) or os390 format (**-x os390**) does. It can also save and restore file attributes which cannot be handled by any other format such as: files greater than 8 GB in size, **uid** and **gid** values greater than 2097151 and z/OS-specific attributes like user audit and auditor audit flags and file format. The **pax** interchange format is supported on z/OS release 8 and later. **pax** interchange format archives can be extracted on older systems; however, there will be loss of information for archived files which have attributes that cannot be stored in USTAR format. When creating archives that might be extracted on older z/OS systems, it is recommended that USTAR (default), extended USTAR(-o saveext) or os390 (-x os390) format be used. When creating archives that will be extracted on z/OS release 8 systems and later, the **pax** format (**-x pax**) is the recommended format. See the **-x pax** option for more information about preserving extended attributes with the **pax** format.

Description

pax reads, writes, or lists an archive file, or copies directory hierarchies. An archive file can be a UNIX file or an MVS data set or an MVS data set member. A file stored inside an archive is called a *component file*. Similarly, a directory that is stored inside an archive is called a *component directory*.

Restrictions: When using **pax**, keep these restrictions in mind.

- **pax** does not support the use of generation data groups (GDGs). To use those MVS data sets, the user must specify the real data set name.
- MVS data sets cannot be specified for component files.
- When writing to an MVS data set, the **-f archive** parameter must be used to identify the data set.

Included with each component file and directory is recorded information such as owner and group name, permission bits, file attributes, and modification time.

You can therefore use a single archive file to transfer a directory structure from one machine to another, or to back up or restore groups of files and directories.

Archives created by **pax** are interchangeable with those created with the **tar** utility. Both utilities can read and create archives in the default format of the other (USTAR for **pax** and TAR for **tar**, **os390** for both). Additionally, OS390 formatted archives created by **pax** are interchangeable with those OS390 formatted archives created by the **tar** utility. Archives are generally named with suffixes such as .pax or .tar (or pax.Z and tar.Z for compressed files), but this is not required.

As shown in "Format" on page 523, **pax** performs one of the four archive functions based on the usage of the **–r** and **–w** options:

list If you do not specify **–r** or **–w**, you are in list mode. In this mode, **pax** uses the standard output to display the table of contents of an existing archive file. The **–v** (verbose) and **–E** options can be used to show the file attributes (to include file tags and ACLs) and extended attributes of each component. By default, **pax** displays all component files and directories contained in the archive. One or more patterns may be used to display information about specific components.

read If you specify **–r** but not **–w**, you are in read mode. In this mode, **pax** reads an archive file as input and extracts components from the archive. By default, **pax** selects all components. Patterns can also be used to identify specific components to extract. If the archive contains several components with the same name, **pax** extracts each of them with later components overwriting files created by earlier components with the same name. The **–k**, **–n**, or **–u** options can be used to control the extraction of files when multiple files with the same name exist in the archive or on the file system. **pax** can read input archives in cpio, tar, and OS390 format.

When extracted, if a component does not have a fully qualified path name beginning with the root (/) directory, its path is assumed to be relative to the current working directory. The **–s** or **–i** options can be used to dynamically change the path name of extracted components. Ownership, permissions, file attributes (such as file tags and ACLs), and extended attributes of the extracted files are discussed under the **–p** option.

write If you specify **–w** but not **–r**, you are in write mode. In this mode, **pax** creates an archive file that contains the specified path name as components. If a path name is a directory, **pax** writes to the archive file all the files and subdirectories in that directory. If you do not specify any path name, **pax** reads the standard input to get a list of path name to select; the input should give one path name per line.

The **–d**, **–X**, and **–L** options can be used to restrict path name to the current directory or device, or to follow symbolic links.

The **–a** (with **-w**) option can be used to append to an existing archive.

copy If you specify both **–r** and **–w**, you are in copy mode. In this mode, **pax** reads the specified path names and copies them to the target directory. In this case, the given directory must already exist and you must be able to write to that directory. If a path name is a directory, **pax** copies all the files and subdirectories in that directory as well as the directory itself. If you do not specify any path name, **pax** reads the standard input to get a list of path names to copy; the input should give one path name per line. **copy** is only carried out in the **pax** (**-x pax**) format.

The name of the archive file can be specified with the **–f** *archive* option. If **–f** is not used, **pax** will read from standard input for the list and read (**–r**) functions and will write to standard output for the write (**–w**) function.

pax can read input archives in **cpio**, **tar**, and **os390** format. It can also write these formats; see the **–x** option.

Patterns

Command-line patterns are similar to the wildcard constructs described in the **sh** command. You can use them to select specific components when reading or listing an archive.

Slash characters in a path name must be explicitly matched by using one or more slashes in the pattern; it cannot be matched by the asterisk (*) or question mark (?) special characters or by a bracket expression. For example, the pattern `"*.c"` will only match files in the archive with name that are not preceded by a slash. The pattern `"*/*.c"` will match files in the archive preceded by a single slash.

Tip: Patterns should be quoted to prevent the shell from first expanding them. For example, if the pattern `*.h` is not quoted, the shell will first resolve it into the list of files in the current directory ending with `.h`. If there are none, the shell will replace `*.h` with an empty list and **pax** will then list every component in the archive because no pattern is specified. If one or more `.h` files are returned by the shell, **pax** will list only those components in the archive matching the `.h` files found in the current directory.

pax does not support patterns when writing or copying. However, wildcards can be used in specifying the path name with the write or copy function because the shell will first expand them before passing the results to **pax**.

The **–c** option can be used to select files that do not match the pattern.

Options

The following options might appear on **pax** command lines. Some of them are appropriate to only some forms of the command, as shown in “Format” on page 523.

–a Appends specified files or directories to the end of the contents of an existing archive. If the archive does not already exist, **pax** creates it.

Restriction: Compressed archives and archives residing in MVS partitioned data sets cannot be appended. Also, archives in OS390 format cannot be appended to archives in non-OS390 format, and archives in non-OS390 format cannot be appended to archives in OS390 format.

–b *blocksize*
Specifies the block size in an output operation. Each output operation writes *blocksize* bytes, where *blocksize* is an integer appropriate to the output device. If `b` follows the *blocksize* number, the block size is the given number of 512-byte blocks. If `k` follows the blocksize number, the block size is the given number of 1024-byte blocks. The default *blocksize* is 10K for tar archives and 5K for cpio archives. For ustar, pax, and os390, the default block size is 32,256 bytes.

The output size will always be in multiples of the block size. Therefore, the minimum output archive size will be equal to the block size.

Rule: The block size must be at least 512 bytes for reading.

–C Causes **pax** to continue after encountering an error on the source file system. **pax** will print an error message and return a nonzero value after the command ends. Errors on the target file system (such as out of space or write errors) will still cause the **pax** command to end as it always has.

Restriction: The **–C** option is only for **pax** copy mode.

–c Selects all those files that do not match any of the patterns given on the command line; this is the opposite of the usual behavior. If a pattern is not given, then no files will match.

–D Files will not be created sparse in the target directory tree. Sparse files are those that do not use real disk storage for pages of file data that contain only zeros, which save on disk space. When those files are opened and read, the file system returns zeros for those portions of the files that do not have real disk storage. The default for **pax** is to copy all files as sparse, whether the original file was sparse, if sparse files are supported on the target file system.

Restriction: The **–D** option is only for **pax** copy mode.

–d Does not traverse directories. A pattern matching a directory extracts only the directory itself. When creating an archive, a directory name stores only the directory itself.

–E Same as verbose (**–v**) output, but additionally displays extended attributes. See "Output" on page 539 for more information. **–o E** is equivalent to **pax –E**.

–f *archive*

Lets you specify the name of the archive file instead of using the standard input for list mode, read mode (**–r** operations), and the standard output for write mode (**–w**). The archive file you specify can be an MVS data set. For more information, see Appendix K, "Specifying MVS data set names in the shell environment," on page 1025.

Tip: Avoid writing to an archive which is in the directory tree or the set of files being archived. Doing so causes **pax** to write the archive to itself and results in unpredictable results during the write or later during a read.

-H Follows symbolic links specified on the command line only. When you specify this option, **pax** copies the file pointed to by a symbolic link to an archive. The exception is if a symbolic link on the command line points to another symbolic link. A chain of symbolic links is followed to the end. Symbolic links encountered during tree traversal are not followed; the symbolic link itself is archived. The default behavior is to archive the symbolic link itself.

Specifying more than one of the mutually exclusive options **-H** and **-L** is not considered an error and the last option specified determines the behavior of the utility.

–i Lets you rename files as **pax** works. With extractions, **pax** displays the name of the component it is about to extract and gives you the chance to specify a name for the extracted file. With write operations, **pax** displays the name of the file or directory it is about to record in the archive, and lets you specify a different name to be assigned to the component. If you enter **.** as the name, **pax** processes the file or directory with no change to the name. If you just press <Enter>, **pax** skips the file (does not extract or archive it). **pax** ends if you enter end–of-file.

If you also specify **–s**, **pax** makes the given substitution before displaying the name of the component.

–k Prevents the overwriting of existing files.

–L Follows symbolic links. When you specify this option, **pax** copies the file to which a symbolic link points to the archive. Normally, only the symbolic link is copied.

Specifying more than one of the mutually exclusive options **-H** and **-L** is not considered an error and the last option specified determines the behavior of the utility.

–l Is applicable only when you are in copy mode—that is, when you are using the **–rw** format to copy files to another directory. If you specify **–l**, **pax** creates links to the original files whenever possible, rather than copying them.

–M Creates empty directories within the target directory tree for each active mount point encountered within the source directory tree. **pax** identifies mount points by checking if a subdirectory in the source tree is on the same device as the parent current directory. This behavior is like the current **pax -X** option (write out only those files and directories that are on the same device as their parent directory) except instead of skipping the subdirectory entirely a corresponding empty directory is created in the target directory tree. Any contents in the subdirectory on the source directory tree are ignored.

Restriction: The **–M** option is only for **pax** copy mode.

–n Treats the *pattern* arguments as ordinary path names. You can use this option only when you specify **–r** but not **–w**. **pax** extracts only the first component with a given path name, even if the archive contains several components with the same name. **pax** checks the given path names against the archive before applying any renaming from the **–i**, or **–s** options. **pax** writes an error message for each specified file that cannot be found in the archive.

–o *options*
Provides information for modifying the algorithm for writing and extracting files.

The following set of options controls the use of z/OS extended USTAR support for the USTAR, OS390 format and **pax** format to preserve, restore, and display z/OS-specific information such as external links, extended attributes, file tag information, ACLs, and other information (long link names, for example) not otherwise supported by the USTAR format. The OS390 and **pax** format saves those z/OS specific attributes by default. For more information about extended USTAR support, see "z/OS-extended USTAR support" on page 548.

–o *keyword[[:]=value][,keyword[[:]=value], ...]*
The value of options shall consist of one or more keywords or keyword/value pairs.

Multiple keywords or keyword/value pairs specified to a single **-o** option can be separated by a comma or a space unless the environment variable **_UNIX03=YES** is used, then this must be a comma-separated list. Some keywords apply only to certain file formats, as indicated with each description. Use of keywords that are inapplicable to the file format being processed will be ignored by **pax**.

If **_UNIX03=YES** is not used, then keywords can be preceded with white space and the value field consists of zero or more characters. Within value, any literal comma must be preceded with a

backslash (\). A comma as the final character, or a comma followed solely by white space at the end of *options* will be ignored.

Multiple **-o** options can be specified. If keywords given to these multiple **-o** options conflict, the keywords and values appearing later in command-line sequences take precedence.

If the **-x pax** format is specified, any of the keywords and values that are defined in "Extended header keywords" on page 541 and are in the following list can be used in **-o** *options* in either of two modes:

keyword=*value*
When used in write or copy mode, these keyword-value pairs are written into the global extended header records of the new archive. When used in read or list mode, these keyword-value pairs act as if they were present in the global extended header records of the archive being read. In both cases, the given value is applied to all files that do not have a value assigned in their individual extended header records for the specified keyword.

keyword:=value
When used in write or copy mode, these keyword-value pairs are written into the extended header records of each file in the new archive. When used in read or list mode, these keyword-value pairs act as if they were present in the extended header records of each file in the archive being read. In both cases, the given value overrides any value for the specified keyword found in the global or file-specific extended header records.

For example:

```
pax -r -o "gname:=mygroup" <archive>
```

the group name is forced to a new value for all files read from the archive.

The following keywords are supported:

A Displays data for the extended access control list (ACL). For more information about ACLs, see *z/OS UNIX System Services Planning* and "pax support for access control list (ACL)" on page 550.

Specifying **pax -o A** does not automatically turn on the verbose table of contents format. You must also specify **–v** to display the file permission bit settings that are associated with the file.

atime=*value*
See "Extended header keywords" on page 541.

charset=*value*
See "Extended header keywords" on page 541.

comment=*value*
See "Extended header keywords" on page 541.

delete=*pattern*
(Applicable only to the **-x pax** format.) When used in write or copy mode, **pax** omits any keywords matching the string pattern from

the extended header records. When used in read or list mode, **pax** ignores any keywords matching *pattern* in the extended header records. For example:

```
-o delete=realtime.*
```

suppresses information that is related to the **realtime** keyword. When multiple **-o delete=***pattern* options are specified, the patterns are additive; all keywords matching the specified string patterns are omitted from extended header records that **pax** produces. Patterns follow the same rules given in "File name generation" on page 622.

E Shows extended attributes when displaying the archive table of contents. Automatically turns on **-v**. This option is synonymous with the **pax -E** option.

exthdr.name=*string*
(Applicable only to the **-x pax** format.) This keyword allows user control over the name that is written into the USTAR header blocks for the extended header produced under the circumstances described in "pax header block" on page 1009. The name is the contents of *string*, after the following character substitutions have been made:

Table 23. String values for exthdr.name

string **includes:**	**Replaced by:**
%d	The directory name of the file, equivalent to the result of the **dirname** utility on the translated path name.
%f	The file name of the file, equivalent to the result of the **basename** utility on the translated path name.
%p	The process ID of the **pax** process.
%%	A % character.

Any other % characters in string produce the character itself. For instance, %s prints the character 's'.

If no **-o exthdr.name=***string* is specified, **pax** uses the following default value:

```
%d/PaxHeaders.%p/%f
```

from=*codeset*

from=*codeset* is typically used with **to**=*codeset*.

Converts data from one code set to another while reading or writing an archive. This is functionally equivalent to using the **iconv** utility to convert each file before or after archiving. This option has the format where *keyword* is **from** and *value* is the code set. *codeset* can be a code set name known to the system or the numeric coded character set identifier (CCSID). If a code set name is specified, the numeric CCSID associated with that name is used. Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names.

Two common code set names and their values are:
ISO8859-1
ASCII

IBM-1047
EBCDIC

For example, to convert from ASCII to EBCDIC, use:

```
-ofrom=ISO8859-1,to=IBM-1047
```

From EBCDIC to ASCII, use:

```
-ofrom=IBM-1047,to=ISO8859-1
```

For a complete list of code sets, refer to *z/OS XL C/C++ Programming Guide*.

You can omit either the **to** or **from** keyword.

- When writing an archive, if you specify **from**, but omit **to**, then **pax** assumes that you want to write a portable archive and will convert the data to ISO/IEC 8859-1. If you specify **to**, but omit **from**, then **pax** will convert the data from IBM-1047.
- When reading an archive, if you specify **from**, but omit **to**, then **pax** will convert the data to IBM-1047. If you specify **to**, but omit **from**, then **pax** will convert the data from ISO/IEC 8859-1.

If your input contains a character that is not valid in the source code set, **pax** displays a warning and continues, leaving the character untranslated. If the source code set contains a character that is not in the destination code set, **pax** converts the character to an underscore (_).

By default, no code set conversion of file contents is done. When making code set conversions, **pax** assumes that all files are text files, because only text files are portable.

fromfiletag
For use with **–o** *from=,to=*.

Use of **–o fromfiletag** indicates that if a component file has a coded character set assigned to it, then that coded character set is used as the *from=codeset*, which overrides the value specified on **–o** *from=,to=*.

gid=value
See "Extended header keywords" on page 541.

globexthdr.name=*string*
(Applicable only to the **-x pax** format.) When used in write or copy mode with the appropriate options, **pax** creates global extended header records with USTAR header blocks that will be treated as regular files by previous versions of **pax**. This keyword allows user control over the name that is written into the USTAR header blocks for global extended header records. The name is the contents of string, after the following character substitutions have been made:

Table 24. String values for globexthdr.name

***string* includes:**	**Replaced by:**
%n	An integer that represents the sequence number of the global extended header record in the archive, starting at 1.
%p	The process ID of the **pax** process.
%%	A % character.

Any other % characters in string produce the character itself. For instance, %s prints the character 's'.

If no **-o globexthdr.name=***string* is specified, **pax** uses the following default value:

```
$TMPDIR/GlobalHead.%p.%n
```

where $TMPDIR represents the value of the TMPDIR environment variable. If TMPDIR is not set, **pax** uses /tmp.

gname=value
See "Extended header keywords" on page 541.

invalid=action
(Applicable only to the **-x pax** format.) This keyword allows user control over the action **pax** takes after encountering values in an extended header record that, in read or copy mode, are not valid in the destination hierarchy or, in list mode, cannot be written in the code set and current locale. The following are values for the invalid keyword that are recognized by **pax**:

- In read or copy mode, a file name or link name that contains character encodings that are not valid in the destination hierarchy. For example, the name might contain embedded NULL characters.
- In read or copy mode, a file name or link name that is longer than the maximum allowed in the destination hierarchy for either a path name component or the entire path name.
- In list mode, any character string value (file name, link name, user name, and so on) that cannot be written in the code set and current locale.

bypass
In read or copy mode, **pax** bypasses the file, causing no change to the destination hierarchy. In list mode, **pax** writes all requested valid values for the file, but will not write invalid values.

rename
In read or copy mode, **pax** acts as if the **-i** option were in effect for each file with invalid file name or link name values, allowing the user to provide a replacement name interactively. In list mode, **pax** behaves identically to the bypass action.

UTF-8 When used in read, copy, or list mode and a file name, link name, owner name, or any other field in an extended header record cannot be translated from the **pax UTF-8** code set format to the code set and current locale, **pax** uses the actual UTF-8 encoding for the name.

write In read or copy mode, **pax** writes the file, translating the name, regardless of whether this may overwrite an existing file with a valid name. In list mode, **pax** behaves identically to the bypass action.

If no **-o invalid**= option is specified, **pax** acts as if **-o invalid= bypass** were specified. Any overwriting of existing files that might

be allowed by the **-o invalid=** actions is subject to permission (**-p**) and modification time (**-u**) restrictions, and is suppressed if the **-k** option is also specified.

linkdata
(Applicable only to the **-x pax** format.) In write mode, **pax** writes the contents of a file to the archive even when that file is merely a hard link to a file whose contents have already been written to the archive.

linkpath=*value*
See "Extended header keywords" on page 541.

listopt=*format*
This keyword specifies the output format of the table of contents produced when the **-v** option is specified in list mode. To avoid ambiguity, **listopt=** *format* must be only or final keyword in the **-o** *options* argument. All characters in the remainder of the **-o** *options* argument are considered part of the *format* string. When multiple **-o listopt=***format* options are specified, the format strings are considered a single, concatenated string, evaluated in command line order.

To ensure proper data display, use the proper conversion specifier character for the field being displayed for numeric data. For example, the size field on z/OS systems is often a long data type. Attempting to display the size field using a conversion specifier for a smaller data type, for example %d, will result in a zero being displayed instead of the contents of the size field.

mtime=*value*
See "Extended header keywords" on page 541.

noext See **-o saveext | noext**.

path=*value*
See "Extended header keywords" on page 541.

realtime.*any***=***value*
See "Extended header keywords" on page 541.

security.*any***=***value*
See "Extended header keywords" on page 541.

saveext | noext
For USTAR and OS390-formatted archives, controls whether extended USTAR support is enabled (*saveext*) or disabled (*noext*). *noext* is the default behavior for USTAR format when writing an archive.

The *saveext* option is the default behavior for OS390 format when writing an archive. It is the default behavior when extracting or listing files from the archive. It is also the default to save extended attributes and external links. To list attributes such as ACLs or file tags, **-o A** and **-o T** option must be used. This option has no effect for non-USTAR format. For more information about extended USTAR support, see "z/OS-extended USTAR support" on page 548.

Table 25. USTAR defaults

Action	USTAR default
Writing, copying	**-noext**
Extracting, listing	**-saveext**

saveext
During archive writing, *saveext* causes **pax** to preserve extended USTAR information. During archive listing, *saveext* causes **pax** to display extended USTAR information. During archive reading, *saveext* enables **pax** to restore extended USTAR information. To restore certain information, the user must also have the appropriate privileges and have specified the corresponding options. For example, in order to restore extended attributes, **-px** must be specified and to restore ACLs -pA must be specified. The external links and extended attributes are saved by default for USTAR and OS390 format. The file attributes requiring special headers, such as long links, file tags, and ACLs, need the **-o** *saveext* to be specified for USTAR (OS390 uses **-o** *saveext* by default). The environment variable _OS390_USTAR=Y can also be used to turn on the support. For more information about extended USTAR support, see "z/OS-extended USTAR support" on page 548.

noext When creating archives, does not preserve extended USTAR information. When reading or listing an archive, ignore any extended USTAR support (such as extended attributes, long links, external links, file tags, and ACLs) encoded within the archive. If an archive contains z/OS special header files, these will be displayed or restored (or both) as regular files. Special header files are described in "z/OS-extended USTAR support" on page 548).

Restriction: The **pax** (**-x pax**) format does not recognize the **noext** option.

setfiletag
For use with **-o** *from=,to=*.

Using **-o setfiletag** will tag component files that have not already been tagged.

If a file is untagged (TXTFLAG = OFF, CCSID = 0), then it is automatically stored with TXTFLAG = ON and with CCSID = to the target code set.

For files that are already not untagged, **-o setfiletag** does not change the default behavior. The target code set and TXTFLAG values are left as is. For example, a file tagged as mixed will have TXTFLAG = OFF and CCSID <> 0. UNIX will not automatically force TXTFLAG = ON because it does not want to override the user's reason for making the file mixed.

size=*value*
See "Extended header keywords" on page 541.

times (Applicable only to the **-x pax** format.) When used in write or copy mode, **pax** includes **atime** and **mtime** extended header records for each file.

T Displays file tag information. Similar to **ls –T** and **chtag** output. Does not automatically turn on verbose (**–v**) in the same way that **ls –T** does not automatically turn on its **–l** (long listing) option. When used without **–v**, only the file tag information and file names are displayed.

Example: When used without **–v**:

```
/tmp> pax -o T -f asciitagged.pax
m ISO8859-1   T=off text_am
t ISO8859-1   T=on  text_at
- untagged    T=off text_au
```

This option can be used with **–v** or **–o E** to display additional verbose output.

Example: To display additional verbose output:

```
/tmp> pax -o T -vf asciitagged.pax
m ISO8859-1 T=off -rw-r--r-- 1 SteveS  Kings 9 Apr 30 22:31 text_am
t ISO8859-1 T=on  -rw r--r-- 1 SteveS  Kings 9 Apr 30 22:31 text_at
- untagged  T=off -rw-r--r-- 1 SteveS  Kings 9 Apr 30 22:06 text_au
```

to=*codeset*

to=*codeset* is typically used with **from**=*codeset*.

Converts data to another code set while reading or writing an archive. This is functionally equivalent to using the **iconv** utility to convert each file before or after archiving. This option has the format where *keyword* is **to** and *value* is a code set. *codeset* can be a code set name known to the system or the numeric coded character set identifier (CCSID). If a code set name is specified, the numeric CCSID associated with that name is used. Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names.

Two common code set names and their values are:

ISO8859-1
: ASCII

IBM-1047
: EBCDIC

For example, to convert from ASCII to EBCDIC, use:

```
-ofrom=ISO8859-1,to=IBM-1047
```

From EBCDIC to ASCII, use:

```
-ofrom=IBM-1047,to=ISO8859-1
```

For a more complete list of code sets, refer to *z/OS XL C/C++ Programming Guide*.

You can omit either the **to** or **from** keyword.

- When writing an archive, if you specify **from**, but omit **to**, then **pax** assumes that you want to write a portable archive and will convert the data to ISO/IEC 8859-1. If you specify **to**, but omit **from**, then **pax** will convert the data from IBM-1047.

- When reading an archive, if you specify **from**, but omit **to**, then **pax** will convert the data to IBM-1047. If you specify **to**, but omit **from**, then **pax** will convert the data from ISO/IEC 8859-1.

If your input contains a character that is not valid in the source code set, **pax** displays a warning and continues, leaving the character untranslated. If the source code set contains a character that is not in the destination code set, **pax** converts the character to an underscore (_).

By default, no code set conversion of file contents is done. **pax** assumes that all files are text files, since only text files are portable.

uid=*value*
See "Extended header keywords" on page 541.

uname=*value*
See "Extended header keywords" on page 541.

ZOS.*any=value*
See "Extended header keywords" on page 541.

–p *string*
Specifies which file characteristics to restore. By default, **pax** will only restore the access time (if it is stored in the archive) and modification time of each component file, and the access permissions (mode) as modified by the current umask, that is, they will only be restored entirely when the umask is 000. Currently only **pax** format archives are capable of storing the access time. Other archive formats use the modification time as the access time.

To store the access time in a **pax** format archive, you must specify **-o** *times* when the archive is created or you can manually specify a value for a common access time for all the files in the archive with the **-o** option used with the **atime** keyword on archive creation or extraction. The file tag information, external links, and links whose target exceed 100 characters are also restored by default. Only file attributes that are available in the archive being read can be restored. See the **-x** option, the **-o** *saveext | noext* option, and the file format descriptions in Appendix H, "File formats," on page 1003 to understand the limitations of the archive formats.

string can consist of any combination of the following characters:

A Restores ACL data.

a Does not preserve file access times.

e Preserves the user ID, group ID, file mode, access time, modification time, extended attributes, and ACL entries. Prior to z/OS 1.8, audit flags and file format (line end) attributes were not restored because they are not available in any archive format. The extended attributes are the **apsl** flags that are set by the **extattr** command. A **pax** format archive can be used to store the audit flags and file format, and **-p e** will restore them when available.

m Does not preserve file modification times.

o Preserves the user ID and group ID.

p Preserves the file mode: access permissions (without modification by umask), set-user-ID bit, set-group-ID bit, and sticky bit.

pax restores access permissions by default. If **_UNIX03=YES** extracted files will have permissions of 0666 (modified by umask) unless **-p p** or **-p e** are used.

W Preserves user-requested audit attributes and auditor-requested audit attributes and the file format . The invoking user id must have the AUDITOR attribute set in the system security product to successfully set auditor-requested audit attributes.

x Preserves extended attributes. The extended attributes are the **apsl** flags that are set by the **extattr** command.

If neither the **e** nor the **o** specification character is specified, or the user ID and group ID are not preserved for any reason, **pax** shall not set the set-user-ID and set-group-ID bits of the file mode.

–q For read mode only, **pax** assumes that all created files are text files and extracts them to the local text file format. On systems with fixed length records, this might mean appending blanks as padding.

On UNIX and POSIX-compliant systems, **pax** removes all carriage return characters (**\r**) and retains only the newline (**\n**) characters.

–r Reads an archive file from standard input.

–s *substitute*

Modifies path name using a substitution command *substitute*. This is similar to the substitution command of the **ed** text editor. The full option has the form:

```
–s#bregexp#string#[gp]
```

where *bregexp* is a basic regular expression and *string* is a string that **pax** is to insert in place of matches for the regular expression. *string* can contain an ampersand `&` (standing for the string matching *bregexp*), or `\1`, `\2`, and so on (with the meanings defined in **regexp**), for subexpression matching.

The `#` is used as the delimiter character separating *bregexp* and *string*. You can use any non-null character instead. There cannot be any space between **-s** and the delimiter character.

Normally, **–s** replaces only the first match for *bregexp*. A `g` following the *string* replaces all matches in the line.

A `p` following the *string* prints all successful substitutions on the standard error stream. **pax** displays a substitution in the format:

```
oldname >> newname
```

There might be more than one **–s** option on the command line. In this case, **pax** tries the substitutions in the order given. **pax** stops trying to make these substitutions as soon as it makes its first successful substitution. If the null string replaces a file name, **pax** ignores that file name on both input and output.

–t After reading files being archived, **pax** resets the access time to that prior to **pax**'s access.

–u Compares component dates to dates of existing files with the same name. When extracting components with **–r** (read mode), **pax** extracts a file only if its modification date is more recent than the modification date on an existing file of the same name. In other words, it doesn't overwrite an existing file if the existing file is newer than the one in the archive.

Similarly, when copying files with **–rw** (copy mode), **pax** does not overwrite an existing file if the existing file is newer than the one being copied.

In a command that uses **–w** but not **–r** (write mode), **–u** checks to see if the file being added has the same name as a file already in the archive. If so, and if the file being added is newer than the one in the archive, **pax** leaves the old file in the archive and appends the new one at the end. In this case, **–u** automatically implies **–a**, which means that **pax** adds new files to the end of the archive.

–V *volpat*
Provides automatic multivolume support. **pax** writes output to files the names of which are formatted with *volpat*. It replaces any occurrence of *#* in *volpat* with the current volume number. When you invoke **pax** with this option, it asks for the first number in the archive set, and waits for you to type the number and a carriage return before proceeding with the operation. **pax** issues the same sort of message when a write error or read error occurs on the archive; the reasoning is that this kind of error means that **pax** has reached the end of the volume and is to go on to a new one. An interrupt at this point ends **pax**.

–v Lists path name on the standard error stream just before beginning to process the files or directories, but after any **–i**, or **–s** options have had their effect. In list mode (neither **–r** nor **–w** is specified), **pax** displays a "verbose" table of contents; this verbose format shows information about the components in the same format used by the **ls** command. See "Output" on page 539 for more information.

-W seqparms=*parms*
Specifies the parameters needed to create a sequential data set if one does not already exist. You can specify the RECFM, LRECL, BLKSIZE, and SPACE in the format that fopen() function uses.

`SPACE=(units,(primary,secondary)` where the following values are supported for units:
- Any positive integer indicating BLKSIZE
- CYL (mixed case)
- TRK (mixed case)

Space can be specified as follows:

```
SPACE=(500,(100,500)) units, primary, secondary
SPACE=(500,100) units and primary only
```

The fopen() arguments: LRECL specifies the length, in bytes, for fixed-length records and the maximum length for variable-length records. BLKSIZE specifies the maximum length, in bytes, of a physical block of records. RECFM refers to the record format of a data set and SPACE indicates the space attributes for MVS data sets. For example:

```
pax -W "seqparms='RECFM=U,space=(500,100)'" -wf "//'target.dataset'" source
```

For information about specifying these parameters, see *z/OS XL C/C++ Programming Guide*.

–w Writes files to standard output in the specified archive format.

–X Writes out only those files that are on the same device as their parent directory. However, it will not copy a directory currently used as a mount point. The user must either unmount the file system from that mount point or copy the directory manually.

–x *format*
Specifies a file format for an output archive. The *format* argument can be:

cpio The ASCII format used by the **cpio** command.

cpiob The binary format used by **cpio**.

os390 The OS390 format, which has all the support for saving and restoring extended USTAR support such as special headers, external links, and long links. This format is only supported on z/OS systems.

pax The **pax** interchange format which, like os390 format (**-x os390**) and extended USTAR (**-o saveext**), saves or restores file attributes that cannot be stored in the USTAR header format such as ACLs, external links, long link names, long path names, file tags and extended attributes.

Additionally, the **pax** interchange format can save and restore file attributes that cannot be handled by any other format such as files greater than 8 GB in size, **uid** and **gid** values greater than 2097151 and z/OS-specific attributes like user audit and auditor audit flags and file format. To restore certain information, the user must also have the appropriate privileges and have specified the corresponding options. See **-p** for options for restoring file attributes.

In copy mode, **pax** shall behave as if it were using the **pax** interchange format.

tar The historical format of **tar** files.

ustar The USTAR format used by the **tar** command. It is the default for *format*.

To preserve information about extended attributes, external links, and link names greater than 100 characters, `ustar` with either the **_OS390_USTAR=Y** environment variable or the **-o** *saveext* option can be used. You can also use the `-x os390` or `-x pax` option to store these attributes.

Guideline: When creating archives that might be extracted on older z/OS systems, use the USTAR, extended USTAR (**-o** *saveext*) or os390 format. If the archives will only be extracted on z/OS release 8 systems and later, the **pax** format **(-x pax)** is the recommended format.

–z For write or read mode, performs Lempel-Ziv compression. **–z** cannot be used when appending (**–a**) to an existing archive.

It is recommended that, when creating archive files using the **–f** option, the archive name be suffixed with a .Z to identify it as a compressed file and to facilitate it being processed by uncompress (if needed).

For reads, **–z** is functionally equivalent to first uncompressing the archive using the uncompress utility and then reading it. This option is not required when reading a compressed archive. **pax** will automatically detect that the archive is compressed. It might be useful, however, to use **–z** to confirm that the archive is compressed; you will receive an error message if you specify **–z** on an archive that is not compressed.

Output

When the **–v** or **–E** option is used in list mode, **pax** produces a verbose table of contents for the archive. The output for **–v** is similar to the output from the **ls –l** command with the following exceptions:

- The notation:

  ```
  pathname == linkname
  ```

  indicates that *linkname* is a hard link of *pathname*.
- For symbolic and external links, **pax** output always shows a file size of 0.

The output from the **–E** option has the same format as **–v** and additionally displays a column showing the extended attributes:

a Program runs APF-authorized if linked AC=1
p Program is considered program-controlled
s Program runs in a shared address space
l Program is loaded from the shared library region. (l is a lowercase L, not an uppercase i.)
– Attribute not set

The format of the **pax –E** output is variable in length and is extended as necessary to display additional file characteristics that are not supported by **pax –v** (**ls –l**).

Usage notes

1. On the z/OS system, superuser privileges or read access to the appropriate FACILITY class resources are required to create character special files, restore user and group names, and to set certain extended attributes (read access to the corresponding FACILITY class resources).
2. The POSIX 1003.1 standard defines formats for **pax**, **tar**, and **cpio** archives that limit the UIDs and GIDs that can be stored to the following maximum values:

   Table 26. Maximum UID and GID values for tar, USTAR, cpio and pax

Format	Maximum UID and GID values
tar, USTAR	2,097,151
cpio	262,143
pax	2,147,483,647

   Values larger than these will not be properly restored for **tar** and **cpio** formatted archives. For USTAR formatted archives, because the user and group names are also stored in the archive, the correct UID and GID will be restored only if the name is defined on the target system.
3. In historical UNIX standard formats, for **pax** and **tar** archives, the length of a link file target is limited to 100 characters or less. If hard links exist, the target is the first occurrence of the hard link that is saved in the archive. Subsequent hard links refer to the first instance. You can use the extended USTAR support provided by **pax** and **tar** to save the long hard links when the archives are created, and to restore them when the archives are read. As of z/OS V1R8, the **pax** format as defined by the current UNIX standard provides a means to save and restore long link names that can be transferred between other (including non-z/OS) UNIX platforms. For more information, see -x pax.
4. In historical UNIX standard formats, the size of a file that can be stored in a **pax** and **tar** archive was limited to 8 gigabytes. As of z/OS V1R8, the **pax** format archive allows files greater than 8 gigabytes to be archived. For more information, see -x pax.

5. When transferring archives between z/OS systems and other UNIX systems, note the following:
   a. Archive files must always be transferred in binary mode, even if the archives contain only text files. Common ways of transferring files include FTP, the **cp** shell command, and the OPUT and OGET TSO/E commands.
   b. You might need to convert text files from EBCDIC to ASCII (or some other character set). The **pax -o** option can be used to convert text files while an archive is being created or being restored. You can use the **iconv** utility to convert files before they are stored in the archive or after restoring them from an archive.
6. Automatic conversion on files with file tag information is disabled when reading files during creation of an archive or during writes while extracting files from an archive. That is, the settings of system and environment variables that turn automatic conversion on and off will have no effect on the reading and writing of files by **pax**.

File tagging

When the **–o** *from=,to=* option is used to perform translation, the default behavior for storing the file tag information is as follows:

–w (write)

For files that are tagged, the CCSID preserved in the archive is set to the CCSID of the *to=codeset* argument. Files that are untagged (TXTFLAG = OFF and CCSID = 0) will not have file tag information stored. The **–o setfiletag** option can be used to force the tagging of files which are not already tagged.

When a file in the archive is tagged with a different CCSID than the *from=codeset*, an error message is generated. However, **pax** will continue processing. Because this situation indicates a probable corruption of data, upon completion, **pax** will issue a nonzero return code. To avoid this situation, the **–o fromfiletag** option can be used. It causes **pax** to use the CCSID of the file instead of the one specified on the **–o** *from=,to=* option.

–r (read)

For files that are tagged, the TXTFLAG value is restored to the value preserved in the archive (ON or OFF), but the CCSID of the target file is altered to the *to=codeset* CCSID. For example, a file tagged as `mixed` will have TXTFLAG = OFF and CCSID ≠ 0. z/OS UNX will not automatically force TXTFLAG = ON because it does not want to override the user's reason for making the file mixed.

The default behavior for files in the archive that are untagged will not change, and the target file will also be set to untagged. The **–o setfiletag** option can be used to force the tagging of files that do not have filetag information associated with them in the archive.

If the target file already exists, its filetag information is ignored.

When a file in the archive is tagged with a different CCSID than the *from=codeset*, an error message will be generated. However, **pax** will continue processing. Because this situation indicates a probable corruption of data, upon completion, **pax** issues a nonzero return code. The **–o fromfiletag** option can be used to avoid this situation. It causes **pax** to use the CCSID of the file rather than the one specified on the **–o** *from=,to=* option.

–wr (copy)

If the source files are tagged, then the target file will have its CCSID set to the CCSID of the *to=codeset* CCSID. If the target already exists, then its TXTFLAG values are ignored; the source file is used to determine the TXTFLAG setting of the target and will override whatever the TXTFLAG settings are of the target.

Like **–r** and **–w**, when the CCSID of the source file is different from the *from=codeset* CCSID, a warning message is generated and, upon completion, **pax** issues a nonzero return code. The **–o fromfiletag** option can be used to avoid this situation. It causes **pax** to use the CCSID of the file rather than the one specified on the **–o** *from=,to=* option.

Extended header keywords

The following extended header keywords are applicable only in the **-x pax** format.

atime The file access time for the following files, equivalent to the value of the st_atime member of the stat structure for a file. The access time shall be restored if the process has the appropriate privilege required to do so.

charset

The name of the character set used to encode the data in the following files. The entries in this table are defined to refer to known standards and the **charset** value used to represent each:

The encoding is included in an extended header for information only; when **pax** is used as described, it does not translate the file data into any other encoding. The BINARY entry indicates unencoded binary data.

Table 27. Charset standards

<value>	**Formal standard**
ISO-IR 646 1990	ISO/IEC 646:1990
ISO-IR 8859 1 1998	ISO/IEC 8859-1:1998
ISO-IR 8859 2 1999	ISO/IEC 8859-2:1999
ISO-IR 8859 3 1999	ISO/IEC 8859-3:1999
ISO-IR 8859 4 1998	ISO/IEC 8859-4:1998
ISO-IR 8859 5 1999	ISO/IEC 8859-5:1999
ISO-IR 8859 6 1999	ISO/IEC 8859-6:1999
ISO-IR 8859 7 1987	ISO/IEC 8859-7:1987
ISO-IR 8859 8 1999	ISO/IEC 8859-8:1999
ISO-IR 8859 9 1999	ISO/IEC 8859-9:1999
ISO-IR 8859 10 1998	ISO/IEC 8859-10:1998
ISO-IR 8859 13 1998	ISO/IEC 8859-13:1998
ISO-IR 8859 14 1998	ISO/IEC 8859-14:1998
ISO-IR 8859 15 1999	ISO/IEC 8859-15:1999
ISO-IR 10646 2000	ISO/IEC 10646:2000
ISO-IR 10646 2000 UTF-8	ISO/IEC 10646, UTF-8 encoding
BINARY	None

comment
A series of characters used as a comment. All characters in the value field are ignored by **pax**.

gid The group ID of the group that owns the file, expressed as a decimal number using digits from ISO/IEC 646. This record overrides the **gid** field in the following header blocks.

When used in write or copy mode, pax includes a **gid** extended header record for each file whose group ID is greater than 2097151 (octal 7777777).

gname
The group of the following files, formatted as a group name in the group database. This record overrides the **gid** and **gname** fields in the following header blocks, and any **gid** extended header record.

When used in read, copy, or list mode, **pax** translates the name from the UTF-8 encoding in the header record to the character set appropriate for the group database on the receiving system. If any of the UTF-8 characters cannot be translated, and if the **-o invalid=UTF-8** option is not specified, the results are undefined as if **-o invalid=bypass** were specified.

When used in write or copy mode, **pax** includes a **gname** extended header record for each file whose group name cannot be represented entirely with the letters and digits of the portable character set.

linkpath
The path name of a link being created to another file, of any type, previously archived. This record overrides the linkname field in the following USTAR header blocks.

The following USTAR header block determines the type of link created, whether hard or symbolic. In the latter case, the **linkpath** value is the contents of the symbolic link. **pax** translates the name of the link (contents of the symbolic link) from the UTF-8 encoding to the character set appropriate for the local file system.

When used in write or copy mode, **pax** includes a **linkpath** extended header record for each link whose path name cannot be represented entirely with the members of the portable character set other than NULL.

mtime The file modification time of the following files, equivalent to the value of the st_mtime member of the stat structure for a file. This record overrides the **mtime** field in the following header blocks. The modification time is restored if the process has the appropriate privilege to do so.

path The path name of the following files. This record overrides the name and prefix fields in the following header blocks. **pax** translates the path name of the file from the UTF-8 encoding to the character set appropriate for the local file system.

When used in write or copy mode, **pax** includes a path extended header record for each file whose path name cannot be represented entirely with the members of the portable character set other than NULL.

realtime.*any*
The keywords prefixed by **realtime.** are reserved for future POSIX **realtime** standardization. **pax** recognizes but silently ignores them.

security.*any*
The keywords prefixed by **security.** are reserved for future POSIX security standardization. **pax** recognizes but silently ignores them.

size The size of the file in octets, expressed as a decimal number using digits from ISO/IEC 646. This record overrides the size field in the following header blocks.

When used in write or copy mode, **pax** automatically includes a size of extended header record for each file with a size value greater than 8589934591 (octal 77777777777).

As with other keywords, the user can manually set this value by using **-o size=***value* or **-o size:=***value*. However, it is strongly recommended this not be done. Creating a global or extended size record for the size extended record keyword can cause failures or data corruption when used in read or write mode. **size** extended records are ignored by **pax** in copy mode.

uid The user ID of the user that owns the file, expressed as a decimal number using digits from ISO/IEC 646. This record overrides the **uid** field in the following header blocks.

When used in write or copy mode, **pax** includes a **uid** extended header record for each file whose owner ID is greater than 2097151 (octal 7777777).

uname

The owner of the following files, formatted as a user name in the user database. This record overrides the **uid** and **uname** fields in the following header blocks, and any **uid** extended header record.

When used in read, copy, or list mode, **pax** translates the name from the UTF-8 encoding in the header record to the character set appropriate for the user database on the receiving system. If any of the UTF-8 characters cannot be translated, and if the **-o invalid=UTF-8** option is not specified, the results are as if **-o invalid=bypass** were specified.

When used in write or copy mode, **pax** includes a **uname** extended header record for each file whose user name cannot be represented entirely with the letters and digits of the portable character set.

ZOS.acls

The extended access control lists (extended ACLs) of the following files.

When used in write or copy mode, **pax** includes a ZOS.acls record for each file which has extended ACLs set. Values of the **ZOS.acls** keyword have the following format

```
[d[efault]: | f[default]:]u[ser]:uid:perm
[d[efault]: | f[default]:]g[roup]:gid:perm
```

where:

d[efault]
If specified, extended ACL refers to directory default ACL

f[default]
If specified, extended ACL refers to file default ACL

u[ser] Extended ACL refers to a particular numeric user ID (UID) or user name

g[roup]
Extended ACL refers to a particular numeric group ID (GID) or group name

uid User name or numeric user ID (UID)

gid Group name, or numeric group ID (GID)

perm Permissions specified either in absolute form (string rwx with - as a placeholder or octal form

Syntax examples:

```
-o ZOS.acls=user:billy:r-x
-o ZOS.acls=g:cartoons:r
```

In the next example, note that the multiple entries in the value are comma-separated. However, because these literal commas are in a **-o** value, they must be preceded by a backslash since commas are used to delimit keyword-value pairs regardless of whether the value is enclosed in quotation marks.

```
-o
ZOS.acls=user:user1:r-x\,group:thegang:r--\,user:user2:r-x
\,d:user:user1:r-x\,d:group:thegang:r--\,d:user:user2:r-x
```

ZOS.taginfo

The value for the **ZOS.taginfo** keyword is composed of a text flag (txtflag) and a coded character set and allows the user to modify the taginfo associated with the file.

The txtflag indicates whether a file contains uniformly encoded or non-uniformly encoded text data. Values for txtflag are 0 (indicating txtflag is OFF) or 1 (indicating txtflag is ON). If the txtflag is 1 (ON), it indicates that the specified file contains pure (uniformly encoded) text data. For files that contain binary, mixed or unknown data, the txtflag is 0 (OFF).

The coded character set represents the code set in which text data is encoded. The code set can be used for uniformly encoded text files or files that contain mixed text/binary data. It can be a code set name known to the system or the numeric coded character set identifier (CCSID). If a code set name exists, the numeric CCSID associated with that name will be used).

When used in write or copy mode, **pax** includes a **ZOS.taginfo** extended header record for each file for which txtflag is 1 (ON) or the file is not untagged.

The command `iconv -l` lists existing CCSIDs along with their corresponding code set names. Values of the **ZOS.taginfo** keyword have the following format:

```
0 [ccsid]
1 ccsid
```

Syntax examples:

```
-o ZOS.taginfo=0
-o ZOS.taginfo="1 819"
-o ZOS.taginfo="0 1208"
-o ZOS.taginfo="1 1047"
```

ZOS.useraudit

Indicates the user-requested audit attributes of the specified files or directories. Audit attributes determine whether accesses to a file are audited by the system authorization facility (SAF) interface.

When used in write or copy mode, **pax** includes a **ZOS.useraudit** record for each file which the user-requested audit attributes are anything other than auditing read, write and execute failures on the file.

The value of the **ZOS.useraudit** keyword is a sequence of three characters, each of which can be one of the following four characters. The character in the first position represents the audit properties for read operations on the corresponding file, the second represents audit properties for write operations on the corresponding file and the third character represents audit properties for execute operations on the corresponding file.

- Do not audit
f Audit failures
s Audit successes
a Audit both successes and failures

Syntax examples:

```
-o ZOS.useraudit=ffa
-o ZOS.useraudit=ssa
-o ZOS.useraudit=sf-
```

ZOS.auditoraudit

Indicates the auditor-requested audit attributes of the specified files or directories. Audit attributes determine whether accesses to a file are audited by the system authorization facility (SAF) interface.

When used in write or copy mode, **pax** includes a **ZOS.auditoraudit** record for each file which the auditor-requested audit attributes are set on the file.

The value of the **ZOS.auditoraudit** keyword is a sequence of three characters, each of which can be one of the following four characters. The character in the first position represents the audit properties for read operations on the corresponding file, the second represents audit properties for write operations on the corresponding file and the third character represents audit properties for execute operations on the corresponding file.

- Do not audit
f Audit failures
s Audit successes
a Audit both successes and failures

Syntax examples:

```
-o ZOS.auditoraudit=ffa
-o ZOS.auditoraudit=ssa
-o ZOS.auditoraudit=sf-
```

ZOS.filefmt

Specifies if a file is binary or text and for text files, specifies the end-of-line delimiter. For format you can specify:

not Not specified
bin Binary data
rec Record. (File data consists of records with prefixes. The record prefix contains the length of the record that follows. From the shell command perspective, files with this format are treated as if they were binary files.)

Or the following text data delimiters:

nl Newline character
cr Carriage return
lf Line feed
crlf Carriage return followed by line feed
lfcr Line feed followed by carriage return

crnl Carriage return followed by a newline character

Restriction: The **rec** value for **ZOS.filefmt** is only available on z/OS V1R12 and later. Therefore, if an object with the **rec** file format is restored on an earlier release, the **rec** file format information will be lost.

ZOS.extattr

The value of this keyword is a 4-character string that specifies the extended attributes for files to allow executable files to be marked so they run APF authorized, as a program controlled executable, or not in a shared address space.

- The first character of the value specifies whether the program runs APF authorized and is either 'a' or '-'.
- The second character of the value specifies whether the program is considered program controlled and is either 'p 'or '-'.
- The third character of the value specifies whether the program runs in a shared address space and is either 's' or '-'.
- The fourth character of the value specifies whether the program file is loaded from the shared library region and is either 'l' or '-'.

a The program runs APF-authorized if linked AC=1.
p The program is considered program controlled.
s The program runs in a shared address space.
1 The program file is loaded from the shared library region.
- The attribute is not set

Syntax examples:

```
-o ZOS.extattr=apsl
-o ZOS.extattr=ap-l
-o ZOS.extattr=-p--
```

Extended header keyword precedence

(Applicable only to the **-x pax** format.)

This topic describes the precedence in which the various header records and fields and command-line options are selected to apply to a file in the archive. When **pax** is used in read or list modes, it determines a file attribute in this sequence:

1. If `-o delete=`*`keyword-prefix`* is used, the affected attribute is determined from step 7 if applicable, or ignored otherwise.
2. If **-o keyword:=** is used with no value specified, the affected attribute is ignored.
3. If `-o keyword:=`*`value`* is used, the affected attribute is assigned the value.
4. If a **keyword** exists in a file-specific extended header record, the affected attribute is assigned the value. When extended header records conflict, the last one given in the header takes precedence.
5. `If -o keyword=`*`value`* is used, the affected attribute is assigned the value.
6. If a **keyword** exists in a global extended header record, the affected attribute is assigned the value. When global extended header records conflict, the last one given in the global header takes precedence.
7. Otherwise, the attribute is determined from the USTAR header block.

List mode format specifications

In list mode with the **-o listopt=***format* option, the format argument is applied for each selected file. The **pax** utility appends a newline character to the listopt output for each selected file. The format argument is used as the format string with the following exceptions:

1. A <space> character in the format string, in any context other than a flag of a conversion specification, is treated as an ordinary character that is copied to the output.
2. In addition to the escape sequences \\,\a, \b, \f, \n, \r, \t, and \v, the escape sequence \ddd, where *ddd* is a one-, two-, or three-digit octal number, is written as a byte with the numeric value specified by the octal number.
3. Output from the d or u conversion specifiers is not preceded or followed with s not specified by the format operand.
4. Output from the o conversion specifier is not preceded with zeros that are not specified by the format operand.
5. The sequence (keyword) can occur before a format conversion specifier. The conversion argument is defined by the value of keyword. The following keywords are supported:

   Any of the Field Name entries in USTAR Header Block and Octet-Oriented cpio Archive Entry. The implementation supports the **cpio** keywords without the leading c_ in addition to the form required by Values for cpio c_ mode Field.

   Any keyword defined for the extended header in “Extended header keywords” on page 541.

   Any keyword provided as an implementation-defined extension within the extended header defined in “Extended header keywords” on page 541. For example, the sequence "%(charset)s" is the string value of the name of the character set in the extended header.

   To ensure proper data display be sure to use the proper conversion specifier character for the field being displayed for numeric data. For example, the size field on z/OS systems ID is often a long long data type. Attempting to display the size field using a conversion specifier for a smaller data type, for example %d, will result in a zero being displayed instead of the contents of the size field.

   The result of the keyword conversion argument is the value from the applicable header field or extended header, without any trailing NULs. All keyword values used as conversion arguments are translated from the UTF-8 encoding to the character set appropriate for the local file system, user database, and so on, as applicable.
6. An additional conversion specifier character, T, is used to specify time formats. The T conversion specifier character can be preceded by the sequence (keyword=subformat), where subformat is a date format as defined by date operands. The default keyword is mtime and the default subformat is:

   ```
   %b %e %H:%M %Y
   ```
7. An additional conversion specifier character, M, is used to specify the file mode string as defined in ls Standard Output. If (keyword) is omitted, the mode keyword is used. For example, %.1M writes the single character corresponding to the entry type field of the ls -l command.
8. An additional conversion specifier character, D, is used to specify the device for block or special files.
   - If the use of D is applicable, the format is "devmajor,devminor".

- If the use of D is not applicable and (keyword) is specified, then this conversion is equivalent to %(keyword)u.
- If the use of D is not applicable and (keyword) is omitted, then this conversion is equivalent to <space>.

9. An additional conversion specifier character, F, is used to specify a path name. The F conversion character can be preceded by a sequence of comma-separated keywords:

   ```
   (keyword[,keyword] ... )
   ```

   The values for all the keywords that are non-null are concatenated, each separated by a /. The default is (path) if the keyword path is defined. Otherwise, the default is *(prefix,name)*.

10. An additional conversion specifier character, L, is used to specify a symbolic link expansion. If the current file is a symbolic link, then %L expands to:`"%s -> %s"`, value of keyword, contents of link.

    Otherwise, the %L conversion specification is the equivalent of %F.

z/OS-extended USTAR support

OS390 archive format stores all the extended USTAR attributes by default (the **-o** options do not apply). By default, the z/OS implementation of **pax** and **tar** provide extended support with the USTAR format to preserve and restore z/OS-specific file attributes and other information not otherwise supported due to limitations with the USTAR format. The OS390 format also stores these by default. Examples of these include:

- External links
- Extended file attributes (such as program-controlled and APF-authorized). The extended attributes are the **apsl** flags that are set by the **extattr** command. Audit flags and file format attributes are not stored.

This support is only provided for archives using the USTAR format. USTAR is the default format for **pax** when creating an archive. For **tar**, the default format is the original **tar** format. The **-U** option, however, can be used to cause **tar** to use USTAR. When reading an archive, **tar** will automatically recognize the USTAR format– no special option is required. (For more information about the USTAR format, see "tar -- Format of tar archives" in Appendix H, “File formats,” on page 1003.)

The **pax** and **tar** commands also allow the storing/restoring of additional file attributes using explicit options and environment variable. The following attributes require special header support. OS390 format stores and restores these by default. Examples of these additional attributes include:

- Links whose targets exceed 100 characters
- Access control lists (ACLs)
- File tag information
- Files with names longer than 255 characters

The extended USTAR support is provided by using two mechanisms: encoding the information within the USTAR header record and through the creation of special header files. (The same mechanism is used for the OS390 archive format.)

Encoding information within the USTAR header record

External link and extended attribute information is encoded within the standard USTAR header in a manner which is compliant with POSIX standards and should

be tolerated by other non-z/OS versions of **pax** and **tar**. Because external links and extended attributes are specific to z/OS, however, they cannot be restored on other platforms.

Special header files

Hard links and symbolic links with targets greater than 100 characters cannot be preserved within the standard USTAR format (for a hard link, the target is the first occurrence of the hard link which is archived; subsequent hard links refer to the first instance). In order to preserve links with targets greater than 100 characters, *special header files* are created for each link and stored in the archive. The special headers are stored when one of the following is used: **-o** *saveext* option, environment variable _OS390_USTAR=Y, or **-x** *os390* option (OS390 format).

Each special header file contains information used by z/OS **pax** and **tar** to restore the link to its original state. Special header files are identified in the archive with type "S" (see "tar -- Format of tar archives" in Appendix H, “File formats,” on page 1003 for more information about file types).

Each special header file in the archive has the same name: **/tmp/OS390_USTAR_SUMMARY**_*timestamp* where *timestamp* is the creation time (represented in seconds since the epoch) of the first special header file. For example:

```
/tmp/OS390_USTAR_SUMMARY_919026474
```

When a special header file is required to preserve a file and the _OS390_USTAR=Y environment variable was used, an informative message along with a reason is displayed indicating that a special header file was created. When **-o** *saveext* or **-x** *os390* for **pax** or **-UX** or **-S** for **tar** is used, the informational message is not displayed.

When reading or listing an archive containing special header files and when using the default extended USTAR support, **pax** and **tar** recognize type "S" files as special header files and display or restore the file described by the special header rather than the actual special header file. So, typically, the presence of special header files is not known to the user.

When the archive is complete, if one or more special header files were created, then a final *special header* **summary** *file* is created and added to the archive. This file is identified in the archive with type "T" and has the same name as the special header files. This file summarizes, via script commands and comments, the contents of all previously archived special header files. Its primary purpose is to provide help restoring files included via special header files to those with versions of **pax** or **tar** that do not implement extended USTAR support.

So, to allow users of non-z/OS systems to read the *special header* **summary** *file*, it is encoded in the ASCII ISO8859-1 code set. To view the special header file in EBCDIC code page IBM-1047, first convert the file using the **iconv** command. For example:

```
 iconv  -f ISO8859-1  -t IBM-1047  /tmp/OS390_USTAR_SUMMARY_919026474  >
summary_in _ebcdic
```

If extended USTAR support is disabled during reading or listing an archive by using the **pax -o** *noext* or the **tar -O** option, or if the archive is processed by either an earlier version of z/OS **pax** or **tar** that does not implement extended USTAR support or a non-z/OS system version of **pax** or **tar**, then the special header files is

not recognized and are processed as unknown type regular files. During extraction, because all files have the same name, each extracted special header file will overlay the previous one with the special header summary file being the final one restored.

For an example of the *special header* **summary** *file*, see "USTAR archive format" on page 1007.

File tags and the use of –o *noext*

Because special headers are required to store file tag information, the storing and restoring of file tag information is disabled if the user specifies the **–o** *noext* option. The **–o** *noext* option is the default for writing an archive. To store information in the special headers, the **–o** *saveext* or _OS390_USTAR=Y environment variable must be used. When **–o** *noext* is used, each file is treated as if it were untagged. That is, if **–o** *noext* is specified, the stored or extracted file are set to untagged regardless of its previous file tag setting.

–o *noext* disables all attributes stored with special headers, so this option cannot be used to selectively disable the storing or restoring of text flag information. You will have to use **chtag** to do that.

–o *noext* does not affect the automatic conversion of files. If you use **pax** to read, write or copy files, automatic conversion is disabled whether **–o** *noext* is specified or not.

For more information about automatic conversion and file tagging, see *z/OS UNIX System Services Planning*.

pax support for access control list (ACL)

Archive writing or creating

ACL data is stored in USTAR formatted archives using special headers when one of the following is used: **–o** *saveext* option or _OS390_USTAR=Y environment variable. OS390 format (**-x** *os390* option) automatically stores all special header information to include ACLs.

You can use **pax –o** *noext* to disable the creation of special headers. This prevents **pax** from storing ACL data and other non-standard information such as file tag data and long link names. However, there is no option to disable storing of ACL data only.

Archive reading or restoring

By default, ACL data is not restored when reading or restoring files from an archive. However, you can use **pax –p A** to restore ACL data. You can also use **pax –p e** (which restores all file attributes) to restore ACL data.

Archive copying

If you need to preserve ACLs when copying files to an archive, you must use **pax –p A** or **pax –p e**.

Archive listing (table of contents)

For verbose output (**pax –v**), a **+** is added to the end of the file permission bits for all files with extended ACL entries. For more information about access control lists, see *z/OS UNIX System Services Planning*.

Examples

For **archive listing (table of contents**):

If *file2* and *dir1* have extended ACL entries:

```
> pax -vf acldata.pax
-rwx------   1 STIERT   SHUT      294912 Nov  9 09:57 file1
-rwx------+  1 STIERT   SHUT      294912 Nov  9 09:57 file2
drwxr-xr-x+  2 STIERT   SHUT        8192 Mar 20  2000 dir1/
```

Writing (creating) an archive:

1. The following creates an archive file named **/tmp/files.pax** from all the files in the current working directory. The **-v** option is used to display each file as it is being added:

   ```
   pax -wvf /tmp/files.pax *
   ```

   or

   ```
   pax -wvf /tmp/files.pax .
   ```

   The difference between these two forms is that in the latter example (using .), names recorded in the archive is preceded by a "./" which will include and preserve the attributes of the current working directory and any hidden files in the current working directory.
2. Either of these commands creates a compressed version of the archive created in Example 1:

   ```
   pax -wzvf /tmp/files.pax.Z  *
   ```

   or

   ```
   pax -wzvf /tmp/files.pax.Z  .
   ```

   In some instances, you can obtain a smaller, more compressed output archive by first creating the pax archive uncompressed, and then using the **compress** command on the archive. For example:

   ```
   pax -wvf /tmp/files.pax *
   compress /tmp/files.pax
   ```
3. The following example creates an archive **/tmp/dironly.pax** containing only the files and directory names in the current directories (it does not include the contents of subdirectories):

   ```
   pax -wdvf /tmp/dironly.pax.  *
   ```
4. This example creates the archive **/tmp/cfiles.pax** containing all c files in the current directory:

   ```
   pax -wvf /tmp/cfiles.pax  *.c
   ```
5. This example creates the archive **/tmp/allcfiles.pax** containing all c files in the current directory and all subdirectories:

   ```
   pax -wvf /tmp/allcfiles.pax  $(find . -name "*.c")
   ```
6. This example creates the archive **/tmp/ascii_src.pax** using all .c and .h files in the current directory converted into ASCII:

   ```
   pax -wv -o to=ISO8859-1 -f /tmp/ascii_src.pax  *.[ch]
   ```
7. The following example creates the compressed archive **/u/smith/oldfiles.pax.Z** containing all files on the system that were not accessed within the last 10 days:

   ```
   pax -wvzf /u/smith/oldfiles.pax.Z   $(find / -type f -atime +10)
   ```

8. The following example creates the archive **/tmp/basename.pax** containing all files in the directory **sub1** stored in the archive with "sub1/" removed from each component name. The pound character # is used as the delimiter for the **–s** option:

```
pax -wv -s#sub1/## -f /tmp/basename.pax  sub1/*
```

Reading an archive:

1. This example extracts all the components of the archive **source.pax**. The **–v** option is used to display each file or directory as it is extracted.

```
pax -rvf source.pax
```

2. To extract all files in **source.pax** and translate them from ASCII to EBCDIC:

```
pax -ofrom=ISO8859-1,to=IBM-1047 -rf source.pax
```

3. To extract all files in the archive **source.pax** ending with **.h**:

```
pax -rf source.pax  `pax -f source.pax | grep h$`
```

   This example uses command substitution to first read the archive and generate a list of all files in the archive that end with **/**.

4. This example extracts files into a directory that is different from the directory they are stored in within the archive. Assume the names of all files stored in the archive **source.pax** begin with the root directory (**/**). To extract them into **/newroot/**, use the following command:

```
pax -rvf source.pax -s#/#/newroot/#
```

   The **–v** option is used to show the names of the files as they are extracted and is not required.

5. In the following examples, archive **acldata.pax** contains *file1*, *file2*, and *dir1*. *file1* has no ACL data, *file2* has an access ACL, and *dir1* has a file default ACL, a directory default ACL and an access ACL. If you only specify option **–f**, your output is:

```
> pax -f acldata.pax
file1
file2
dir1
```

   If you also specify **–o** *A*, ACL information is displayed:

```
> pax -o A -f acldata.pax
file1
file2
user:WELLIE2:rw-
group:SYS1:rwx
dir1
```

   Finally, if you add the verbose option, **–v**, you will see the file permission bit settings that are associated with the file:

```
> pax -o A -vf acldata.pax
-rwx------   1 STIERT   SHUT      294912 Nov  9 09:57 file1
-rwx------+  1 STIERT   SHUT      294912 Nov  9 09:57 file2
user:WELLIE2:rw-
group:SYS1:rwx
drwxr-xr-x+  2 STIERT   SHUT        8192 Mar 20  2000 dir1/
user:RRAND:rwx
user:WELLIE2:rw-
group:SHUT:rwx
fdefault:user:RRAND:rwx
fdefault:group:SHUT:r-x
default:user:ANGIEH:rwx
default:group:SYS1:r--
```

Specifying **pax -o A** does not automatically turn on the verbose table of contents format. You must also specify **-v** to display the file permission bit settings associated with the file. To check if a file has an ACL when for example, *file2* and *dir1* have ACLs:

```
>
 pax -vf acldata.pax
-rwx------   1 STIERT   SHUT      294912 Nov  9 09:57 file1
-rwx------+  1 STIERT   SHUT      294912 Nov  9 09:57 file2
drwxr-xr-x+  2 STIERT   SHUT        8192 Mar 20  2000 dir1/
```

For more information about access control lists, see *z/OS UNIX System Services Planning*.

To store a file with an ACL using the OS390 archive format:

```
> pax -o os390 -wf acldata.pax fileAcls
```

Files

/tmp/OS390_USTAR_SUMMARY_
: *timestamp* is a z/OS-extended USTAR special header file. See "z/OS-extended USTAR support" on page 548 for more information.

Environment variables

pax uses the following environment variable:

_UNIX03
: For more information about the effect of _UNIX03 on this command, see Appendix N, "Shell commands changed for UNIX03," on page 1039.

Localization

pax uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following reasons:
- Incorrect option
- Incorrect command-line arguments
- Out of memory
- Compression error
- Failure on extraction
- Failure on creation

If **pax** cannot extract a particular file when reading, or find a particular file when writing, it generates an error message and continues to process other files but returns a status of 1. If any other error occurs, **pax** ends immediately without attempting further processing.

If you see the following message after a write operation:

```
If you want to go on, type device/filename when ready
```

it indicates that your directory or device containing the archive file is full. To continue, enter the name of a new directory; to end **pax**, type <Ctrl-C>.

If you see that message after a read operation, it means that **pax** could not find the archive file that you specified, or that it was damaged. In this case, type <Ctrl-C> to end the operation and then restart **pax** with the correct archive name.

Portability

POSIX.2, X/Open Portability Guide.

The **–L**, **–q**, **–V**, **–E**, **–p x** and **–z** options are extensions of the POSIX standard.

Related information

compress, **cpio**, **ls**, **tar**, **uncompress**

See Appendix C, "Regular expressions (regexp)," on page 971 for more information about **regexp**.

See the **cpio** and **pax** file formats in Appendix H, "File formats," on page 1003.

pcat — Unpack and display Huffman packed files

Format

pcat *file ...*

The **pcat** utility is fully supported for compatibility with older UNIX systems. However, it is recommended that the **zcat** utility be used instead because it may provide greater functionality and is considered the standard for portable UNIX applications as defined by POSIX.2 IEEE standard 1003.2-1992.

Description

pcat uncompresses files that were compressed by **pack** using a Huffman minimal redundancy code. The uncompressed data is sent to the standard output. This is

handy for packed text files, but inappropriate for binary files, because the standard output is treated as a text stream. Binary files can be decoded in place by **unpack**.

The names of compressed input files are expected to end in `.z`. If a specified input file name does not end in this suffix, **pcat** automatically adds the `.z`. For example, if the command line specifies file **abc**, **pcat** looks for `abc.z`.

Localization

pcat uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

`0` Successful completion

`n` Indicates that `n` files could not be unpacked properly. For example, if three out of six files could not be unpacked properly, the exit status is 3.

Related information

cat, **file**, **pack**, **unpack**

pg — Display files interactively

Format

pg [**–cefnst**] [**–p** *prompt*] [**–** *screen*] [**+***line*] [**+**/*pattern*/] [*file ...*]

The **pg** utility is fully supported for compatibility with older UNIX systems. However, it is recommended that the **more** utility be used instead because it may provide greater functionality and is considered the standard for portable UNIX applications as defined by POSIX.2 IEEE standard 1003.2-1992.

Description

pg displays input files or piped output from another command, a screen at a time. If you do not specify any files, the standard input (**stdin**) is read. Any file named **–** specifies the **stdin**.

"Commands" on page 556 lists commands that can be entered at page and file breaks.

Options

–c Clears the screen before displaying each new window.

–e Eliminates the `(EOF):` prompt at the end of each file.

–f Does not fold lines. Typically, lines longer than the screen width, as given

by the environment variable **COLUMNS** are folded into multiple lines. This option may be useful for files containing device-specific escape sequences.

–n Executes interactive commands immediately after receiving the command character. This works for most commands. Typically, you must press <Enter> for interactive commands.

–p *string*
Sets the prompt string that appears at the end of each screen of text to *string*. The default prompt is a colon (**:**). If *string* contains the characters `%d`, **pg** replaces those characters with the current page number as in [Page %d].

–s Displays all interactive command prompts in standout mode (most often reverse video) on the screen.

–t Does not save input in a temporary file. Typically, if any of the inputs is not directly seekable (as is the case for a serial device or pipe), **pg** reads input and saves it in a temporary file so that it can be reviewed. Because of this, you cannot scan backwards when viewing such input. This option is also recommended when reading a larger amount of data from a stream that cannot be accommodated on disk.

–*screen* Sets the number of lines displayed in each screen to *n* lines. If you do not select this option, the number of lines displayed is one less than the number of lines on the screen as given by the environment variable **LINES**. "Commands" discusses the **w** command.

+*line* Starts printing at line *n* of the first file. The default is to start printing at line 1.

+/*pattern***/**
Starts printing at the line containing the first occurrence of the extended regular expression *pattern*.

See Appendix C, "Regular expressions (regexp)," on page 971 for more information about **regexp**.

Commands

Depending on the options you specify, **pg** pauses between windows (screens) of text, at the end of each file and before starting any file after the first. At these pauses, **pg** prompts you to enter a command. To read the file, type the command ENTER (newline or Return) at each prompt.

An optional sign (**+** or **–**) followed by an optional numeric address can precede the following commands. Addresses work in multiples of screen displays: for example, an address of +2 displays the second next screen. Typically, an unsigned address implies direct addressing (measured from the beginning of the file). A signed address implies relative addressing in the file; a command beginning with a **+** scans forward and one beginning with a **–** scans backward from the current position.

You can edit commands interactively with the standard erase and kill characters.

These are the interactive commands:

h Prints a summary of the interactive commands.

q, Q Exits immediately from **pg**.

!*command*
Executes the string *command* as if it were typed to the default command interpreter (as in **ed**). Whether or not you specified the **–n** option, you must end this command with a newline.

[[±]*n***] ENTER, [[±]***n***] SPACEBAR**
Without a specified address, displays the next window of text. With an address, displays the *n*th next window of text.

[[±]*n***]d, [[±]***n***]CRTL–D**
Scrolls a half screen of text. The address is measured in half screens and defaults to the next half screen.

[[±]*n***]l** With no address, displays the next line of the file. With an address, it displays a screen starting at the addressed line.

$ Displays the last screen of text in the file.

<Ctrl-L>, .
Redisplays the current displayed window of text.

s *file* Saves the entire contents of the current file in *file*. Whether or not you specified the **–n** option, you must end this command with a newline.

[*n***] n** Displays the first screen of the next file. The address (*n*) is actually the *n*th next file, counting from the current file. If present, *n* must be unsigned.

[*n***] p** Displays the first screen of the previous file. The address (*n*) is actually the *n*th previous file, counting from the current file. If present, *n* must be unsigned.

[*n***] w** Scrolls another window of text. The argument, *n* (which must be unsigned), sets the window size to *n* and displays the next window of text.

[*i***]/***pattern***/[tmb]**
Searches forward within the current file for the *i*th next occurrence of a line matching the regular expression *pattern* (default *i* is 1, the next matching pattern). The search starts right after the current window and continues to the end of the file. Typically, the matching line is displayed at the top of the window, but this can be changed by an optional character at the end of the search command. The letter `t` is the default and displays the line at the top of the window, `m` displays it in the middle of the window, and `b` displays it in the bottom of the window. When no letter is present, **pg** uses the last letter entered (or `.t` if no letter has been entered). Whether or not you specified the **–n** option, you must end this command with a newline.

[*i***]?***pattern***?[tmb], [***i***]^ ***pattern***^[tmb]**
Is similar to the previous command, but searches backward instead of forward. The search starts just before the current window.

Examples

The following interactive commands illustrate the flexibility of **pg**. Suppose you enter the command:

```
pg –n *.c
```

and that there are a large number of source files in the current directory:

1 Redisplays the first screen of the current file.

–4 Goes back 4 windows in the current file and displays a screen of text.

p Displays the first screen of the previous file.

10w Sets the screen size to 10 lines.

/Fred/m
Finds the first line containing
`Fred`

searching forward from the current position in the file, and displays a screen with that line in the middle of the screen.

Localization

pg uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Unknown command-line option
- Insufficient memory
- Inability to create a temporary file
- Inability to access the terminal
- Missing *string* after a **–p** option

Files

pg uses the following file:

$TMPDIR/pg*
Temporary files to allow backward reading. You can specify a different temporary directory using the **TMPDIR** environment variable.

Environment variables

pg uses the following environment variables:

COLUMNS
Contains the width of the screen in columns.

LINES
Contains the number of lines on the screen.

TMPDIR
Contains the pathname of the directory where temporary files reside.

Portability

X/Open Portability Guide, UNIX System V.

This implementation does not handle double-byte characters.

The **–screen** and **–+line** options are extensions to the XPG standard.

Related information

alias, **ed**, **head**, **more**, **sh**, **tail**, **vi**

See Appendix C, “Regular expressions (regexp),” on page 971 for more information about **regexp**.

pr — Format a file in paginated form and send it to standard output

Format

pr [**–adFfprtW**] [**–n** | **–c** *n* | **–m**] [**–e** [*char*][*gap*]] [**–H** *header-fmt*] [**–h** *header*] [**–i**[*char*] . [*gap*]] [**–l** *n*] [**–n**[*char*] [*n*]] [**–o** *n*] [**–s**[*char*]] [**–w** *n*] [**+***n*] [*file ...*]

Description

pr prints the specified files on standard output (stdout) in a paginated form. If you do not specify any *file*s or if you specify a file name of –, **pr** reads the standard input. By default, **pr** formats the given files into single-column 66-line pages. Each page has a five-line header. By default, the third line contains the file's path name, the date it was last modified, and the current page number; the other lines are blank. A five-line trailer consists of blank lines.

If you specify multiple columns, **pr** places its output in columns of equal width separated by at least one space, truncating each line to fit in its column. Input lines can be ordered down the columns or across the page on output; or different columns can each represent different files.

Options

+*n* Starts printing with the *n*th page of each file; that is, skips the first *n*–1 pages. The default for *n* is 1.

–*n* Prints *n* columns of output. When you specify this option, **pr** behaves as though you had also specified the **–e** and **–i** options. When you specify both this option and **–t**, **pr** uses the minimum number of lines possible to display the output. Do not specify this option with the *–m* option.

–a Orders input lines across the page on output, instead of down. You should use this option only with **–n**.

–c *n* Displays *n* columns of output. When you specify this option, **pr** behaves as though you had also specified the **–e** and **–i** options. When you specify both this option and **–t**, **pr** uses the minimum number of lines possible to display the output. Do not specify this option with **–m**.

–d Produces double-spaced output.

–e[*char*][*gap*]
Expands each occurrence of the input tab character to a string of spaces so that the following character has the next column position which is a positive multiple of *gap*, plus 1. If you do not specify *gap*, or if it is zero, **pr** assumes that *gap* has the value of 8. If you specify the nondigit character *char*, **pr** treats it as the input tab character. Otherwise, **pr** uses the standard tab character.

–F Uses form feeds to separate pages. **pr** normally separates pages by sending a series of <newline> characters to fill the length of a page.

–f Uses form feeds to separate pages. When output is to a terminal, **pr** sounds the bell and waits for you to type a carriage return before displaying the text. **pr** normally separates pages by sending a series of <newline> characters to fill the length of a page.

–H *header_fmt*
Lets you customize your header line by specifying a format with the string *header_fmt*. **pr** recognizes the following special formatting commands:

%c	Date and time
%F	The current file name , or *header* string given by **–h**
%P	Page number
%L	Line number
%D	Date
%T	Time
%u	The current user name

The default header format is equivalent to the option: -H "%c %F Page %P"

–h *header*
Uses the *header* string instead of the file name on each succeeding page header.

–i[*char***][***gap***]**
Replaces white space with tabs on output. *char*, if given, is the output tab character. The default is the tab character. **pr** sets tabs every *gap* positions; the default for *gap* is 8. If this tab character differs from the input tab character and the actual data contains this tab character, the result is liable to be quite a mess.

–l *n* Sets the number of lines per page of output. The default is 66. The actual number of lines printed per page is this number less 5 for the header and 5 for the trailer. If *n* is less than 10 (the number of lines needed for the header and the trailer), **pr** displays neither the header nor the trailer.

–m Prints each file in its own column down the page. This overrides the **–a** option, forcing the **–n** option to be the number of files given. When you also specify the **–n** option, it gives line numbers for the first column only.

–n[*char***][***n***]**
Numbers the lines of each file. Each number takes up *n* positions; the default for *n* is 5. The character *char* separates the number from the line; this defaults to the tab character. If *char* is the same as the input tab character, **pr** follows the number with the spaces needed to get to the next tab stop. **pr** may in turn replace these spaces with the output tab character if you specified the **–i** option. For multicolumn output, **pr** adds line numbers to each column. The **–m** option gives the line number for the first column only.

–o *n* Offsets each line of output by *n* character positions.

–p Pauses before the beginning of each page if output is to a terminal device. **pr** sounds the bell and waits for a carriage return from the controlling workstation (not the input files).

–r Suppresses error messages due to failures when opening files.

–s[*char***]**
Prints each column at its correct length. The character *char* separates columns. The default value for *char* is the tab character. This character is

never replaced by the output tab character. Normally **pr** pads each column with spaces or truncates it to the exact column width. Unless the **–w** option is also used, **–s** resets the page width to 512 column positions.

–t Does not print the headers and trailers, and quits after the last line of the file—it does not display any extra lines.

–W Folds lines at the column width when you do not specify the **–s** option; **pr** treats each separate part of the line as a separate line.

–w *n* Sets the width of the page to *n* column positions. If you do not specify this option, the default page width is 72 (if you did not specify **–s** option) or 512 (if you did specify **–s**). This page width does not normally apply to single-column output; however, single-column output with the **–W** option does use this width.

Files

pr uses the following file:

/dev/tty
For prompting.

Environment variables

pr uses the following environment variable:

TZ Contains the local time zone. **pr** uses this value when displaying times in header lines.

Localization

pr uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Insufficient memory
- Insufficient line width
- Write error on **stdout**

2 Syntax error or unknown command-line option

Messages

Possible error messages include:

Missing header
You specified **–h** or **–H** but did not supply a *header* or *header_fmt* string.

Width is insufficient
The line is not wide enough to hold the given number of columns with the given column width; or a column is not wide enough to hold the minimum amount of data.

Portability

POSIX.2, X/Open Portability Guide.

The **–c**, **–H**, **–p**, and **–W** options are extensions of the POSIX standard.

In a double-byte environment, remember that column positions are always based on the width of characters. A double-byte character may take up two columns of output (called a *thick character*), but a single-byte character will only take up one column of output (called a *thin character*). Specify column widths according to the expected thickness of characters.

For example, with a column width of 10, then ten thin characters or five thick characters are displayed.

Related information

cat, **expand**, **fold**, **unexpand**

For information about setting the local time zone, see Appendix I, "Format of the TZ environment variable," on page 1021.

print — Return arguments from the shell

Format

print [**–npRrs**] [**–u**[*descriptor*]] [*argument ...*]

Description

Calling **print** without options or with only the **–** option displays each *argument* to the standard output using the same escape conventions as **echo**. In this case, **print** and **echo** work the same way; see **echo**.

Options

The options accepted by **print** increase its utility beyond that of **echo**.

–n Does not automatically add a new line to the end of the output.

–p Sends output to a coprocess.

–R Is similar to **–r**, except that **print** treats all subsequent options (except **–n**) as arguments rather than as options.

–r Ignores escape conventions.

–s Appends the output to the command history file rather than sending it to standard output.

–u[*descriptor***]**
Redirects the output to the file corresponding to the single digit file *descriptor*. The default file descriptor is 1.

Usage notes

print is a built-in shell command.

Localization

print uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Incorrect *descriptor* specified with **–u**
- Nonexistent coprocess

2 Failure due to an incorrect command-line option

Messages

Possible error messages include:

Cannot print on file descriptor ...
You tried to print on a file descriptor that was not opened for writing.

History not available
You specified the **–s** option to write into a history file, but you are not now using a history file.

Portability

print is an extension to POSIX.2 and XPG.

Related information

echo, **fc**, **read**, **sh**

printenv — Display the values of environment variables

Format

printenv [*name*]

tcsh shell: **printenv** [*name*]

Description

The **printenv** command displays the values of environment variables. If the *name* argument is specified, only the value associated with *name* is printed. If it is not specified, **printenv** displays the current environment variables, one *name=value* pair per line.

If a *name* argument is specified but is not defined in the environment variable, **printenv** returns exit status 1; otherwise it returns status 0.

In the tcsh shell, **printenv** prints the names and values of all environment variables or, with *name*, the value of the environment variable named. For more information, see "tcsh — Invoke a C shell" on page 689.

Options

There are no options.

Examples

To find the current setting of the HOME environment variable, enter:

```
printenv HOME
```

Usage notes

1. Only one *name* argument can be specified.
2. **printenv SOMENAME** is equivalent to **echo $SOMENAME** for exported variables.
3. **printenv** without any arguments is functionally equivalent to **env** without any arguments.

Exit values

0 Successful completion

1 Failure due to one of the following:
- More than one environment variable was specified
- An option was specified (**printenv** has no options)

Portability

printenv is compatible with the AIX® **printenv** utility.

Related information

env, **tcsh**

printf — Write formatted output

Format

printf *format* [*argument* ...]

Description

printf writes the *argument* operands to standard output, formatted according to the *format* operand.

format is a format string that is composed of conversion specifications that convert and add the next *argument* to the output. *format* can contain backslash-escape sequences. These conversions are similar to those used by the ANSI C standard. Conversion specifications have the form:

```
%[flag][width]
[precision][char]
```

where *flag* is one of the following:

- Left-justifies the field; default is right justification.

+ Always prefixes a signed value with a sign (+ or -).

space Reserves a character position at the start of the string for the minus sign (for negative numbers) or a space (for positive numbers). If both `space` and `-` appear as flags, the `space` flag is ignored.

Prefixes octal values with `0` and hexadecimal values with `0x` or `0X`. For floating-point values, this causes the decimal point always to be displayed even if no characters follow it.

0 Pads numeric values with leading zeros. If both `0` and `-` appear as flags, the `0` flag is ignored.

width is the minimum field width of the output field. If the converted value is shorter than the minimum width, **printf** pads it with spaces or zeros.

In a string, *precision* is the maximum number of bytes to be printed from the string; in a number, the precision is the number of digits to be printed to right of the decimal point in a floating-point value. *width* or *precision* can be specified as `*`, in which case the value is read from the next argument, which must be an integer. For example:

```
printf "%*.*d\n" 20 10 200
```

is equivalent to:

```
printf "%20.10d\n" 200
```

The conversion character *char* is one of the following:

b A string that may contain a backslash-escape sequence.

c Single character of an integer value; the first character of a string.

d Decimal integer.

e,E Floating point (scientific notation).

f,F Floating point.

g,G The shorter of e and f (suppresses nonsignificant zeros).

i Decimal integer.

o Unsigned octal integer.

s String.

u Unsigned decimal integer.

x,X Unsigned hexadecimal integer.

When there are more arguments than positions in *format*, the *format* string is applied again to the remaining arguments. When there are fewer arguments than there are positions in the *format* string, **printf** fills the remaining positions with null strings (character fields) or zeros (numeric fields).

Caution

The POSIX.2POSIX.2 **printf** facility (like the C language **printf()** on which it is based), does not accommodate double-byte characters gracefully when using **%c**

conversion, or either of **%b** or **%s** conversions with a specified precision. Use these features cautiously when you have double-byte characters in the character set.

In a double-byte environment, normal backslash-escape characters are handled correctly (**printf** shifts state as required) but octal and hexadecimal escape characters do not change state. This behavior is significant in a shift-lock environment. For example, if an octal escape character contains the shift-in character, it is the user's responsibility to ensure that there is also a shift-out character. Further, an octal or hexadecimal backslash escape character that comes immediately after a double-byte character may or may not be processed in the shifted state.

For more information about double-byte character environments, see "Using the double-byte character set (DBCS)" on page 7.

Localization

printf uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_NUMERIC**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

>0 The number of failures due to any of the following:
- Missing format specifications
- Arguments that were supplied for a *format* string that does not accept them (that is, that has no %s)
- Incorrect integer argument
- Incorrect floating-point argument

Portability

POSIX.2, X/Open Portability Guide, UNIX System V.

The **%F** format and the handling of * as a width or precision argument are extensions of the POSIX standard.

Related information

echo, **print**

ps — Return the status of a process

Format

ps [**–Aacdefjlm**] [**–G** *idlist*] [**–g** *grouplist*] [**–n** *name*] [**–o** *format*] ... [**–p** *proclist*] [**–s** *idlist*] [**–t** *termlist*] [**–U** | **u** *uidlist*]

Description

ps displays status information about processes, and optionally, the threads running under each process.

By default, for each process associated with the user's terminal, **ps** displays the process ID (PID), TTY, processor time used (TIME), and name of the command (COMM).

The **–a**, **–A**, and **–e** options can be used to show information associated with all available or accessible processes on the system. However, these options can only show information for those processes the user has appropriate privileges to access. The **–g**, **–G**, **–p**, **–s**, **–t**, **–u**, and **–U** options can be used to select specific processes by process id, terminal id, and user name.

The **–f**, **–j**, and **–l** options can be used to display additional status fields using predefined formats. The **–o** format option allows the user to select specific status fields and to define the format in which these fields are displayed.

ps displays information for each thread associated with a process when the **–m** and **–o THREAD** options are used. Output lines for thread information immediately follow the output line for the parent process. Because the default behavior of **ps** displays process status fields only, to provide meaningful thread output, the **–o** option is used to specify thread-specific status fields. There are some conditions, such as when the process is in a terminating or zombie state, where thread data cannot be captured. In these cases, a single thread output line is displayed showing a **?** in the thread output fields.

Options

ps accepts several options. When a description says that **ps** lists “all processes”, it means all the processes on the system, provided that you have appropriate privileges.

The fields `pcpu`, `nice`, `pri`, `addr`, and `wchan` are unsupported and will always display a dash.

–A Displays information about all available processes. You can specify **–A**, **–a**, and **–e** in any combination; however, **–a** overrides both **–A** and **–e**.

–a Displays information about all processes associated with terminals. You can specify **–A**, **–a**, and **–e** in any combination; however, **–a** overrides both **–A** and **–e**.

–c Displays more detailed information about processes for the **–f** and **–l** options. **–c** is accepted but not currently implemented.

–d Displays information for all processes except group leaders.

–e Displays information about all accessible processes. You can specify **–A**, **–a**, and **–e** in any combination; however, **–a** overrides both **–A** and **–e**.

–f Displays information as if the user specified:

```
–oruser=UID –opid,ppid,pcpu=C –ostime,tty=TTY –oatime,args=CMD
```

–G *grouplist*
Displays information about processes with real group ID numbers in *grouplist*. Separate numbers in *grouplist* with either blanks or commas.

–g *idlist*
Displays information about processes with process ID numbers in *idlist*. Separate the numbers in *idlist* with either blanks or commas.

–j Displays information as if the user specified:

```
-o pid,sid,pgid=PGRP -o tty=TTY -o atime,args
```

–l Displays information as if the user had specified:

```
–oflags,state,ruid=UID –opid,ppid,pcpu=C –opri,nice,addr,vsz=SZ
–owchan,tty=TTY –oatime,comm=CMD
```

–m Displays thread status information. Output lines for thread status immediately follow the output line for the parent process. Process-only status fields will contain dashes for thread output lines. Since the default behavior of **ps** is to display process-only status fields, to provide meaningful thread output, the **–o** option should be used to specify thread supported status fields. If **–o THREAD** is used, **–m** is assumed.

–n *name*
Specifies the name of the executable file containing the kernel symbol table. This option is currently not supported and is ignored.

–o *format*
Displays information according to the given *format* specifications. If **–o** is not used, the default format is the same as specifying:

```
–o pid,tty=TTY –o atime,comm
```

See “Format specifications.”

–p *proclist*
Displays information for processes with process ID numbers in *proclist*. Separate numbers in *proclist* with either blanks or commas.

–s *idlist*
Displays information for processes with session ID numbers in *idlist*. Separate the numbers in *idlist* with commas.

–t *termlist*
Displays information for processes with terminals in *termlist*. You denote terminals in *termlist* with either the filename of the device (for example, `tty04`). Or, if the filename begins with `tty`, you can simply specify the characters following `tty`. For example, `tty04` and `04` both denote the same terminal. Terminals in *termlist* are separated by either blanks or commas.

–U *userlist*
Displays information for processes with user IDs in *userlist*. Items in *userlist* can be user ID numbers or login names, and are separated by commas.

–u *userlist*
Displays information for processes with user IDs in *userlist*. Items in *userlist* can be user ID numbers or login names, and are separated by commas.

Format specifications

Using the **–o** option, the user can define the status fields that will be displayed and their column headings. If you do not specify the **–o** option, **ps** displays the information as though you specified:

```
-o pid,tty=TTY -o atime,comm
```

The *format* specification is a list of status field names separated with blanks or commas. However, if the list of names is separated by blanks, the list must be contained in single quotes. Below you'll find a list of status field names recognized by **ps**.

Multiple **–o** format specifications can be provided and, in the case where user-specified column headings are defined, these specifications may be necessary.

The first line of **ps** output contains column headings for each status field. Each status field has a default heading which can be overridden by the user by specifying `=newheading` after the status field. When a new heading is specified, it must be the last field given on the **–o** option. To specify additional fields, it is necessary to use additional **–o** statements.

For example, if you want to display the process id (pid), real user name (ruser), and command name (comm), but change the heading for the real user name from the default of (`RUSER`) to `WHO`, use:

```
-o pid,ruser=WHO -o comm
```

An additional **–o** is required when `comm` is specified because the last argument must be user-specified headings (in this case ruser=`WHO`).

If you specify `=` with no heading, **ps** displays that column without a heading. If none of the columns have a heading, **ps** displays no heading line.

In a double-byte locale, user-defined headings may contain multibyte (double-byte) characters.

The following list shows the names that **ps** recognizes. The list is separated into three groups:

process only
: These are fields which only display meaningful data for process output lines. For thread output lines, a dash is shown in these fields.

thread only
: These are fields which only display meaningful data for thread output lines. For process output lines, a dash is shown in these fields.

processes and threads
: These are fields that apply to both processes and threads. For example, `state` is meaningful because both processes and threads have a state that can be determined for them.

At the end of each description, the default column heading is inside square brackets.

The **Process Only** group:

addr Displays the address of the process. This field is currently not supported and will display a dash. [`ADDR`]

args Displays the command that is running, with all its arguments. [`COMMAND`]

atime Displays the amount of processor time that the process has used since it began running. Time is displayed in one of the following abbreviated formats:

- *days* d *hours*

- *hours* h *minutes*
- *minutes* : *seconds*

depending on the amount of processor time used. [TIME]

attr Displays the process attributes. [ATTR]

The following values might be displayed:

B Shutdown blocking process; will prevent the shutdown from proceeding until it either de-registers as a blocking process or ends.

For more information about the B attribute, see *z/OS UNIX System Services Planning*.

P Permanent process; will survive across a shutdown.

For more information about the P attribute, see *z/OS UNIX System Services Planning*.

R Respawnable process; will be restarted when it ends.

For more information about the R attribute, see *z/OS UNIX System Services Planning*.

T Tracing is active.

For more information about tracing, see "bpxtrace — Activate or deactivate traces for processes" on page 71.

comm Displays the name of the command that is running without its arguments. This string is padded on the right if necessary. [COMMAND]

etime Displays the amount of real time that has elapsed since the process began running. **ps** shows the time in the form:

[*dd*-]*hh*:*mm*:*ss*

where *dd* is the number of days, *hh* is the number of hours, *mm* is the number of minutes, and *ss* is the number of seconds. [ELAPSED]

gid Displays the effective group ID of the process. [EGID]

group Displays the effective group ID of the process, as a group name if possible and as a decimal group ID if not. [GROUP]

jobname
Displays the job name. [JOBNAME]

nice Displays the nice value (urgency) of the process as a decimal value. This field is currently not supported and will display a dash. [NI]

pcpu Displays a percentage value giving the ratio of processor time used to processor time available. This field is currently not supported and will display a dash. [%CPU]

pgid Displays the process group ID as a decimal value. [PGID]

pid Displays the process ID as a decimal value. Decimal *pid*s are reported with default actions. [XPID]

ppid Displays the parent process ID as a decimal value. [PPID]

pri Displays the process priority. This field is currently not supported and will display a dash. [PRI]

rgid Displays the real group ID of the process. [GID]

rgroup Displays the real group ID of the process, as a group name if possible and as a decimal group ID if not. [RGROUP]

ruid Displays the real user ID of the process. [UID]

ruser Displays the real user ID of the process, as a user name if possible and as a decimal user ID otherwise. [RUSER]

sid Displays the session ID of the process. [SID]

stime Displays the start time of the process. [STIME]

thdcnt Displays the total number of threads. [THCNT]

time Displays the amount of processor time that the process has used since it began running. **ps** displays this time in form similar to that used by etime. [TIME]

tty Displays the name of the controlling terminal (if any). [TT]

uid Displays the effective user ID of the process. [EUID]

user Displays the effective user ID of the process, as a user name if possible and as a decimal user ID otherwise. [USER]

vsz Displays the amount of (virtual) memory that the process is using, as a decimal number of kilobytes. [VSZ]

vszlmt64

Displays the maximum amount of virtual storage above the 2–gigabyte bar allowed for the current process[VSZLMT64].

When displayed, each value will be followed by a multiplier indicating the units represented:

```
(space) No multiplier
K   Kilo
M   Mega
G   Giga
T   Tera
P   Peta
```

For example:

```
> ps -o comm,vsz64,vszlmt64

COMMAND      VSZ64   VSZLMT64
/bin/sh          0          0
/loop_64       100     16383P
```

vsz64 Displays the virtual storage used above the 2–gigabyte bar[VSZ64].

When displayed, each value will be followed by a multiplier indicating the units represented:

```
(space) No multiplier
K   Kilo
M   Mega
G   Giga
T   Tera
P   Peta
```

For example:

```
> ps -o comm,vsz64,vszlmt64

COMMAND      VSZ64   VSZLMT64
/bin/sh          0          0
/loop_64       100     16383P
```

wchan Displays the channel upon which the process is waiting. This field is currently not supported and will display a dash. [WCHAN]

xasid Displays the address space id as a hexadecimal value (Note: a non-hexadecimal ASID is not supported). [ASID]

xpgid Displays the process group ID as a hexadecimal value. [XPGID]

xpid Displays the process ID as a hexadecimal value. [XPID]

xppid Displays the parent process ID as a hexadecimal value. [XPPID]

xsid Displays the session ID as a hexadecimal value. [XSID]

The **Thread Only** group:

lpid Displays the latch pid waited for. [lpid]

lsyscall
Displays the last five syscalls. This is a 20 character string consisting of five four character syscalls with no delimiting characters between them. From left-to-right the syscalls are ordered from most recent to oldest. In the following example of lsyscall output, 1WAT is the most recent syscall: 1WAT1SPM1SPM1SPM1TSP. [LASTSYSC]

semnum Displays the semaphore number of the semaphore the thread is in a wait state for. (Note: a semaphore number is only available when the thread is in a semaphore wait state (state field value equals d), otherwise, a dash will be displayed). [SNUM]

semval Displays the semaphore value of the semaphore the thread is in a wait state for. (Note: a semaphore value is only available when the thread is in a semaphore wait state (state field value equals D), otherwise, a dash will be displayed). [SVAL]

sigmask
Displays the signal pending mask as a hexadecimal value. [SIGMASK]

syscall
Displays the current syscall (for example, 1frk for fork). [SYSC]

tagdata
Displays the tag assigned to the thread using pthread_tag_np(). If a tag was not assigned, a dash will be displayed. [TAGDATA]

wtime Displays waiting time in one of the following abbreviated formats:

- *days* d *hours*
- *hours* h *minutes*
- *minutes* : *seconds*

depending on the amount of waiting time to display. [TIME]

xtcbaddr
Displays the tcb address as a hexadecimal value. A non-hexadecimal tcb address is not supported. [TCBADDR]

xstid Displays the short thread id as a hexadecimal value. This is the low order word (the sequential value) of the thread id. A non-hexadecimal short thread ID is not supported. [STID]

xtid Displays thread id as a hexadecimal value. A non-hexadecimal thread ID is not supported. [TID]

The **Processes and Threads** group:

flags Displays the state field values using a hexadecimal representation. flags is the four-byte value determined when a bit is set to one for each corresponding state that is active. Below is the state-to-state bit mapping for the currently defined state values:

```
 Byte    0        1        2        3
 Bits 11111111 11111111 11111111 11010000
      -------- -------- -------- --------
state ABCDEFG   JK  NO   RS UVWX YZ 1
```

For example, if a thread or process had a state field value of 1W, then the following bits would be set:

```
 Byte    0        1        2        3
 Bits 00000000 00000000 00000010 00010000
      -------- -------- -------- --------
state
```

Which when represented as a hexadecimal value would be 210.[F]

state Displays the process state. [STATE] Various values can be printed in this field:

1 A single task using assembler callable services.

A Message queue receive wait.

B Message queue send wait.

C Communication system kernel wait.

D Semaphore operation wait.

E Quiesce frozen.

F File system kernel wait.

G MVS Pause wait.

H One or more pthread created tasks (implies M as well).

I Swapped out.

J Pthread created.

K Other kernel wait (for example, pause or sigsuspend).

L Canceled, parent has performed wait, and still session or process group leader.

M Multithread.

N Medium weight thread.

O Asynchronous thread.

P Ptrace kernel wait.

R Running (not kernel wait).

S Sleeping.

T Stopped.

U Initial process thread.

V Thread is detached.

W Waiting for a child (wait or waitpid function is running).

X Creating a new process (fork function is running).

Y MVS wait.

Z Canceled and parent has not performed wait (Z for zombie).

THREAD THREAD [THREAD] is a synonym for specifying the following fields:

```
-m -o ruser=UID -o pid,ppid,xstid,state=STATE -o atime,syscall,args=CMD
```

The following is an example of how this output will appear:

```
    UID        PID       PPID      STID   STATE  TIME   SYSC   CMD
WELLIE8    67108867  15099496         -   1W     0:25   -      sh -L
      -           -         -  00000002   W      0:17   1WAT   -
WELLIE8  1073741830   67108867        -   1Y     0:00   -      ./ps -o THREAD
      -           -         -  00000000   Y      0:00   1GTH   -
```

Environment variables

ps uses the following environment variable:

COLUMNS
Contains the maximum number of columns to display on one line.

Localization

ps uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to the inability to open the process table

2 Failure due to any of the following:
- Unknown command-line option
- Missing *format* string after **–o**
- Missing lists after other options
- Too many arguments on the command line

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide.

The **–c**, **–d**, **–e**, **–f**, **–g**, **–j**, **–l**, **–m**, **–n**, **–s**, and **–u** options are extensions of the POSIX standard.

Related information

jobs, **kill**

pwd — Return the working directory name

Format

pwd

Description

pwd displays the absolute path name of the working directory to standard output.

If the current working directory is a symbolic link to another directory, the path name displayed depends on the setting of the shell's logical flag. See **set** for more information.

Usage notes

pwd is a built-in shell command and is also a separate utility.

Localization

pwd uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Inability to determine the working directory

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

set, **sh**

r — Process a command history list

Format

r [*old=new*] [*specifier*]

Description

r is an alias for **fc –s**. Like **fc –s**, **r** reenters exactly one command without going through an editor. If a command specifier is given, **r** selects the command to reenter; otherwise, **r** uses the last command entered. To perform a simple substitution on the command before reentry, use a parameter of the form *old=new*. The string *new* replaces the first occurrence of string *old*. **r** displays the (possibly modified) command before reentering it.

See “fc — Process a command history list” on page 310 for more information.

Related information

fc, **history**, **sh**

---

read — Read a line from standard input

Format

read [**–prs**] [**–u**[*d*]] [*variable***?***prompt*] [*variable ...*]

Description

When you call **read** without options, it reads one line from the standard input, breaks the line into fields, and assigns the fields to each *variable* in order.

To determine where to break the line into fields, **read** uses the built-in variable **IFS** (which stands for *internal field separator*). Encountering any of the characters in **IFS** means the end of one field and the beginning of the next. The default value of **IFS** is blank, tab, and newline.

In general, a single **IFS** character marks the end of one field and the beginning of the next. For example, if **IFS** is colon (`:`), **read** considers the input `a::b` to have three fields: `a`, an empty field, and `b`. However, if **IFS** contains blanks, tabs or escaped newlines, **read** considers a sequence of multiple blanks, tabs, or escaped newlines to be a single field separator. For example, "`a  b`" has two fields, even though there are several blanks between the `a` and `b`.

The *n*th *variable* in the command line is assigned the *n*th field. If there are more input fields than there are variables, the last variable is assigned all the unassigned fields. If there are more variables than fields, the extra variables are assigned the null string ("").

The environment variable **REPLY** is assigned the input when no variables are given. The exit status of **read** is `0`, unless it encounters the end of the file.

Options

–p Receives input from a coprocess.

–r Treats input as raw data, ignoring escape conventions. For example, **read –r** does not interpret a final backslash (\) as a line continuation character, but as part of the input.

–s Adds input to the command history file as well as to the variables specified with *variable*.

–u[*d*] Reads input from the single-digit file descriptor *d*, rather than from the standard input. The default file descriptor is `0`.

When the first variable parameter has the form:

*variable***?***prompt*

it defines a prompt for input. If the shell is interactive, **read** sends the prompt to the file descriptor `d` if it is open for write and is a terminal device. The default file descriptor for the prompt is `2`.

Examples

```
IFS=':'
while read name junk junk1 junk2 junk3
do
  echo $name
done </samples/comics.lst
```

provides a list of comic names from the sample **comics.lst** file.

Environment variables

read uses the following environment variables:

IFS Contains a string of characters to be used as internal field separators.

PS2 Contains the prompt string that an interactive shell uses when it reads a line ending with a backslash and you did not specify the **–r** option, or if a here-document is not terminated after you enter a newline.

REPLY
Contains the input (including separators) if you did not specify any variables. The ability of omitting the variable from the command and using the environment variable **REPLY** is an extension.

Localization

read uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Usage notes

read is a built-in shell command.

Exit values

0 Successful completion

1 Failure due to any of the following:
- End-of-file on input
- Incorrect *variable*
- Incorrect descriptor specified after **–u**
- Missing coprocess

2 Incorrect command-line argument

Messages

Possible error messages include:

Cannot read on file descriptor ...
You tried to read a file descriptor that was not opened for reading.

Portability

POSIX.2, X/Open Portability Guide.

The **–p**, **–s**, and **–u** options are extensions of the POSIX standard.

Related information

continue, **fc**, **print**, **sh**

readonly — Mark a variable as read-only

Format

readonly [**–p**] [*name*[**=***value*] ...]

Description

readonly prevents subsequent changes in the value of any of the *name* arguments. Parameters of the form:

```
name=value
```

assign *value* to *name* as well as marking *name* read-only. If **readonly** is called without arguments, it lists, with appropriate quoting, the names you have set as read-only in the following format:

```
Variable="value"
```

Options

–p Displays *export name=value* pairs that, when read by a shell, ensures the read-only status and values of variables. The shell formats the output so it is suitable for reentry to the shell as commands that achieve the same attribute-setting results.

Because it is not possible to change a read-only variable, you cannot source the output unless you go to a new shell.

Usage notes

readonly is a special built-in shell command.

Localization

readonly uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion
1 An attempt to give read-only status to a variable that is already read-only
2 Failure due to incorrect command-line argument

Portability

POSIX.2, X/Open Portability Guide.

The behavior given for calling **readonly** with no arguments is an extension of the POSIX standard.

Related information

alias, **sh**, **typeset**

renice — Change priorities of a running process

Format

renice [**–n** *increment*] [**–g**|**–p** **–u**] *ID ...*
renice *priority* [**–p**] *pid ...* [**–g** *pgrp ...*] [**–p** *pid ...*] [**–u** *user ...*]
renice *priority* **–g** *pgrp ...* [**–g** *pgrp ...*] [**–p** *pid ...*] [**–u** *user ...*]
renice *priority* **–u** *user ...* [**–g** *pgrp ...*] [**–p** *pid ...*] [**–u** *user ...*]

Description

renice changes the priority of one or more running processes. Normal users can change only the priority of processes that have the same real or effective user ID as the real or effective user ID of the process that calls **renice**. Privileged users can set the priority of any process.

You can specify the new *priority* as a decimal integer, with higher values indicating more urgent priority. The range of priorities is site-specific, and you may require appropriate privileges for some priority values.

When you change the priority of a process group, the priority of all processes in that group are changed.

If the string **--** appears in the arguments, **renice** does *not* interpret it as the end of command-line arguments. This is an exception to the usual POSIX syntax rules.

Options

–g Treats all following *ID*s (or just *pgrp*s in the obsolescent versions) as process group IDs.

–n *increment*
Adjusts the system scheduling priority of the specified processes by *increment*. Positive *increment*s lower the priority while negative *increment*s result in a higher priority.

Note: Negative *increment*s may require appropriate privileges.

–p Treats all following *ID*s (or just *pid*s in the obsolescent versions) as process IDs.

–u Treats all following *ID*s (or just *user*s in the obsolescent versions) as either user names or numeric user IDs.

priority
A number that indicates an absolute priority value (higher numbers reflect higher priorities).

If no **–p**, **–g**, or **–u** option appears on the command line, **renice** assumes **–p**.

Localization

renice uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to one of the following:
- Incorrect command-line argument
- The wrong number of command-line arguments
- A *priority* that is outside the range
- An incorrect *priority* argument
- An incorrect *ID* argument
- Missing arguments following one of the options

2 Failure because the system does not recognize the *ID* in a **–u** option

Portability

POSIX.2 User Portability Extension, UNIX systems.

POSIX considers all but the first form of the **renice** command to be obsolescent.

Related information

nice

return — Return from a shell function or . (dot) script

Format

return [*expression*]

Description

return returns from a shell function or **.** (dot) script. The exit status is the value of *expression*. The default value of *expression* is the exit status of the last command run.

Usage notes

return is a special built-in shell command.

Localization

renice uses the following localization environment variables:
- **LANG**

- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

The current function or script returns the value of *expression*. If no *expression* is given, the exit status is the exit status of the last command run.

Portability

POSIX.2, X/Open Portability Guide.

Related information

exit, **sh**

---

rlogind — Validate rlogin requests

Format

rlogind [**–a**] [**–d**] [**–l**] [**–L**] [**–m**] [**–n**]

Description

The **rlogind** program is the server for the remote login command **rlogin** commonly found on UNIX systems. It validates the remote login request and verifies the password or password phrase of the target user. It starts a z/OS shell for the user and handles translation between ASCII and EBCDIC code pages as data flows between the workstation and the shell.

The **rlogind** program is given control via an **execl()** issued by the **inetd** daemon.

Rule: Always invoke **rlogind** from **inetd** through the **/etc/inetd.conf** file. Do not invoke it from the shell. **inetd** sets up certain files and sockets needed by **rlogind**. Invoking **rlogind** directly gives unpredictable results.

Options

–a Specifies that the requester's Internet address be checked against the local gethostbyname() file. This option has no effect because the rlogin program never uses the **.rhosts** file for authentication.

–d Specifies that the debugging option be enabled. Informational messages on the rlogin process is written to the system log.

–l Specifies that the **.rhosts** file for authentication not be used. This option has no effect because the rlogin program never uses the **.rhosts** file for authentication.

–L Allows the calling of a ruserok exit that lives in **/usr/sbin**. A return code zero will allow bypassing of password or password phrase checking. The installation is responsible for providing the ruserok exit.

Note: IBM does not recommend using this capability. Using this capability may open security holes, allowing unauthorized users to access and

modify files and MVS data sets. Even with the most rigorous checking in the ruserok exit, it is important to keep in mind the well-known IP spoofing attacks that make it impossible to accurately identify the remote user's identity.

IBM recommends that the **-L** flag not be specified. IBM will not accept APARS for security problems resulting from the use of this option. When the **-L** flag is specified, **/usr/sbin/ruserok** is called, passing:

- The name of the program, **/usr/sbin/ruserok**
- "hostname" or "hostname.domainname" of the client
- A superuser flag, an integer set to 1 if the user wants to be superuser
- Client user name, the username on the client system
- Server user name, the username on this (server's) system

If the ruserokprogram exits with a zero return value, the user is allowed to login. Otherwise, normal password or password phrase checking will be done.

Note: If the facility class is active, and BPX.DAEMON defined, then both inetd's and rlogind's user names must be permitted to BPX.DAEMON and the ruserok program (as well as **inetd** and **rlogind**) must be marked program controlled.

–m Specifies that multiprocessing support in the user's address space be enabled. Using the **–m** option uses fewer system resources and provides faster performance for the end user.

If you do not specify **–m**, each rlogin request causes two MVS address spaces to be consumed. The first address space is the rlogind code, which provides the user connection to the socket, and the second is the user's shell. In this mode, all shell functions behave in a manner conformant to the standards.

If you specify **–m**, the rlogin process and the shell process share the same address space using z/OS UNIX System Services support for multiple processes in an address space. Using **–m** has the potential of doubling the number of users supported via rlogin.

Note: If you issued **rlogind** with the **–m** option, the shell process cannot execute a setuid program that replaces the shell. This causes functions like **newgrp** to fail. In this situation, you may want to create a secondary shell that runs in its own address space.

–n Specifies that the transport-level keep-alive messages be disabled. The messages are enabled by default.

Usage notes

1. The **rlogind** program normally translates all error and warning messages to ASCII and then sends them to the originating terminal.

   However, when the C runtime library writes error messages, the **rlogind** program cannot intercept them to translate the messages to ASCII. Therefore, these messages are written to the file **/tmp/rlogind.stderr** or **/tmp/rlogind2.stderr**.

   These two files must be predefined in **/tmp**, and owned by the superuser (UID 0). The files should have permissions of rw–rw–rw or rw—w—w–. In addition,

the sticky bit must be set for the **/tmp** directory so that these files (and other files in **/tmp**) cannot be removed except by the files' owners or the superuser.

2. **rlogind** is not affected by the locale information specified in locale-related environment variables.

Related information

inetd

---

rm — Remove a directory entry

Format

rm [**–fiRrv**] *file ...file ...*

Description

rm removes files (provided that it is a valid path name). If you specify either **.** or **..** as the final component of the path name for a *file*, **rm** displays an error message and goes to the next file. If a file does not have write permission set, **rm** asks you if you are sure you want to delete the file; type the yes expression defined in LC_MESSAGES (the English expression is typically `y` or `yes`) if you really want it deleted.

Restriction: A file can be removed by any user who has write permission to the directory containing the file, unless that directory has its sticky bit turned on. If the file is in a directory whose sticky bit is turned on, only the file owner, the owner of the directory, or a superuser can remove the file.

Tip: If you delete a file, remember that the space is not actually reclaimed until any processes that have that file open either terminate or close that file. See the "fuser — List process IDs of processes with open files" on page 330 command to find out how to get more information about what processes are accessing a particular file or directory.

Options

–f Deletes read-only files immediately without asking for confirmation. When you specify this option and a file does not exist, **rm** does not display an error message and does not modify the exit status. If you specify both **–f** and **–i**, **rm** uses the option that appears last on the command line. If no files are specified, **rm –f** will not issue an error.

–i Prompts you for confirmation before deleting each file. If you specify both **-R** and **-i**, **rm** also prompts you for confirmation before deleting a directory. If you specify both **–f** and **–i**, **rm** uses the option that appears last on the command line.

–R Recursively removes the entire directory structure if *file* is a directory.

–r Is equivalent to **–R**.

–v Displays a list of files that were removed.

Localization

rm uses the following localization environment variables:

- **LANG**

- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to remove a file
- Attempt to remove directory without specifying **–r** or **–R**
- Inability to find file information when using **–r** or **–R**
- Inability to read directory when using **–r** or **–R**

2 Failure due to any of the following:
- Incorrect command-line option
- No file was specified

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems.

Related information

cp, **mv**, **rmdir**

rmdir — Remove a directory

Format

rmdir [**–p**] *directory ...*

Description

rmdir removes each requested *directory*. Each directory must be empty for **rmdir** to be successful.

Options

–p Removes all intermediate components. For example:

```
rmdir -p abc/def/ghi
```

is equivalent to:

```
rmdir abc/def/ghi
rmdir abc/def
rmdir abc
```

Localization

rmdir uses the following localization environment variables:
- **LANG**

- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure to remove the directory. For example, the object is not a directory, the directory still contains files or subdirectories, or the user is not authorized.

2 Failure because either the command-line option was incorrect or a directory name was not specified.

Messages

Possible error messages include:

Nonempty directory
Files or other directories are found under the directory to be removed. Use **rm –r** to remove the directory.

No such directory
The requested directory does not exist or is otherwise inaccessible.

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems.

Related information

mkdir, **rm**

runcat — Pipe output from mkcatdefs to gencat

Format

runcat *CatalogName SourceFile* [*CatalogFile*]

Description

runcat invokes the **mkcatdefs** command and pipes the message catalog source data (the output from **mkcatdefs**) to the **gencat** utility.

The file specified by the *SourceFile* parameter contains the message text with your symbolic identifiers. The **mkcatdefs** program uses the *CatalogName* parameter to generate the name of the symbolic definition file by adding `.h` to the end of the *CatalogName* value, and to generate the symbolic name for the catalog file by adding **MF_** to the beginning of the *CatalogName* value. The definition file must be included in your application program. The symbolic name for the catalog file can be used in the library functions (such as the **catopen** subroutine). *SourceFile* cannot be **stdin**.

The *CatalogFile* parameter is the name of the catalog file created by the **gencat** command. If you do not specify this parameter, the **gencat** command names the catalog file by adding `.cat` to the end of the *CatalogName* value. This filename can also be used in the **catopen** subroutine.

Examples

To generate a catalog named **test.cat** from the message source file **test.msg**, enter:

```
runcat test test.msg
```

Related information

dspcat, **dspmsg**, **gencat**, **mkcatdefs**

script — Makes a typescript of a terminal session

Format

script [**-aq**] [*file*]

Description

script makes a typescript of everything displayed on the terminal. The typescript is written to the file specified by the *file* parameter. If no file name is given, the typescript is saved in the current working directory with the file name `typescript`. If the file exists, the default behavior is to overwrite its contents.

script is useful for recording shell session activity for troubleshooting and documenting purposes.

Options

–a Appends the typescript to the file.

–q Quiet mode. All diagnostic messages are suppressed.

Examples

To record shell session activity in order to document the removal of files, follow these steps:

1. Begin recording the shell session activity by issuing the **script** command:

   ```
   script
   ```

2. Start removing the files and then end the recording of the shell session activity:

   ```
   rm -v removeme*
   exit
   ```

3. After the recording ends, the contents of the typescript created by **script** will be similar to the following:

   ```
   Script command is started on Fri Jan 29 11:25:15 2010.
   SYS1: /u/user1/mydir> rm -v removeme*
   removeme1
   removeme2
   removeme3
   SYS1: /u/user1/mydir> exit
   Script command is complete on Fri Jan 29 11:25:17 2010.
   ```

Environment variables

script uses the following environment variable:

SHELL
Contains the name of the shell to be forked by **script**.

Localization

script uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TOD**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Usage notes

1. **script** forks and executes a shell according to the value of the SHELL environment variable. If the environment variable is not set, **script** uses the `/bin/sh` shell. **script** ends when the shell process exits. Use either **exit** or Ctrl-D to exit the shell process.
2. Because **script** writes everything in the typescript to the file including backspaces and prompts, commands that modify terminals such as **vi** might create unexpected data in the typescript.
3. Before and after running **script**, ensure that access to the file containing the typescript is properly controlled because the file might contain sensitive data.
4. **script** does not support setting 3270 passthrough mode during the shell session. As a result, OEDIT, OBROWSE, and other utilities requiring 3270 passthrough mode will fail.
5. **script** creates a new session and controlling terminal for the shell process. A login accounting entry is not added to `/etc/utmpx` for this session and terminal.
6. **script** cannot be run in a background process. For example, using an & at the end of the **script** command is not supported. Executing the **script** command via BPXBATCH is also not supported.
7. Do not access the typescript file in use by **script** during the shell session, or unexpected results might occur.

Exit values

0 Successful start of the **script** command

1 Failure due to any of the following:
- Unable to access the standard output, input or error file descriptors
- An incorrect command-line option
- Unable to open, write to, or initialize the typescript file.
- Unable to open or write to the pseudoterminal
- Unable to access the controlling terminal
- Unable to allocate system resources

129-255
script was interrupted by a signal. The exit value is the signal number combined with 128. For example, SIGTERM (signal number 15) results in an exit value of 143.

Portability

An approved POSIX standard does not exist for **script**.

Related information

tee

---

sed — Start the sed noninteractive stream editor

Format

sed [**–BEn**] [**-W** *option*[,*option*]...] *script* [*file ...*]
sed [**–BEn**] [**–e** *script*] .... [**–f** *scriptfile*] .... [**-W** *option*[,*option*]...] [*file ...*]

Description

The **sed** command applies a set of editing subcommands contained in *script* to each argument input *file*.

If more than one *file* is specified, they are concatenated and treated as a single large file. **script** is the arguments of all **–e** and **–f** options and the contents of all *scriptfile*s. You can specify multiple **–e** and **–f** options; commands are added to *script* in the order specified.

If you did not specify *file*, **sed** reads the standard input.

sed reads each input line into a special area known as the *pattern buffer*. Certain subcommands [**gGhHx**] use a second area called the *hold buffer*. By default, after each pass through the script, **sed** writes the final contents of the *pattern buffer* to the standard output.

Options

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–E Uses extended regular expressions. Normally, **sed** uses basic regular expressions.

–e *script*
Adds the editing subcommands *script* to the end of the script.

–f *scriptfile*
Adds the subcommands in the file *scriptfile* to the end of the script.

–n Suppresses all output except that generated by explicit subcommands in the **sed** script [**acilnpPr**]

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command

`iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*

Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

If you need only one *script* argument, you can omit the **–e** and use the first form of the command.

sed subcommands are similar to those of the interactive text editor **ed**, except that **sed** subcommands necessarily view the input text as a stream rather than as a directly addressable file.

Each line of a **sed** script consists of one or more editing commands. The commands can be preceded by either semicolons or blanks, or both. Each editing command contains up to two addresses, a single letter command, and possible command arguments. The last editing command is followed with a terminating newline. The newline is optional in script strings typed on the command line.

[*addr*[,*addr*]] *command* [*arguments*]

Subcommands

sed subcommands necessarily view the input text as a stream rather than as a directly addressable file. Script subcommands can begin with zero, one, or two addresses, as in **ed**.

- Zero-address subcommands refer to every input line.
- One-address subcommands select only those lines matching that address.
- Two-address subcommands select those input line ranges starting with a match on the first address up to an input line matching the second address, inclusive. If the second address is a number less than or equal to the line number first selected, only one line is selected.

Permissible addressing constructions are:

n The number *n* matches only the *n*th input line.

$ This address matches the last input line.

/*regexp***/**
This address selects an input line matching the specified regular expression *regexp*. If you do not want to use slash (/) characters around the regular expression, use a different character (but not backslash or newline) and put a backslash (\) before the first one. For example, if you want to use % to enclose the regular expression, write *%regexp%*.

If an *regexp* is empty (that is, no pattern is specified) **sed** behaves as if the last *regexp* used in the last command applied (either as an address or as part of a substitute command) was specified.

A command can be preceded by a '!' character, in which case the command is applied if the addresses do not select the pattern space. When the variable _UNIX03=YES is set, one or more '!' characters are allowed, and it is not allowed to follow a '!' character with <blanks>s. When the variable _UNIX03 is unset or is not set to YES, only one '!' character is allowed, and it is not allowed to follow a '!' character with <blanks>s.

The following **sed** subcommand summary shows the subcommands with the maximum number of legitimate addresses. A subcommand can be given fewer than the number of addresses specified, but not more. A subcommand with the form *[a] command* supports up to one address and a subcommand with the form *[a[,b]] command* supports up to two addresses. All other subcommands do not support any addresses.

[a]a *A*ppends subsequent text lines from the script to the standard output. **sed** writes the text after completing all other script operations for that line and before reading the next record. Text lines are ended by the first line that does not end with a backslash (\). **sed** does not treat the \ characters on the end of lines as part of the text.

[a[,b]]b [*label***]**
*B*ranches to **:***label*. If you omit *label*, **sed** branches to the end of the script.

[a[,b]]c
Changes the addressed lines by deleting the contents of the pattern buffer (input line) and sending subsequent text (similar to the *a* command) to the standard output. When you specify two addresses, **sed** delays text output

until the final line in the range of addresses; otherwise, the behavior would surprise many users. The rest of the script is skipped for each addressed line except the last.

[a[,b]]d
*D*eletes the contents of the pattern buffer (input line) and restarts the script with the next input line.

[a[,b]]D
*D*eletes the pattern buffer only up to and including the first newline. Then it restarts the script from the beginning and applies it to the text left in the pattern buffer.

[a[,b]]g
*G*rabs a copy of the text in the hold buffer and places it in the pattern buffer, overwriting the original contents.

[a[,b]]G
*G*rabs a copy of the text in the hold buffer and appends it to the end of the pattern buffer after appending a newline.

[a[,b]]h
*H*olds a copy of the text in the pattern buffer by placing it in the hold buffer, overwriting its original contents.

[a[,b]]H
*H*olds a copy of the text in the pattern buffer by appending it to the end of the hold buffer after appending a newline.

[a]i *I*nserts text. This subcommand is similar to the **a** subcommand, except that its text is output immediately.

[a[,b]]l
*L*ists the pattern buffer (input line) to the standard output so that nonprintable characters are visible. The end-of-line is represented by $, and the characters \\, \a, \b, \f, \r, \t, and \v are printed as escape sequences. Each byte of a nonprintable double-byte character appears as an escape sequence or as a 3-digit octal number. This subcommand is analogous to the **l** subcommand in **ed**.

sed folds long lines to suit the output device, indicating the point of folding with a backslash (\).

[a[,b]]n
Prints the pattern space on standard output if the default printing of the pattern space is not suppressed (because of the **-n** option). The *n*ext line of input is then read, and the processing of the line continues from the location of the **n** command in the script.

[a[,b]]N
Appends the *n*ext line of input to the end of the pattern buffer, using a new line to separate the appended material from the original. The current line number changes.

[a[,b]]p
*P*rints the text in the pattern buffer to the standard output. The **–n** option does not disable this form of output. If you do not use **–n**, the pattern buffer is printed twice.

[a[,b]]P
Operates like the **p** subcommand, except that it prints the text in the pattern buffer only up to and including the first newline character.

[a]q *Q*uits **sed**, skipping the rest of the script and reading no more input lines.

[a]r *file*
*R*eads text from *file* and writes it to the standard output before reading the next input line. The text conversion specified for the **sed** command (for example, the **-B** and **-W** option) is used. The timing of this operation is the same as for the **a** subcommand. If *file* does not exist or cannot be read, **sed** treats it as an empty file.

[a[,b]]s/*reg***/** *sub***/[gp***n***] [w***file***]**
*S*ubstitutes the new text string *sub* for text matching the regular expression, *reg*. Normally, the **s** subcommand replaces only the first such matching string in each input line. You can use any single printable character other than space or newline instead of the slash (/) to delimit *reg* and *sub*. The delimiter itself may appear as a literal character in *reg* or *sub* if you precede it with a backslash (\). You can omit the trailing delimiter.

If an ampersand (&) appears in *sub*, **sed** replaces it with the string matching *reg*. A \n in *reg* matches an embedded newline in the pattern buffer (resulting, for example, from an **N** subcommand). The subcommand can be followed by a combination of the following:

n Substitutes only the *n*th occurrence of *regexp.*

g Replaces all non-overlapping occurrences of *regexp* rather than the default first occurrence. If both **g** and **n** are specified, the last one specified takes precedence.

p Executes the print (**p**) subcommand only if a successful substitution occurs.

w *file* *W*rites the contents of the pattern buffer to the end of *file*, if a substitution occurs. The text conversion specified for the **sed** command (for example, the **-B** and **-W** option) is used. When the variable _UNIX03=YES is set, the file must be preceded with one or more <blank>s. When the variable _UNIX03 is unset or is not set to YES, zero <blank> separation between **w** and *file* is allowed.

[a[,b]]t [*label***]**
Branches to the indicated *label* if a successful substitution occurred since either reading the last input line or running the last **t** subcommand. If you do not specify *label*, **sed** branches to the end of the script.

[a[,b]]w *file*
*W*rites the text in the pattern buffer to the end of *file*. The text conversion specified for the **sed** command (for example, the **-B** and **-W** option) is used.

[a[,b]]x
E*x*changes the text in the hold buffer with that in the pattern buffer.

[a[,b]]y/*set1***/***set2***/**
Transliterates any input character occurring in *set1* to the corresponding element of *set2*. The sets must be the same length. You can use any character other than backslash or newline instead of the slash to delimit the strings.

If the variable _UNIX03=YES is set and a backslash followed by an 'n' appear in *set1* or *set2*, the two characters are handled as a single newline character. If the variable _UNIX03 is unset or is not set to YES, the two characters are handled as a single character 'n'.

If the delimiter is not `n`, within *set1* and *set2*, the delimiter itself can be used as a literal character if it is preceded by a backslash. If a backslash character is immediately followed by a backslash character in *set1* or *set2*, the two backslash characters are counted as a single literal backslash character.

[a[,b]]{
Groups all commands until the next matching } subcommand, so that **sed** runs the entire group only if the { subcommand is selected by its addresses.

:*label* Designates a *label*, which can be the destination of a **b**or **t** subcommand.

Treats the script line as a comment unless it is the first line in the script. Including the first line in a script as `#n` is equivalent to specifying **–n** on the command line. An empty script line is also treated as a comment.

[a]= Writes the decimal value of the current line number to the standard output.

Examples

1. This filter switches desserts in a menu:

   ```
   sed 's/cake\(ic\)*/cookies/g'
   ```

2. To substitute a pattern in a text file that contains ASCII characters, using the **sed** stream-oriented text editor and assuming that
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are processing an untagged public text file or a read-only text file)

   then issue:

   ```
   sed -W filecodeset=819,pgmcodeset=1047 's/pattern1/pattern2/w myOutFile' myAsciiFile
   ```

3. To substitute a pattern in a text file using the **sed** stream-oriented text editor, assuming that automatic conversion was enabled but the text file is incorrectly tagged as UTF-8:

   ```
   sed -B 's/pattern1/pattern2/w myOutputFile' myMisTaggedFile
   ```

Environment variables

sed uses the following environment variables:

COLUMNS
Contains the width of the screen in columns. If set, **sed** uses this value to fold long lines on output. Otherwise, **sed** uses a default screen width of 80.

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

_UNIX03
For more information about the effect of _UNIX03 on this command, see Appendix N, “Shell commands changed for UNIX03,” on page 1039.

Localization

sed uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Missing script
- Too many script arguments
- Too few arguments
- Unknown option
- Inability to open script file
- No noncomment subcommand
- Label not found in script
- Unknown subcommand
- Nesting **!** subcommand not permitted
- No \ at end of subcommand
- End-of-file in subcommand
- No label in subcommand
- Badly formed file name
- Inability to open file
- Insufficient memory to compile subcommand
- Bad regular expression delimiter
- No remembered regular expression
- Regular expression error
- Insufficient memory for buffers
- **y** subcommand not followed by a printable character as separator
- The strings are not the same length
- Nonmatching { and } subcommands
- Garbage after command
- Too many addresses for command
- Newline or end-of-file found in pattern
- Input line too long
- Pattern space overflow during **G** subcommand
- Hold space overflow during **H** subcommand
- Inability to chain subcommand
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

Messages

Possible error messages include:

badly formed filename for *command* **command**
The given subcommand required a file name, but its operand did not have the syntax of a file name.

subcommand **command needs a label**
The specified subcommand required a label, but you did not supply one.

must have at least one (noncomment) command
The input to **sed** must contain at least one active subcommand (that is, a subcommand that is not a comment).

No remembered regular expression
You issued a subcommand that tried to use a remembered regular expression; for example, `s//abc`. However, there is no remembered regular expression yet. Change the subcommand to use an explicit regular expression.

Limits

sed allows a limit of 28000 lines per file. It does not allow the NUL character.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–B**, **–E**, and **-W** options are extensions of the POSIX standard.

Related information

awk, **diff**, **ed**, **grep**, **vi**

For more information about `regexp`, see Appendix C, “Regular expressions (regexp),” on page 971.

set — Set or unset command options and positional parameters

Format

set [**±abCefhiKkLmnPpstuvx–**] [**±o**[*flag*]] [**±A***name*][*parameter ...*]

tcsh shell:

set [**-r**]. **set** [**-r**] *name* ....
set [**-r**] *name=word* ....
set [**-r**] [**-f**|**-l**] *name=(wordlist)* ....
set *name*[*index*]=*word* ...

Description

Calling **set** without arguments displays the names and values of all shell variables, sorted by name, in the following format:

```
Variable="value"
```

The quoting allows the output to be reinput to the shell using the built-in command **eval**. Arguments of the form **–***option* set each shell flag specified as an

option. Similarly, arguments of the form **+***option* turn off each of the shell flags specified as an option. (Contrary to what you might expect, **–** means *on*, and **+** means *off*.)

Note: All of the **set** options except **±A**, **–s**, **–**, and **—** are shell flags. Shell flags can also be set on the **sh** command line at invocation.

In the tcsh shell

See the Format section to view the following forms:

1. The first form of the command prints the value of all shell variables. Variables which contain more than a single word print as a parenthesized word list.

   Variables that are read-only will only be displayed by using the **-r** option. For forms 2, 3 and 4, if **-r** is specified, the value is set to read-only.
2. The second form sets *name* to the null string.
3. The third form sets *name* to the single *word*.
4. The fourth form sets *name* to the list of words in *wordlist*. In all cases the value is command and file name expanded. If **-f** or **-l** is specified, **set** only unique words keeping their order. **-f** prefers the first occurrence of a word, and **-l** the last.
5. The fifth form sets the *index*'th component of *name* to *word*; this component must already exist.

These arguments can be repeated to either set or make read-only multiple variables in a single set command. However, variable expansion happens for all arguments before any setting occurs. Also, = can be next to both name and word or separated from both by white space, but cannot be next to only one or the other. For example:

```
set -r name=word and set -r name = word
```

are allowed, but

```
set -r name= word and set -r name =word
```

are not allowed.

For more information, see “tcsh — Invoke a C shell” on page 689.

Options

–a Sets all subsequently defined variables for export.

–b Notifies you when background jobs finish running.

–C Prevents the output redirection operator > from overwriting an existing file. Use the alternate operator >| to force an overwrite.

–e Tells a noninteractive shell to execute the ERR trap and then exit. This flag is disabled when reading profiles.

–f Disables path name generation.

–h Makes all commands use tracked aliases. (For an explanation of tracked aliases, see the Command execution section in **sh**.

–i Makes the shell interactive.

–K Tells the shell to use Korn Shell compatible support of the ((*expression*)) syntax for arithmetic expressions and trap behavior within shell functions.

Korn Shell behavior might conflict with UNIX standard-conforming behavior. For more details, see the **let** and **trap** command descriptions.

–k Allows assignment parameters anywhere on the command line and still includes them in the environment of the command.

–L Makes the shell a login shell. Setting this flag is effective only at shell invocation.

–m Runs each background job in a separate process group and reports on each as they complete.

–n Tells a noninteractive shell to read commands but not run them.

–o *flag* Sets a shell *flag*. If you do not specify *flag*, this option lists all shell flags that are currently set. *flag* can be one of the following:

allexport
Is the same as the **–a** option.

errexit Is the same as the **–e** option.

bgnice
Runs background jobs at a lower priority.

emacs Specifies **emacs**- style inline editor for command entry. See **shedit** for information about the **emacs** editing mode.

gmacs Specifies **gmacs**- style inline editor for command entry. See **shedit** for information about the **gmacs** editing mode.

ignoreeof
Tells the shell not to exit when an end-of-file character is entered.

interactive
Is the same as the **–i** option.

keyword
Is the same as the **–k** option.

korn Is the same as the **–K** option.

logical
Specifies that **cd**, **pwd**, and the PWD variable use logical path names in directories with symbolic links. If this flag is not set, these built-ins and PWD use physical directory path names. For example, assume **/usr/spool** is a symbolic link to **/var/spool**, and that it is your current directory. If **logical** is not set, PWD has the value **/var/spool**, and **cd** changes the current directory to **/var**. If **logical** is set, PWD has the value **/usr/spool** and **cd** changes the current directory to **/usr**.

login Is the same as the **–L** option of **sh**.

markdirs
Adds a trailing slash (/) to filename-generated directories.

monitor
Is the same as the **–m** option.

noclobber
Is the same as the **–C** option.

noexec
Is the same as the **–n** option.

noglob
Is the same as the **–f** option.

nolog Does not record function definitions in the history file.

notify Is the same as the **–b** option.

nounset
Is the same as the **–u** option.

pipecurrent
Is the same as the **–P** option.

privileged
Is the same as the **–p** option.

trackall
Is the same as the **–h** option.

verbose
Is the same as the **–v** option.

xtrace Is the same as the **–x** option.

vi Specifies **vi**- style inline editor. See **shedit** for information about the **vi** editing mode.

warnstopped
Tells the shell to issue a warning, but not to exit, when there are stopped jobs.

–p Disables the processing of **$HOME/.profile** for a login shell and disables the processing of the script specified by the ENV variable. If **/etc/suid_profile** exists, **sh** runs it instead of the ENV script.

–P Runs the last command of a pipeline in the current shell environment.

–s Sorts the positional parameters.

–t Exits after reading and running one command.

–u Tells the shell to issue an error message if an unset parameter is used in a substitution.

–v Prints shell input lines as they are read.

–x Prints commands and their arguments as they run.

Other options:

– Turns off the **–v** and **–x** options. Also, parameters that follow this option do not set shell flags, but are assigned to positional parameters (see **sh**).

— Specifies that parameters following this option do not set shell flags, but are assigned to positional parameters.

+A *name*
Assigns the parameter list specified on the command line to the array elements of the variable *name*, starting at *name*[0]. For example, the following command assigns the values "a", "b", "c" and "d" to the array elements array[0-3]:

```
set +A array a b c d
echo ${array[*]}
a b c d
```

–A *name*
Unsets the variable *name* and then assigns the parameter list specified on

the command line to the array elements of the variable *name* starting at *name*[0]. For example, if the variable array contains 4 elements, the following command discards the previous values and assigns the values "x" and "y" to the array elements array[0-1]:

```
set -A array a y
echo ${array[*]}
x y
```

Usage notes

set is a special built-in shell command.

Localization

set uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

For more information, see Appendix F, "Localization," on page 997.

Exit values

0	Successful completion
1	Failure due to an incorrect command-line argument
2	Failure resulting in a usage message, usually due to a missing argument

Portability

Several shell flags are extensions of the POSIX standard: **bgnice**, **ignoreeof**, **keyword**, **markdirs**, **monitor**, **noglob**, **nolog**, **privileged**, and **trackall** are extensions of the POSIX standard, along with the shell flags **±A**, **±h**, **±k**, **±p**, **±s**, and **±t**.

Related information

alias, **eval**, **export**, **sh**, **shedit**, **tcsh**, **trap**, **typeset**

setfacl — Set, remove, and change access control lists (ACLs)

Format

setfacl [**–ahqv**] -s entries [**path ...**]
setfacl [**–ahqv**] -S file [**path ...**
setfacl [**–ahqv**] -D type [**...**] [**path ...**]
setfacl [**–ahqv**] -m|M|x|X EntryOrFile [**...**] [**path ...**]

Description

setfacl sets (replaces), modifies, or removes the access control list (ACL). It also updates and deletes ACL entries for each file and directory that was specified by *path*. If *path* was not specified, then file and directory names are read from standard input (stdin). In this case, the input should give one path name per line.

Requirement: To issue **setfacl**, you must be the file owner or have superuser authority (either UID 0 or READ access to SUPERUSER.FILESYS.CHANGEPERMS in the UNIXPRIV class).

If you specify stdin ("-") in place of a file name, you cannot specify it for any of the other options, and you cannot read the target path names from stdin.

The maximum number of ACL entries for a file or directory is regulated by the security product and the physical file system.

The first two forms allow you to set (replace) the entire ACL. The third form allows you to delete an entire extended ACL. The fourth form allows you to delete, add or modify ACL entries. You can specify the `m`, `M`, `x`, and `X` options on a single command line, but you can only specify each option once.

When you are setting the access ACL, the ACL entries must consist of three required base ACL entries that correspond to the file permission bits. The ACL entries must also consist of zero or more extended ACL entries, which will allow a greater level of granularity when controlling access. The permissions for base entries must be in absolute form.

When you are updating ACL entries, you can specify zero or more base entries.

The three required base ACL entry types have the following format:

```
u[ser]::perm
g[roup]::perm
o[ther]::perm
```

They correspond to the owner, group and other fields of the file permission bits.

Extended ACL entries have the following format:

```
[d[efault]: | f[default]:]u[ser]:uid:[+|^]perm
[d[efault]: | f[default]:]g[roup]:gid:[+|^]perm
```

where:

d[efault]
If specified, extended ACL refers to directory default ACL

f[default]
If specified, extended ACL refers to file default ACL

u[ser] Extended ACL refers to a particular numeric user ID (UID) or user name

g[roup]
Extended ACL refers to a particular numeric group ID (GID) or group name

uid User name or numeric user ID (UID)

gid Group name, or numeric group ID (GID)

perm Permissions specified either in absolute form (string `rwx` with `-` as a placeholder or octal form), or in relative format (using the **+** or**^** modifiers).

Rule: For relative permission settings, only one of + or ^ is allowed per ACL entry. When using relative permissions, you must have at least one of r, w, or x. For example, +rw or ^rwx.

The first field of an ACL entry is optional; it specifies the type of ACL (access, directory default, or file default) that will be processed. If the type is not specified, the operation applies only to the access ACL. If you are updating the ACL entries, you can specify the base ACL entries; however, specifying the base ACL entries might cause the file or directory's permission bits to change if what is specified is different than the current settings.

If the permissions are specified in relative format for an ACL entry that does not currently exist, then the permissions will be assigned as though they were given in absolute form. Any permissions that were not specified will default to no permission. For instance, if an extended ACL entry is given as follows to be updated:

```
user:BILLYJC:+rw
```

and user entry BILLYJC does not currently exist, then the resulting entry will be:

```
user:BILLYJC:rw-
```

Similarly, if you try to remove the permissions from an extended ACL entry that does not exist, the resulting permissions will be:

```
---
```

That is, no permission.

For additional information about ACLs and ACL entries, see *z/OS UNIX System Services Planning*.

Options

–a Aborts **setfacl** processing if one of the following errors or warnings occurs:

1. During the attempt to change an ACL for a file or directory, **setfacl** performs a stat(), and the stat() fails with a unique reason code.
2. The user tried to change the file default ACL or directory default ACL for a path name that is not a directory.
3. An attempt to delete all extended ACL entries failed for the current path name.
4. An attempt to set or modify extended ACL entries failed for the current path name.

When you do not specify **–a**, the **setfacl** processing continues.

–D *type*
Deletes all extended ACL entries for the ACL of *type*. For an access ACL, this leaves only the three required base entries intact. For a file default or directory default ACL, the entire ACL for the specified type is deleted. You can specify *type* as one of the following:

a Access ACL
d Directory default ACL
f File default ACL
e Every extended ACL for all ACL types that are applicable for the current path name

–h Does not follow symbolic links. Because ACLs are not associated with symbolic links, nothing will happen if a symbolic link is encountered.

–m *EntryOrFile*
Modifies the ACL entries specified by *EntryOrFile*. *EntryOrFile* represents a string of ACL entries typed directly on the command line. If an ACL entry

does not exist for a user or group specified in *EntryOrFile*, then it is created. If an ACL entry already exists for a user or group that was specified in *EntryOrFile*, then it is replaced.

The specified entries must be unique for each ACL type and its associated user or group combinations.

–M *EntryOrFile*
Modifies the ACL entries specified in *EntryOrFile*. *EntryOrFile* represents a file containing ACL entries. If an ACL entry does not exist for a user or group specified in *EntryOrFile*, then it is created. If an ACL entry already exists for a user or group that was specified in *EntryOrFile*, then it is replaced. If *EntryOrFile* is **–**, then entries are read from stdin.

The specified entries must be unique for each ACL type and its associated user or group combinations.

–q Quiet mode. **setfacl** will suppress all warning and error messages for the following conditions:

- During the attempt to change an ACL for a file or directory, **setfacl** performs a stat(), and the stat() fails with a unique reason code.
- The user tried to change the file default ACL or directory default ACL for a path name that is not a directory.

The condition that caused the warning or error will not affect the return code.

–s *entries*
Sets (replaces) all ACLs with *entries*.

–S *file* Sets (replaces) all ACLs with the entries specified in *file*. If *file* is **–**, then entries are read from stdin.

–v Verbose

–x *EntryOrFile*
Deletes the extended ACL entries specified by *EntryOrFile*. *EntryOrFile* is a string of ACL entries typed directly on the command line. If an ACL entry does not exist for the user or group specified, then you will not get an error. If the permissions field is provided in *EntryOrFile*, then it is ignored when this option is processed. Users cannot delete the base ACL entries (file owner, owning group, and others). If base ACL entries are specified with this option, they are ignored. Deleting an extended ACL entry does not necessarily have the same effect as removing all the permissions from an entry.

–X *EntryOrFile*
Deletes the extended ACL entries specified by *EntryOrFile*. *EntryOrFile* is a file containing ACL entries. If an ACL entry does not exist for the user or group specified, then you will not get an error. If *EntryOrFile* is **–**, then entries are read from stdin. If the permissions field is provided in *EntryOrFile*, then it is ignored when this option is processed. Users cannot delete the base ACL entries (file owner, owning group, and others). If base ACL entries are specified with this option, they are ignored. Deleting an extended ACL entry does not necessarily have the same effect as removing all the permissions from an entry.

Examples

1. To set (replace) the current access ACL for file *foo*, giving only user Billy read and execute access:

```
setfacl -s user::rwx,group::---,other::---,user:billy:r-x foo
```

This might change the permission bits of the file.

2. To modify the current access ACL for file *foo* to contain an extended ACL entry for group cartoons, giving that group read access:

```
setfacl -m group:cartoons:+r foo
```

3. To set (replace) the current access and directory default ACLs for directory Haunted so that users *user1* and *user2* have read and search permissions, while the group *thegang* has read permissions:

```
setfacl -s "u::rwx,g::---,o::---, \
     user:user1:r-x,group:thegang:r--,user:user2:r-x, \
     d:user:user1:r-x,d:group:thegang:r--,d:user:user2:r-x" Haunted
```

4. To copy the ACL from file *foo* such that the file *bar* will have the same ACL:

```
getfacl foo | setfacl -S - bar
```

5. To delete all of the extended ACL entries for user *user3* for all files and directories in the current directory:

```
setfacl -x user:user3,d:user:user3,f:user:user3 *
```

6. To delete all of the extended ACL entries for all files and directories in the current working directory:

```
setfacl -D e *
```

7. To change a directory's access ACL so that *user1* has read, write, and execute access for all files in the Haunted directory:

```
setfacl -m user:user1:rwx Haunted
```

8. RACF recommends placing ACLs on directories, rather than on each file in a directory. To find and remove all of the extended ACL entries for *user1* that are associated with only the files in directory Haunted:

```
setfacl -x user:user1 $(find Haunted -type f -acl_user user1)
```

Even if the **setfacl** command is successful in removing access from *user1*, *user1* might still be able to obtain access to the files in directory `Haunted` based on the file permission bits, assuming the user has search permission for `Haunted`.

Localization

setfacl uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Usage notes

1. When you use **setfacl** to add, change and delete ACL entries, all deletion operations are performed first. In other words, deletion operations are processed before any change or add operations.
2. **setfacl** should not be considered an atomic operation because if multiple operations are requested and an error occurs, some of the operations might have been processed before the error was encountered. Note that the **-s** option is considered a multiple operation request.

Exit values

0 Success.

1 Failure due to any of the following:
- Incorrect command-line option.
- Too few arguments on the command line.
- An attempt was made to read from stdin in more than one place.
- An attempt was made to combine **setfacl** operations that are mutually exclusive.

2 Failure due to any of the following:
- A specified path name does not exist.
- An error occurred while attempting to read the entries file.
- An attempt was made to alter the file default ACL or directory default ACL for a path name that is not a directory.

3 Failure due to any of the following:
- Unable to delete all extended ACL entries from a path name.
- Unable to set or modify ACL entries for a path name.
- Improper syntax of ACL entries.
- An incorrect ACL was specified.
- Unable to allocate enough memory.
- Unable to determine the PATH_MAX.
- Unable to open the entries file for reading.
- The entries file is empty.

Portability

An approved POSIX standard does not exist for **setfacl**.

Related information

chmod, **find**, **getfacl**, **ls**, **filetest**, **pax**, **test**

sh — Invoke a shell

Format

[r]sh [±abCefhiKkLmnPprtuvx] [±o *option*] [*cmd_file* [*argument ...*]]

[r]sh –S [±abCefhiKkLmnPprtuvx] [±o *option*] [*cmd_file* [*argument ...*]]

[r]sh –c *cmdstring* **[±abCefhiKkLmnPprtuvx] [±o** *option*] [*cmd_name* [*argument ...*]]

[r]sh –s [±abCefhikLmnPprtuvx] [±o *option*] [*argument ...*]

Description

sh contains the following topics and subtopics:
- Options and invocations
- Options
- Command syntax
- Reserved word commands
- Command execution
- Quoting
- Directory substitution
- Parameter substitution
- Arithmetic substitution

- File description and redirection
- File name generation
- Variables
- Shell variables
- Shell variables for automatic conversion
- Shell execution environments
- Built-in commands
- Shell archives
- Files
- Localization
- Exit values
- Messages
- Limits
- Portability
- Related information

Subtopics dealing with substitution and interpretation of input appear in the order in which the shell performs those substitutions and interpretations.

Much of what the shell can do is provided through such built-in commands as **cd** and **alias**.

Restriction: If the tagged script is being run with automatic conversion enabled, the code page of the locale must be SBCS and the script must also be encoded in SBCS.

Options and invocation

The z/OS shell is upward-compatible with the Bourne shell.

Typically, you invoke the shell by logging in. You can also invoke the shell by typing an explicit **sh** command. Some people find it useful to copy the **sh** file into a file named `rsh`. If you invoke the shell under the name `rsh`, the shell operates in restricted mode. This mode is described with **–r**.

If you invoke the shell with a name that begins with the – character, it is a *login shell*. (You can also get a login shell if you invoke the shell with the **–L** option.) A login shell begins by running the file `/etc/profile`. It then runs `$HOME/.profile` using the **.** command (see **dot**). If HOME is not set, the shell searches the working directory for:

```
.profile
```

and runs this file with the **.** command if it exists. You do not get an error message if any of these files cannot be found.

You can use these profile files to customize your session with **sh**. For example, your profile files can set options, create aliases, or define functions and variables.

If there is at least one argument on the **sh** command line, **sh** takes the first argument as the name of a shell script to run. (The exception to this is when **–s** is used.) Any additional arguments are assigned to the positional parameters; usually, these serve as arguments to the shell script. See “Parameter substitution” on page 615 for information about positional parameters. Also see **set** for information about changing these parameters.

If **sh** finds the ENV environment variable set when it begins running (after profile processing), **sh** runs the file named by the expansion of the value of this variable.

Options

The shell accepts the following options on the command line:

–c *cmdstring*
: Runs *cmdstring* as if it were an input line to the shell and then exits. This is used by programs (for example, editors) that call the shell for a single command. **sh** assigns arguments after *cmdstring* to the positional parameters. If you specify *cmd_name,* special parameter 0 is set to this string for use when running the commands in *cmdstring*.

–i
: Invokes an interactive shell, as opposed to running a script.With **–i**, the shell catches and ignores keyboard interrupts. Without **–i**, an interrupt ends the shell. For shells that read from the terminal, **–i** is the default.

–L
: Makes the shell a *login shell,*. (A login shell is an interactive shell.)

–r
: Invokes a restricted shell. (You can also invoke a restricted shell by using the name `rsh`. In a restricted shell, you cannot do the following:
  - Use the **cd** command
  - Change the values of the variables ENV, PATH, or SHELL
  - Use > or >> to redirect output; or specify command names containing /

  These restrictions do not apply during execution of your *profile* files.

–s
: Reads commands from standard input (stdin) and assigns all arguments to the positional parameters. Normally, if there is at least one argument to the shell, the first such argument is the name of a file to be run.

–S
: Searches the directories in the environment variable PATH for a file *cmd_file* that contains shell commands. The current working directory is not searched before PATH.

If you do not give either the **–c** or **–s** option, but you do specify *cmd_file*, the shell takes it as the name of a file that contains commands to be run. Special parameter 0 is set to this name.

If *cmd_file* contains a slash, the shell attempts to read that file name. If *cmd_file* does not contain a slash, the following can occur:

- If **–S** is specified, the shell searches for the file in PATH. Only a file with executable access permissions for the user will be found in the PATH search.
- If **–S** is not specified, the shell searches for the file in the current working directory, then in PATH. The file must have read access permitted for the user. Executable access permission is not necessary.

In addition to these options, you can use any valid option to the **set** command (including **–o** *option*) as a command-line option to **sh**. See **set** for details.

Command syntax

The shell implements a sophisticated programming language that gives you complete control over the execution and combination of individual commands. When the shell scans its input, it always treats the following characters specially:

```
;   &   (   )   <   >   |   '   \   "
space   tab   newline
```

If you want to use any of these characters inside an actual argument, you must quote the argument (so that the shell does not use the special meanings of the characters). See Quoting for more information.

A *simple command* is a list of *argument*s separated by characters in the IFS environment variable (the default value of IFS has blank, tabs, and newlines).

When a word is preceded by an unescaped pound sign (#), the remainder of the line is treated as a *comment*, and the shell discards input up to but not including the next newline. When a command starts with a defined alias, **sh** replaces the alias with its definition (see **alias**).

A reserved-word command starts with a reserved word (for example, **if**, **while**, or **for**). Reserved-word commands provide flow of control operations for the shell and are listed in "Reserved-word commands" on page 608.

A *command* can be any of the following:

command:

- *simple command*
- *reserved-word command*
- (*command*)
- *command* |*command*
- *command* &&*command*
- *command* ||*command*
- *command* &*command*
- *command* &
- *command* |&
- *command* ;*command*
- *command* ;
- *command*<newline>

The following is the order of precedence of the preceding operators. The highest priority operators are listed first, and operators on the same line have equal priority.

```
()
|
&&      ||
&       |&       ;       <newline>
```

The meaning of these operations is as follows:

(*command***)**
Runs *command* in a child shell. The current shell invokes a second shell, and this second shell actually runs *command*. In this way, *command* runs in a completely separate execution environment; it can change working directories, change variables, open files, and so on without affecting the first shell. The child shell's environment begins as a copy of the current environment, so the value of the ENV environment variable is not run when achild shell starts.

|
Creates a pipe between the two *command*s that the | operator connects.The standard output of the first *command* becomes the standard input of the second *command*. A series of commands connected by pipes is called a *pipeline*.The exit status is that of the last command in the pipeline.

&&
Is the logical AND operator. The shell runs the second *command* if and only if the first *command* returns a true (zero) exit status.

|| This is the logical OR operator. The shell runs the second *command* if and only if the first *command* returns a false (nonzero) exit status.

& Runs the *command* that precedes it asynchronously. The shell just starts the *command* running and then immediately goes on take new input, before the *command* finishes execution. On systems where asynchronous execution is not possible, this operation is effectively equivalent to **;**.

|& Runs the *command* that precedes it as a co-process.The *command* runs asynchronously, as with the & operator, but the command's standard input and standard output are connected to the shell by pipes. The shell sends input to *command*'s standard input with the **print –p** command, and reads from *command*'s standard output with the **read –p** command. The *command* should not buffer its output. Because of this and other limitations, coprocesses should be designed to be used as coprocesses. On systems where asynchronous execution is not possible, coprocesses are not supported.

; Is the sequential execution operator. The second *command* is run only after the first *command* has completed.

newline
The unescaped newline is equivalent to the **;** operator.

Reserved-word commands

The shell contains a rich set of *reserved-word commands,* which provide flow of control and let you create compound commands. In the following list, a *command* can also be a sequence of *commands* separated by newlines. Square brackets ([ ]) indicate optional portions of commands, and are included as part of the command syntax except in the case of **[[** *test_expr* **]]**, where square brackets are part of the command.

! The exclamation point is the logical NOT command. When its operand is false (nonzero), this command returns true (zero). When its operand is true (zero), this command returns false (nonzero).

{*command***;**}
Enclosing a command in braces is similar to the (*command*) construct, except that the shell runs the *command* in the same environment rather than under a child shell. { and } are reserved words to the shell. To make it possible for the shell to recognize these symbols, you must put a blank or newline after the {, and a semicolon or newline before the }.

[[*test_expr* **]]**
The double-square-bracket command ([[*test_expr*]]) is a command that returns an exit status indicating whether the *test_expr* (test expression) is true or false.

Word-splitting and wildcard expansion (file name expansion or globbing) are not done within **[[ ]]**. This makes quoting less necessary than when you use the **test** (or **[ ]**) command. Alias expansion is also not done within **[[ ]]**.

The following primitives are used in ([[*test_expr*]]). Spaces or tabs are required to separate operators from operands.

–a file True if file exists (**–e** is recommended to avoid confusion with the **test** command syntax)

–Aa *file*
True if *file* has an extended access ACL entry.

–Ad *file*
True if *file* has a directory default ACL.

–Af *file*
True if *file* has a file default ACL.

–b file True if file is a block special file (block special files are not supported in z/OS)

–B file
True if the file is tagged as binary (not text)

–c file True if file is a character special file

–d file True if file is a directory

–e file True if file exists

–Ea file
True if the file has the APF extended attribute

–El file
True if the file has the shared library extended attribute

–Ep file
True if the file has the program control extended attribute

–Es file
True if the file has the shared address space extended attribute

–f file True if file is an ordinary file

–g file True if the set-group-ID attribute of file is on

–G file
True if file group owner is the effective group ID

–h file True if file is a symbolic link

–k file True if file has the "sticky" bit on

–L file True if file is a symbolic link

-Ma file
True if the file has a security label

–n string
True if the length of the string is greater than zero

–o option
True if shell option is on

–O file
True if file owner is the effective user ID

–p file True if file is a FIFO (named pipe)

–r file True if file is readable (checks permission bits and access control)

–s file True if size of the file is nonzero

–S file True if file is a socket

–t fd True if the numeric file descriptor fd is open and associated with a terminal

–T file
True if the file is tagged as text

–u file True if the set-user-ID attribute of file is on

–w file
True if file is writable (checks permission bits and access control)

–x file True if file is executable (checks permission bits and access control)

–z string
True if length of the string is zero

string True if string is not a null string

string = pattern
True if string matches pattern (== is recommended to avoid confusion with the **test** command syntax)

string == pattern
True if string matches pattern. Quote pattern to treat it as a string. For information about patterns, see "File name generation" on page 622.

string1 != pattern
True if string does not match patterns. For information about patterns, see "File name generation" on page 622.

string1 < string2
True if string1 comes before string2 in the collation order defined in the current locale

string1 > string2
True if string1 comes after string2 in the collation order defined in the current locale

exp1 –eq exp2
True if arithmetic expression exp1 and exp2 are equal

exp1 –ge exp2
True if arithmetic expression exp1 is greater than or equal to exp2

exp1 –gt exp2
True if arithmetic expression exp1 is greater than exp2

exp1 –le exp2
True if arithmetic expression exp1 is less than or equal to exp2

exp1 –lt exp2
True if arithmetic expression exp1 is less than exp2

exp1 –ne exp2
True if arithmetic expression exp1 is not equal to exp2

file1 –nt file2
True if file1 is newer than file2

file1 –ot file2
True if file1 is older than file2

file1 –ef file2
True if file1 is a hard link or symbolic link to file2 (this is different than the **test** command which only tests for hard links on z/OS)

file–CS codeset
True if the file is tagged with the codeset

file -Ml seclabel
True if the file has a security label. False if the file does not have a security label that matches the specified seclabel.

(test_expr)
Grouping to override normal precedence; true if test_expr is true

! test_expr
Logical negation; true if test_expr is false

test_expr1 && test_expr2
Logical AND; true if both test_expr1 and test_expr2 are true

test_expr || test_expr2
Logical OR; true if either test_expr1 or test_expr2 is true

Patterns tested in double-square-bracket conditions are composed of special characters and regular characters. Patterns follow the rules given in "File name generation" on page 622, except that the period (.) and the slash (/) are not treated specially. Note that pattern matching is similar to regular expression processing, but different in syntax.

case *word* **in** *[()][pattern[|pattern] &...* **)***command* **;;** *] ... [()][pattern[| pattern] ...* **)***command* **;;** *] ...* **esac**
The **case** statement is similar to the **switch** statement of the C programming language or the **case** statement of Pascal. If the given *word* matches any one of the patterns separated by "or" bar (|) characters, **sh** runs the corresponding *command*. The patterns should follow the rules given in "File name generation" on page 622, except that the period (.) and slash (/) are not treated specially. Patterns are matched in the order they are given, so more inclusive patterns should be mentioned later. You must use the double semicolon (;;) to delimit *command* and introduce the next *pattern*.

for *variable* **[in** *word ...***] do** *command* **done**
The **for** statement sets *variable* to each *word* argument in turn, and runs the set of *command*s once for each setting of *variable*. If you omit the **in** *word* part, **sh** sets *variable* to each positional parameter. You can divert the flow of control within the loop with the **break** or **continue** statements.

function *variable* **{ command ... }** ... *variable***() { command ... }**
Either one of these forms defines a **function** named *variable*, the body of which consists of the sequence of *commands*. You invoke a function just like any other command; when you actually call the function, **sh** saves the current positional parameters. The function's command-line arguments then replaces these parameters until the function finishes. **sh** also saves the current ERR and EXIT traps, as well as any flags manipulated by EXIT with the **set** command; these are restored when the function finishes. The function ends either by falling off the end of the code of the function body, or by reaching a **return** statement. If the function uses **typeset** to declare any variables in the function body, the variables are local to the function.

if *command* **then** *command* **[elif** *command* **then** *command] ...* **[else** *command]* **fi**
In the **if** statement, if the first (leftmost) *command* succeeds (returns a zero exit status), **sh** runs the *command* following **then**. Otherwise, **sh** runs the *command* (if any) following the **elif** (which is short for "else if"); if that succeeds, **sh** runs the *command* following the next **then**. If neither case succeeds, **sh** runs the *command* following the **else** (if any).

select *variable* **[in** *word ...***] do** *commands* **done**
The **select** statement can handle menulike interactions with the user. Its

syntax is like the **for** statement. Each *word* is printed on the standard error file, one per line, with an accompanying number. If you omit the "**in** *word ...*" part, **sh** uses the positional parameters. **sh** then displays the value of the variable PS3 to prompt the user to enter a numerical reply. If the reply is an empty line, **sh** displays the menu again; otherwise, **sh** assigns the input line to the variable REPLY, sets *variable* to the *word* selected, and then runs the *commands*. **sh** does this over and over until the loop is ended by an interrupt, an end-of-file, or an explicit **break** statement in the *commands*.

until *command1* **do** *command2* **done**
The **until** statement runs *command1* and tests its exit status for success (zero) or failure (nonzero). If *command1* succeeds, the loop ends; otherwise, **sh** runs *command2* and then goes back to run and test *command1* again. **break** and **continue** commands in the *commands* can affect the operation of the loop.

while *command1* **do** *command2* **done**
The **while** statement works similarly to the **until** statement. However, the loop ends whenever *command1* is unsuccessful (nonzero exit status).

Shell reserved words are recognized only when they are the unquoted first token of a command. This lets you pass these reserved words as arguments to commands run from the shell. The full list of reserved words is:

```
!           done        function        while
[[          elif        if
{           else        select
}           esac        then
case        fi          time
do          for         until
```

Command execution

Before running a *simple command*, the shell processes the command line, performing expansion, assignments, and redirection.

First, **sh** examines the command line and divides it into a series of *tokens*, which are either *operators* or *words*. An operator is either a control operator, which is described in "Command syntax" on page 606. Or it can be a redirection operator, described in "File descriptors and redirection" on page 620. A word is any token that is not an operator.

Next, the shell expands words in the following order:

1. **sh** performs directory substitution.
2. **sh** performs parameter substitution, command substitution, or arithmetic substitution, as appropriate, in the order that the words appear on the command line, expanding each word to a *field* (see the appropriate topics).
3. **sh** scans each field produced in step 2 for unquoted characters from the IFS environment variable and further subdivides this field into one or more new fields.
4. **sh** expands any aliases to their definitions.
5. **sh** performs path name expansion on each unquoted field from step 3.
6. **sh** removes all quote mechanisms (\, ', and ") that were present in the original word unless they have themselves been quoted.

The shell considers the first field of the expanded result to be a command.

The expanded simple command can contain variable assignments and redirections. Variable assignments affect the current execution environment. After expansion, the shell handles all redirection constructs, and the command, if one was found, it performs the redirection in a child shell environment (see "Shell execution environments" on page 628).

When a simple command contains a command name, variable assignments in the command affect only the execution of that command.

After the shell has expanded all appropriate arguments in a simple command, but before it performs file name generation, it examines the command name (if the command has one). **sh** first checks the names against currently defined aliases (see the **alias** command) and functions (see **function** in "Reserved-word commands" on page 608), and finally against the set of built-in commands: commands that the shell can run directly without searching for program files.

The **autoload** command, an alias of **typeset –fu**, identifies functions that are not yet defined. The first time an undefined function is called within the shell, the shell will search directories in the FPATH shell variable for a file with the same name as the function. If a matching file is found, it is assumed to contain the function definition of the same name. The file is read and executed in the current shell environment, storing the function in the shell's memory for subsequent execution. (Multiple function definitions may be contained in the same file. When the file is processed by the shell, all the functions will be defined. Every function definition in the file should be a link name to the file.)

If the command is a built-in or function, the shell executes it.

If the command name is not a function or a built-in command, the z/OS shell looks for a program file or script file that contains an executable version of that command. The shell uses the following procedure to locate the program file:

- If the command name typed to the shell has slash (/) characters in its name, the command is taken to be a full path name (absolute or relative). The shell tries to execute the contents of that file.
- Otherwise, the shell performs a path search. To do this, the shell obtains the value of the PATH environment variable. The value should be a list of directory names. **sh** searches under each directory for a file, the name of which matches the command name. If the FPATH shell variable is set, the shell will search the PATH and FPATH directories. If a file with a name matching the command name is found in the same directory in both PATH and FPATH, or if a matching file is found only in FPATH, this file will be read and executed in the current shell environment (defining the functions contained in the file). The shell will then execute the function matching the command name. This allows users to use FPATH for locating functions without the need to identify every function with the **autoload** command.

  If FPATH is not set, or if the command is not found in FPATH, the shell executes the first matching file found in the PATH directories. For more information about specifying the PATH variable, see the topic in *z/OS UNIX System Services User's Guide* on using the PATH variable when customizing the search path for commands.

Command names can be marked as tracked aliases. The first time you run a command with a tracked alias, the shell does a normal PATH search. If the search is successful, the shell remembers the file that it finds. The next time you run a

command with the same name, **sh** immediately runs the file found on the last PATH search; there is no new search. This speeds up the time that it takes the shell to find the appropriate file.

The **set –h** command tells the shell that all commands should be treated as tracked aliases. See **alias** and **set** for more information.

Quoting

To let you override the special meaning of certain words or special characters, the shell provides several quoting mechanisms. In general, you can turn off the special meaning of any character by putting a backslash (\) in front of the character. This is called *escaping* the character.

For example, you can tell the shell to disregard the special meaning of the newline character by putting a backslash at the very end of a line. The shell ignores the escaped newline, and joins the next line of input to the end of the current line. In this way, you can enter long lines in a convenient and readable fashion.

Escaping characters by putting a backslash in front of them is the most direct way of telling the shell to disregard special meanings. However, it can be awkward and confusing if you have several characters to escape.

As an alternative, you can put arguments in various types of quotation marks. Different quotation mark characters have different “strengths.” The single quotation marks are the strongest. When you enclose a command-line argument in single quotation marks, the shell disregards the special meanings of everything inside the single quotation mark. For example:

```
 echo
'*'
```

Double quotation marks are weaker. Inside double quotation marks, the shell performs command substitutions (see “Command substitution” on page 619), parameter substitutions (see “Parameter substitution” on page 615) and arithmetic substitutions (see “Arithmetic substitution” on page 618). The shell does not perform such substitutions when they appear inside single quotation marks. You can use the backslash to escape another character when they appear inside double quotation marks, but inside single quotation marks the shell ignores this special meaning.

The shell treats internal field separator characters (that is, characters in the value of the IFS variable) literally inside quoted arguments, whether they're quoted with double quotation marks or single quotation marks. This means that a quoted argument is considered a single entity, even if it contains IFS characters.

Quoting can override the special meanings of reserved words and aliases. For example, in:

```
"time" program
```

the quotes around **time** tell the shell not to interpret **time** as a shell reserved word. Instead, **sh** does a normal command search for a command named **time**.

You must always quote the following characters if you want **sh** to interpret them literally:

```
|   &   ;   <   >   (   )   $    '   "   `   \
<space>  <tab>  <newline>
```

The following characters need to be quoted in certain contexts if they are to be interpreted literally:

```
*   ?   [   #   %   =
 ~
```

Directory substitution

When a word begins with an unquoted tilde (~), **sh** tries to perform directory substitution on the word.**sh** obtains all characters from the tilde (~) to the first slash (/) and uses this as a *user name*. **sh** looks for this name in the user profile, the file that contains information about all the system's users. If **sh** finds a matching name, it replaces ~name with the name of the user's home directory, as given in the matching RACF user profile entry.

For example, if you specify a file name as:

```
~jsmith/file
```

sh would look up jsmith's home directory and put that directory name in place of the `~jsmith` construct.

If you specify a ~ without an accompanying name, **sh** replaces the ~ with the current value of your HOME variable. For example:

```
echo ~
```

displays the name of your home directory. Similarly, **sh** replaces the construct ~+ with the value of the PWD variable (the name of the working directory), and replaces the tilde hyphen (~–) with the value of OLDPWD (the name of your previous working directory). In variable assignments, tilde expansion is also performed after colons (:).

Parameter substitution

The shell uses three types of parameters: positional parameters, special parameters, and variables. A positional parameter is represented with either a single digit (except 0) or one or more digits in braces. For example, 7 and {15} are both valid representations of positional parameters. Positional parameters are assigned values from the command line when you invoke **sh**.

A special parameter is represented with one of the following characters:

```
*    @    #    ?    !    -    $     0
```

The values to which special parameters expand are listed in the following paragraphs.

Variables are named parameters. For details on naming and declaring variables, see “Variables” on page 623.

The simplest way to use a parameter in a command line is to enter a dollar sign ($) followed by the name of the parameter. For example, if you enter the command:

```
echo $x
```

sh replaces $x with the value of the parameter *x* and then displays the results (because **echo** displays its arguments). Other ways to expand parameters are shown in the following paragraphs.

The following parameters are built in to the shell:

$1, $2, ... $9
Expands to the *d* positional parameter (where *d* is the single digit following the $). If there is no such parameter, $*d* expands to a null string.

$0 Expands to the name of the shell, the shell script, or a value assigned when you invoked the shell.

$# Expands to the number of positional parameters.

$@** Expands to the complete list of positional parameters. If **$@ is quoted, the result is separate arguments, each quoted. This means that:

```
"$@"
```

is equivalent to:

```
"$1" "$2" ...
```

$*** Expands to the complete list of positional parameters. If **$* is quoted, the result is concatenated into a single argument, with parameters separated by the first character of the value of IFS (see "Variables" on page 623). For example, if the first character of IFS is a blank, then:

```
"$*"
```

is equivalent to:

```
"$1 $2 ..."
```

$– Expands to all options that are in effect from previous calls to the **set** command and from options on the **sh** command line.

$? Expands to the exit status of the last command run.

$$ Expands to the process ID of the shell. If running in a child shell environment (see "Shell execution environments" on page 628), it is the process ID of the parent shell. Otherwise, it is the process ID of the current shell.

$! Expands to the process number of the last asynchronous command.

These constructs are called *parameters* of the shell. They include the positional parameters, but are not restricted to the positional parameters.

We have already mentioned that you can expand a parameter by putting a $ in front of the parameter name. More sophisticated ways to expand parameters are:

${*parameter***}**
Expands any parameter.

${*number***}**
Expands to the positional parameter with the given number. (Remember that if you just enter $*d* to refer to the *d*th positional parameter, *d* can only be a single digit; with brace brackets, *number* can be greater than 9.) Since braces mark the beginning and end of the name, you can have a letter or digit immediately following the expression.

${*variable***[***arithmetic expression***]}**
Expands to the value of an element in an array named *variable*. The *arithmetic expression* gives the subscript of the array. (See "Arithmetic substitution" on page 618.)

${*variable* **[*]}**
Expands to all the elements in the array *variable*, separated by the first character of the value of **$IFS**.

${***variable* **[@]$}
When unquoted, is the same as ${ *variable*[*]} When quoted as "${*variable* [@]$} ," it expands to all the elements in the array *variable*, with each element quoted individually.

${#*parameter***}**
Expands to the number of characters in the value of the given *parameter*.

${#} Expands to the number of positional parameters.

${# *} Expands to the number of positional parameters.

${#@} Expands to the number of positional parameters.

${#*variable* **[*]}**
Expands to the number of elements in the array named *variable*. Elements that do not have assigned values do not count. For example, if you only assign values to elements `0` and `4`, the number of elements is `2`. Elements `1` through `3` do not count.

${*parameter***:–***word***}**
Expands to the value of *parameter* if it is defined and has a nonempty value; otherwise, it expands *word.* This means that you can use *word* as a default value if the parameter isn't defined.

${*parameter***–***word***}**
Is similar to the preceding construct, except that the parameter is expanded if defined, even if the value is empty.

${*variable***:=***word***}**
Expands *word* with parameter expansion and assigns the result to *variable*, provided that *variable* is not defined or has an empty value. The result is the expansion of *variable*, whether or not *word* was expanded.

${*variable***=***word***}**
Is similar to the preceding construct, except that the *variable* must be undefined (it cannot just be null) for *word* to be expanded.

${*parameter***:?***word***}**
Expands to the value of *parameter* provided that it is defined and non-empty. If *parameter* isn't defined or is null, **sh** expands and displays *word* as a message. If *word* is empty, **sh** displays a default message. After a non-interactive shell has displayed a message, it ends.

${*parameter***?***word***}**
Is similar to the preceding construct, except that **sh** displays *word* only if *parameter* is undefined.

${*parameter***:+***word***}**
Expands to *word*, provided that *parameter* is defined and non-empty.

${*parameter***+***word***}**
Expands to *word*, provided that *parameter* is defined.

${*parameter***#***pattern***}**
Attempts to match *pattern* against the value of the specified *parameter*. The *pattern* is the same as a case *pattern*. **sh** searches for the shortest prefix of the value of *parameter* that matches *pattern*. If **sh** finds no match, the

previous construct expands to the value of *parameter*; otherwise, the portion of the value that matched *pattern* is deleted from the expansion.

${*parameter***##***pattern***}**
Is similar to the preceding construct, except that **sh** deletes the longest part that matches *pattern* if it finds such a match.

${*parameter***%***pattern***}**
Searches for the shortest suffix of the value of *parameter* matching *pattern* and deletes the matching string from the expansion.

${*parameter***%%***pattern***}**
Is similar to the preceding construct, except that **sh** deletes the longest part that matches *pattern* if it finds such a match.

Arithmetic substitution

Arithmetic substitution is available with the syntax:

```
$((arithmetic expression))
```

or:

```
$[arithmetic expression]
```

This sequence is replaced with the value of *arithmetic expression*. Arithmetic expressions consist of expanded variables, numeric constants, and operators. Numeric constants have the forms:

- A number that starts with 0x is hexadecimal.
- A number that starts with 0 is octal.
- A number that does not start with 0x or 0 is decimal.
- *base* #*number*, where *base* is a decimal integer between 2 and 36 inclusive, and *number* is any nonnegative number in the given base.

Undefined variables evaluate to zero.

If the shell variable x contains a value that forms a valid integer constant, then the arithmetic expansions `"$((x))"` and `"$(($x))"` or `$[x]` or `$[$x]` return the same value.

The operators are listed in decreasing order of precedence in Table 28. Operators sharing a heading have the same precedence. Evaluation within a precedence group is from left to right, except for the assignment operator, which evaluates from right to left.

Table 28. Shell operators (sh command)

Unary operators	
-	Unary minus
!	Logical negation
+ ~	Identity, bitwise negation
Multiplicative Operators	
* / %	Multiplication, division, remainder
Additive Operators	
+ -	Addition, subtraction
Bitwise Shift Operators	

Table 28. Shell operators (sh command) (continued)

Unary operators	
`<< >>`	Bitwise shift right, bitwise shift left
Relational Operators	
`< >`	Less than, greater than
`<= >=`	Less than or equal, greater than or equal
`= = !=`	Equal to, not equal to
Bitwise AND/OR Operators	
`&`	AND
`^`	Exclusive OR
`|`	Inclusive OR
Logical AND/OR Operators	
`&&`	Logical AND
`||`	Logical OR
`? :`	If-else
Assignment Operator	

`= *= /= %=`
`+= -= <<=`
`>>= &= ^= |=`
	Assignment

You do not need the $(( )) syntax to enclose an arithmetic expression in these situations:

- In assignment to an integer variable. (See **typeset**.)
- As an argument to the following built-in shell commands:

  break exit return continue let shift
- When used as arguments in the **test** built-in shell command numeric comparisons (**–eq**, **–ge**, **–gt**, **–le**, **–lt**, and **–ne**). See **test**.

Command substitution

In *command substitution*, **sh** uses the expansion of the standard output of one command in the command line for a second command. There are two syntaxes.

The first syntax (called *backquoting*) surrounds a command with grave accents `, as in:

```
ls `cat list`
```

To process this command line, **sh** first runs the **cat** command and collects its standard output. The shell then breaks this output into arguments and puts the result into the command line of the **ls** command. The previous command therefore lists the attributes of all files, the names of which are contained in the file **list**.

This syntax is easy to type, but is not useful if you want to put one command substitution inside another (*nesting* command substitutions). A more useful syntax is:

```
$(command)
```

as in:

```
ed $(grep –f –l function $(find . –name '*.c'))
```

This command uses **find** to search the current directory and its subdirectories to find all files, the names of which end in **.c**. It then uses **grep –f** to search each such file for those that contain the string `function`. Finally, it calls **ed** to edit each such file.

There is a historical inconsistency in the backquoting syntax. A backslash (\) within a backquoted command is interpreted differently depending on its context. Backslashes are interpreted literally unless they precede a dollar sign ($), grave accent (`), or another backslash (\). In these cases, the leading backslash becomes an escape character to force the literal interpretation of the `$`, `` ` ``, or `\`. Consequently, the command:

```
echo '\$x'
```

issued at system level produces the output:

```
\$x
```

whereas the same command nested in a backquoted syntax:

```
echo `echo '\$x'`
```

produces the output:

```
$x
```

We recommend the `$(`*command*`)` syntax for command substitutions.

sh performs command substitutions as if a new copy of the shell is invoked to run the command. This affects the behavior of `$-` (standing for the list of options passed to the shell). If a command substitution contains `$-`, the expansion of `$-` does not include the **–i** option, since the command is being run by a non-interactive shell.

File descriptors and redirection

The shell sometimes refers to files using *file descriptors*. A file descriptor is a number in the range `0` to `9`. It can have any number of digits. For example, the file descriptors `001` and `01` are identical to file descriptor `1`. Various operations (for example, **exec**) can associate a file descriptor with a particular file.

Some file descriptors are set up at the time the shell starts up. These are the standard input/output streams:

- Standard input (file descriptor 0)
- Standard output (file descriptor 1)
- Standard error (file descriptor 2)

Commands running under the shell can use these descriptors and streams too. When a command runs under the shell, the streams are normally associated with your terminal. However, you can redirect these file descriptors to associate them with other files (so that I/O on the stream takes place on the associated file instead of your terminal). In fact, the shell lets you redirect the I/O streams associated with file descriptors `0` through `9`, using the following command-line constructs.

number`<`*file*

> Uses *file* for input on the file descriptor, the number of which is *number*. If you omit *number*, as in `<`*file*, the default is `0`; this redirects the standard input.

*number***>***file*

Uses *file* for output on the file descriptor, the number of which is *number*. If you omit *number*, as in >*file*, the default is 1; this redirects the standard output. The shell creates the file if it does not already exist. The redirection fails if the file already exists and **noclobber** is set (see **set**).

*number***>|***file*

Is similar to *number*>*file* but if *file* already exists, the output written to the file overwrites its current contents.

*number***< >***file*

Uses *file* for input and output with the file descriptor, the number of which is *number*. This is most useful when the file is another terminal or modem line. If you omit *number*, as in < >*file*, the default *number* is zero; this redirects the standard input. Output written to the file overwrites the current contents of the file (if any). The shell creates the file if it does not already exist.

*number***>>***name*

Is similar to *number* > *file*, except that output is appended to the current contents of the file (if any).

*number***<<[-]***name*

Lets you specify input to a command from your terminal (or from the body of a shell script). This notation is known as a *here-document*.The shell reads from the standard input and feeds that as input to file descriptor *number* until it finds a line that exactly matches the given *name*. If you omit *number*, the default is the standard input. For example, to process the command:

```
cat <<abc >out
```

the shell reads input from the terminal until you enter a line that consists of the word `abc`. This input is passed as the standard input to the **cat** command, which then copies the text to the file `out`.

If any character of *name* is quoted or escaped, **sh** does not perform substitutions on the input; instead, it performs variable and command substitutions, respecting the usual quoting and escape conventions. If you put **-** before *name*, **sh** deletes all leading tabs in the *here-document*.

*number1***<&***number2*

Makes the input file descriptor *number1* a duplicate of file descriptor *number2*. If you omit *number1*, the default is the standard input (file descriptor 0). For example, <&4 makes the standard input a duplicate of file descriptor 4. In this case, entering input on 4 has the same effect as entering input on standard input (**stdin**).

*number1***>&***number2*

Makes the output file descriptor *number1* a duplicate of file descriptor *number2*. If you omit *number1*, the default is the standard output (file descriptor 1). For example, >&2 makes the standard output a duplicate of file descriptor 2 (the standard error). In this case, writing output on stdout has the same effect as writing output on stderr.

*number***<&-**

Closes input descriptor *number*.If you omit *number*, it closes the standard input.

*number***>&-**
Closes output descriptor *number*. If you omit *number*, it closes the standard output.

Normally, redirection applies only to the command where the redirection construct appears; however, see **exec**.

The order of *redirection* specifications is significant, since an earlier redirection can affect a later one. However, these specifications can be freely intermixed with other command arguments. Since the shell takes care of the redirection, the redirection constructs are not passed to the command itself.

Note: The shell performs the implicit redirections needed for pipelines before performing any explicit redirections.

File name generation

The characters `* ? [` are called *glob characters,* or *wildcard characters*. If an unquoted argument contains one or more glob characters, the shell processes the argument for file name generation. The glob characters are part of *glob patterns,* which represent file and directory names. These patterns are similar to regular expressions, but differ in syntax, since they are intended to match file names and words (not arbitrary strings). The special constructions that may appear in glob patterns are:

? Matches exactly one character of a file name, except for the separator character `/` and a `.` at the beginning of a file name. `?` only matches an actual file name character and does not match nonexistent characters at the end of the file name. `?` is analogous to the metacharacter `.` in regular expressions.

* Matches zero or more characters in a file name, subject to the same restrictions as `?`. `*` is analogous to the regular expression `.*`.

[*chars***]** Defines a *class* of characters; the glob pattern matches any single character in the class. A class can contain a range of characters by writing the first character in the range, a dash `-`, and the last character. For example, `[A-Za-z]`, in the POSIX locale, stands for all the uppercase and lowercase letters. If you want a literal `-` character (or other glob character) in the class, use the backslash to escape the character, causing it to lose its special meaning within the pattern expression. If the first character inside the brackets is an exclamation mark (`!`), the pattern matches any single character that is *not* in the class.

Some sample patterns are:

[!a-f]*.c
Matches all **.c** files beginning with something other than the letters from `a` through `f`.

/???/?.?
Matches all files that are under the root directory in a directory with a three-letter name, and that have a basename containing one character followed by a `.` followed by another single character.

***/*.[chyl]**
Matches all **.c**, **.h**, **.y**, and **.l** files in a subdirectory of the working directory.

~mks/*.ksh
Matches all shell scripts in the home directory of user `mks`

(see "Directory substitution" on page 615 for the use of ~).

If no files match the pattern, **sh** leaves the argument untouched. If the **set** option **–f** or **"–o noglob"** is in effect, the shell does not perform file name generation.

Tip: Double-byte characters in a file name may cause problems. For instance, if you use a double-byte character in which one of the bytes is a **.** (dot) or / (slash), the file system treats this as part of the path name.

Variables

The shell maintains variables and can expand them where they are used in command lines; see "Parameter substitution" on page 615 for details.

A variable name must begin with an uppercase or lowercase letter or an underscore (_). Subsequent characters in the name, if any, can be uppercase or lowercase letters, underscores, or digits `0` through `9`. You can assign a value to a variable with:

variable=value

For integer variables (see "Options" on page 782 for details), the value may be specified as an arithmetic expression. For the syntax of an arithmetic expression, see "Arithmetic substitution" on page 618.

You can implicitly declare a variable as an array by using a subscript expression when assigning a value, as in:

variable[*arithmetic expression*]*=value*

You can use a subscripted array variable anywhere that the shell allows an ordinary variable. For the syntax of an arithmetic expression, see "Arithmetic substitution" on page 618. Also see **typeset**, **export**, and **readonly** for details about the attributes of shell variables, and how shell variables can be exported to child processes.

For a list of variables that the shell either sets or understands, see Shell variables.

Shell variables

You cannot use double-byte characters for a shell variable name, but you can use them for shell variable values. Double-byte characters in file names and path names are treated as single-byte characters.

Shell variables that are exported are called *environment variables* and are made available in the environment of all commands that are run from the shell. Table 29 on page 624 contains a list of built-in shell variables and also includes frequently-used environment variables. For more information about environment variables that are used by the C-RTL, see *z/OS XL C/C++ Programming Guide*. A list of other environment variables can be found in *z/OS UNIX System Services User's Guide*. The following table lists frequently-used shell variables and their purposes.

Table 29. Built-in shell variables (sh command)

Variable	Purpose
_	(Underscore) For every command that is run as a child of the shell, **sh** sets this variable to the full path name of the executable file and passes this value through the environment to that child process. When processing the MAILPATH variable, this variable holds the value of the corresponding mail file.
~	(Tilde) expands to value of the HOME directory.
_UNIX03	When **_UNIX03** is set to YES, the utilities that have implemented support for the UNIX03 specification will conform to the UNIX03 specification. This variable is only needed when the syntax or behavior of UNIX03 conflicts with the existing implementation. The value YES must be specified in uppercase.
CDPATH	Contains a list of directories for the **cd** command to search. Directory names are separated with colons. CDPATH works like the PATH variable.
COLUMNS	Used by several commands to define the width of the terminal output device.
EDITOR	Enables the corresponding editing mode (see **set** and **shedit**) when using **vi**, **emacs**, or **gmacs**.
ENV	Contains the path name of a setup script that contains commands and aliases. When you invoke **sh** as a login shell, the ENV script is run after the login profiles (`/etc/profile`, `$HOME/.profile`), before the shell accepts commands. For other **sh** invocations, the ENV script is run before the shell accepts commands. It is typically used to define shell options, functions and aliases. **sh** performs parameter substitution on this value and uses the results as the name of a setup script. This script is run in the current shell environment. The ENV variable is usually set in your **.profile**.
ERRNO	Contains the system error number of the most recently failed system call. The shell sets this variable only for errors that occur in the current environment. Assigning a value of `0` to this variable clears it.
FCEDIT	Contains the name of the default editor for the **fc** command. If this variable is not set, the default is the **ed** command.
FPATH	Contains a list of directories that the system searches to find executable functions. Directories in this list are separated with colons. **sh** searches each directory in the order specified in the list until it finds a matching function. If you want the shell to search the working directory, put a dot (.) or a null string in the list of directories (for example, to tell the shell to search the working directory first, start the list with a colon or semicolon).
HISTFILE	Contains the path name of a file to be used as the history file. When the shell starts, the value of this variable overrides the default history file.
HISTSIZE	Contains the maximum number of commands that the shell keeps in the history file. If this variable contains a valid number when the shell starts, it overrides the default of 127.

Table 29. Built-in shell variables (sh command) (continued)

Variable	Purpose
HOME	Contains your home directory.This is also the default directory for the **cd** command. The HOME variable is set automatically from the RACF user profile when the user logs in.
IFS	Contains a series of characters to be used as *internal field separator* characters. Any of these characters can separate arguments in unquoted command substitutions such as `` `command` `` or `$(command)`, or in parameter substitutions. In addition, the shell uses these characters to separate values put into variables with the **read** command. Finally, the first character in the value of IFS separates the positional parameters in `$*` expansion. By default, IFS contains space, tab, and newline.
LANG	Contains the default locale value.
LIBPATH	Used to specify the directory to search for a DLL (Dynamic Link Library) file name. If it is not set, the working directory is searched. For more information, see **dlload** in *z/OS XL C/C++ Runtime Library Reference*. LIBPATH can be updated by the _CEE_ENVFILE or _CEE_ENVFILE_S environment variables. For more information about _CEE_ENVFILE, see *z/OS XL C/C++ Programming Guide*.
LINENO	Contains the number of the line currently being run by a shell script or within a function.
LINES	Used by several commands to define the number of lines on the terminal output device.
LOCPATH	Tells the setlocale()function the name of the directory in the z/OS UNIX file system from which to load locale object files. (localedef produces locale object files by processing locale source files.)
LOGNAME	Contains the user login name. This is set automatically from the RACF user profile when the user logs in.
MAILCHECK	Contains the number of seconds of elapsed time that must pass before the system checks for mail; the default value is 600 seconds. When using the MAIL or MAILPATH variables, the shell checks for mail before issuing a prompt.
MAILPATH	Contains a list of mailbox files. This overrides the MAIL variable. The mailbox list is separated by colons. If any name is followed by **?***message* or **%***message*, **sh** displays the message if the corresponding file has changed. **sh** performs parameter and command substitution on *message*, and the variable _. (temporarily) expands to the name of the mailbox file. If no **?***message* or **%** *message* is present, the default message is `you have mail in $_`.
MANPATH	Contains a list of paths to search for man pages.
MBOX	Contains the path name of your personal mailbox, usually **$HOME/mbox**, used to store messages that have been read from your system mailbox. This variable is usually set in your **.profile**.
NLSPATH	Specifies where the message catalogs are to be found.
OLDPWD	Contains the name of the directory you were previously working in. The **cd** command sets this variable.

Table 29. Built-in shell variables (sh command) (continued)

Variable	Purpose
PATH	Contains a list of directories that the system searches to find executable commands. Directories in this list are separated with colons. **sh** searches each directory in the order specified in the list until it finds a matching executable. If you want the shell to search the working directory, put a dot (.) or a null string in the list of directories (for example, to tell the shell to search the working directory first, start the list with a colon or semicolon). The shell commands directory `/bin` must always be in the list of directories. For more information about specifying the PATH variable, see the topic in *z/OS UNIX System Services User's Guide* on using the PATH variable when customizing the search path for commands.
PPID	Contains the decimal value of the process ID of the parent of the shell. If running in a child shell environment (see "Shell execution environments" on page 628), the **PPID** value is the same as the **PPID** value of the current shell.
PS1	Contains the primary prompt string used when the shell is interactive.The default value is a dollar sign followed by a space (`$ `). The shell expands parameters before the prompt is printed. A single exclamation mark (!) in the prompt string is replaced by the command number from the history list; see the **fc** command. For a real exclamation mark in the prompt, use !!. This variable is usually set in your `.profile`.
PS2	Contains the secondary prompt, or continuation prompt, used when completing the input of such things as reserved-word commands, quoted strings, and here-documents. The default value of this variable is a greater than sign followed by a space (`> `).
PS3	Contains the prompt string used with the **select** reserved word. The default value is a number sign followed by a question mark and a space (`#? `).
PS4	Contains the prefix for traced commands with **set -x**. The default value is a plus sign followed by a space (`+ `).
PWD	Contains the name of the working directory. When the shell starts, the working directory name is assigned to PWD unless the variable already has a value.
RANDOM	Returns a random integer. Setting this variable sets a new seed for the random number generator.
SECONDS	Contains elapsed time. The value of this variable grows by 1 for each elapsed second of real time. Any value assigned to this variable sets the SECONDS counter to that value; initially the shell sets the value to `0`.
SHELL	Contains the full path name of the current shell. It is not set by the shell, but is used by various other commands to invoke the shell. This is set automatically from the RACF user profile when the user logs in.

Table 29. Built-in shell variables (sh command) (continued)

Variable	Purpose
STEPLIB	Identifies a STEPLIB variable to be used in building a process image for running an executable file. A STEPLIB is a set of private libraries used to store a new or test version of an application program, such as a new version of a runtime library. STEPLIB can be set to the values CURRENT or NONE or to a list of MVS data set names. If STEPLIB is not set, it defaults to CURRENT, which passes on the TASKLIB, STEPLIB, or JOBLIB allocations that are part of the invoker's MVS program search order environment to the process image created for an executable file. IBM recommends that STEPLIB be set to NONE, which indicates you do not want a STEPLIB environment for executable files. You can specify up to 255 MVS data set names, separated by colons, as a list of data sets used to build a STEPLIB variable. Refer to *z/OS UNIX System Services Planning* for more information about building a STEPLIB environment.
TMOUT	Contains the number of seconds before user input times out. If user input has not been received within this length of time, the shell ends. The _BPXK_TIMEOUT environment variable allows the timeout value of the job to be overridden on an individual process basis. The system administrator can specify the BPXPRMxx PWT option to honor the SMF job wait time values and to allow specification of the _BPXK_TIMEOUT variable. These settings can be used instead of TMOUT to control when the shell times out. The PWT and _BPXK_TIMEOUT options will also time out commands running in the shell, such as **vi** or **oedit**, providing more control over timing out processes. If the TMOUT variable is set in combination with the BPXPRMxx PWT option or the _BPXK_TIMEOUT variable (or both), then the TMOUT setting is honored for timing out the shell if the TMOUT time value is less than the SMF job wait times.
TMPDIR	Is the path name of the directory being used for temporary files. If it is not set, the z/OS shell uses **/tmp.**
TZ	Contains the system time zone value used for displaying date and time. You can set the TZ variable in your `$HOME/.profile` file used during shell startup. The system administrator can also define a TZ default for all shell users in the `/etc/profile` file. If you are not in the same time zone, you can set TZ yourself. The system administrator can also define TZ for the `/etc/init` process in the `/etc/init.options` file.
VISUAL	Overrides the EDITOR environment variable in setting **vi**, **emacs**, or **gmacs** editing modes (see **shedit**).

Shell variables for automatic conversion

When the shell is redirecting stdin, stdout, or stderr, it will default to no automatic conversion of tagged files, and no tagging of files created by the redirection. The following shell variables will override this behavior:

Table 30. Shell variables for automatic conversion (sh command)

Variable	Purpose
_TAG_REDIR_IN=TXT	Redirected stdin will override the file's text flag (TXTFLAG), treating it as if it were tagged as: TXTFLAG = ON, CCSID = existing file tag CCSID This has no effect if CCSID = 0.
_TAG_REDIR_IN=BIN	Redirected stdin will override the file's TXTFLAG, treating it as if it were tagged as: TXTFLAG = OFF, CCSID = existing file tag CCSID This effectively disables automatic conversion.
_TAG_REDIR_OUT=TXT	Redirected stdout will be tagged as: TXTFLAG = ON, CCSID = program CCSID at the time of the first write (if not already tagged)
_TAG_REDIR_OUT=BIN	Redirected stdout will be tagged as: TXTFLAG = OFF, CCSID = program CCSID at the time of the first write (if not already tagged)
_TAG_REDIR_ERR=TXT	Redirected stderr will be tagged as: TXTFLAG = ON, CCSID = program CCSID at the time of the first write (if not already tagged)
_TAG_REDIR_ERR=BIN	Redirected stderr will be tagged as: TXTFLAG = OFF, CCSID = program CCSID at the time of the first write (if not already tagged)

The automatic conversion shell variable can be specified for one command, or for multiple commands within a shell session or shell script. If the variable is exported, it will affect child shells, that is, nested shell scripts.

Note: Because the standard shell execution performs redirection before variable assignment, the syntax for specifying the shell variable for one command is:

```
(_TAG_REDIR_OUT=TXT; command >file)
```

You can also use these shell variables for commands in a pipeline. For example, they can be used to tag the standard output of each command that is writing to a pipeline or to tag the standard input of each command that is reading from a pipeline.

The _TAG_REDIR_IN shell variable can also be used with here-documents to tag the input that is fed into the associated command.

Shell execution environments

A shell execution environment is the set of conditions affecting most commands run within the shell. It consists of:

- Open files
- The working directory (see **cd**)
- The file creation mask (see **umask**)
- The traps currently set (see **trap**)
- The shell parameters (see **set** and **export**)

- The shell functions currently defined (see Command execution)
- Options (see **set**)

A child shell environmentstarts as a duplicate of the shell environment, except that traps caught by the shell are set to default values in the child shell. Since the child shell environment starts as a duplicate, the value of the ENV environment variable is not run. Changes made to a child shell environment do not affect the shell environment.

Command substitutions (such as *$command*), commands within parentheses (such as (*command*)), and commands to be run asynchronously (such as *command*&)—all run in child shell environments. Each command in a pipeline (such as "*command* | *command*") runs in a child shell environment, unless the **pipecurrent** shell option is in effect. If **pipecurrent** is set on (with **set -o pipecurrent** or **set -P**), then the last command of the pipeline is executed in the current shell environment.

Shell commands also run in a separate environment that does not affect the shell environment, except for certain built-in commands (for example, **cd** and **umask**) that explicitly alter the shell environment. The environment of a shell command is set up by the shell to include the following:

- Open files, subject to redirection.
- Working directory (see **cd**).
- File creation mask (see **umask**).
- Traps; traps caught by the shell are set to default values and traps ignored by the shell are ignored by the command.
- Variables defined inside the shell and having the `export` attribute.

Built-in commands

This topic lists the commands that are built into the shell. Such commands are built into the shell to increase performance of shell scripts or to access the shell's internal data structures and variables. These internal commands are designed to have semantics indistinguishable from external commands.

Built-in commands

:	**chgrp**	**exit**	**let**	**r**	**times**	**whence**
.	**chmod**	**export**	**link**	**read**	**trap**	**writedown**
[	**chown**	**false**	**ln**	**readonly**	**true**	
[[	**comm**	**fc**	**login**	**return**	**type**	
alias	**command**	**fg**	**ls**	**rm**	**typeset**	
autoload	**continue**	**functions**	**mkdir**	**set**	**umask**	
basename	**cp**	**getopts**	**mv**	**shift**	**unalias**	
bg	**du**	**history**	**newgrp**	**stop**	**unlink**	
break	**echo**	**integer**	**print**	**suspend**	**unset**	
cat	**eval**	**jobs**	**printf**	**test**	**unset**	
cd	**exec**	**kill**	**pwd**	**time**	**wait**	

POSIX.2 recognizes a subset of these commands as *special* built-ins. Syntax errors in special built-in commands may cause a shell executing that command to terminate, while syntax errors in regular built-in commands will not cause the shell executing that command to terminate. If a special built-in command encountering a syntax error does not terminate the shell, its exit value is nonzero.

Also, shell variable assignments included on shell command lines that invoke special built-in commands remain in effect after the built-in command completes; this is not the case with regular built-in commands or other utilities.

Special built-in commands					
:	continue	exit	readonly	shift	unset
.	eval	export	return	trap	
break	exec	set	typeset		

As well as built-in commands, the shell has a set of predefined aliases:

Predefined aliases				
autoload	functions	history	nohup	stop
hash	integer	r	suspend	

See **alias** for details.

Shell archives

Software distributed over computer networks such as Usenet is often distributed in a form known as a *shell archive,*In essence, a shell archive is a shell script containing the data of one or more files, plus commands to reconstruct the data files and check that the data was sent correctly. The following shows a sample shell archive:

```
# This is a shell archive.
# It contains the one file "frag.ksh"
# To extract contents, type
# sh file
#
if      [ -f frag.ksh ]
then    echo frag.ksh exists: will not overwrite
else
    echo extracting frag.ksh
    sed 's/^X//' >frag.ksh <<_EOF_
X# This is frag.ksh
X# Not very interesting, really.
Xecho frag.ksh here!
_EOF_
    if [ "`sum frag.ksh|awk '{print $1{'`" != 52575 ]
    then        echo frag.ksh damaged in transit
    fi
fi
```

The following is a simple script to produce as much of the Fibonacci sequence as can be calculated in integers:

```
# Print out Fibonacci sequence; start sequence
# with first two positional parameters:
# default 1 1
typeset -i x=${1:-1{ y=${2:-1} z
while   [ x -gt 0 ]     # until overflow
do
        echo $x
        let z=y+x x=y y=z
done
```

The following implements the **basename** command as a shell function:

```
# basename command as shell function
function basename {
        case $# in
        1)      ;;
        2)      eval set \${1%$2} ;;
        *)      echo Usage:       $0 pathname '[suffix]     '
                return 1 ;;
```

```
        esac
        echo ${1##*/}
        return 0
}
```

Files

sh_history
The default history storage file.

.profile
The user profile for login shell.

/etc/profile
The system-wide profile for login shells.

/tmp/sh*
Temporary files for here-documents, command substitution, history re-execution, and so on. The default directory `/tmp` can be overridden by setting the shell variable TMPDIR to the name of some other directory.

/etc/suid_profile
Used instead of the script specified by the ENV variable (and the `$HOME/.profile` for a login shell) under the privileged option or when the real and effective UIDs are different, or the real and effective GIDs are different.

Localization

sh uses the following localization environment variables:
- LANG
- LC_ALL
- LC_COLLATE
- LC_CTYPE
- LC_MESSAGES
- LC_SYNTAX

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- The shell was invoked with an incorrect option.
- The shell was invoked to run a shell script and the command.
- A command syntax error.
- A redirection error.
- A variable expansion error.

Otherwise, the exit status of the shell defaults to the exit status of the last command run by the shell. This default can be overridden by explicit use of the **exit** or **return** commands.The exit status of a pipeline is the exit status of the last command in the pipeline.

Messages

Ambiguous redirection
A redirection construct expanded to more than one path name.

Argument too long
Any single argument to a command is limited in length (see "Limits" on page 633). Command and parameter substitution may exceed this limit.

Cannot restore privileged state
This message occurs only when the implementation of POSIX does not support the *saved IDs* option (*_POSIX_SAVED_IDS*). The message is generated if you tried to use a saved ID feature to return to a privileged state.

File *file* **already exists**
You are attempting to redirect output into an existing file, but you have turned on the **noclobber** option (see the **set** command). If you really want to redirect output into an existing file, use the construct `>|`*filename*, or turn off the option with:

```
set +o noclobber
```

File descriptor number already redirected
You attempted to redirect a file descriptor that was already being redirected in the same command. You can redirect a file descriptor only once.

Hangup
The shell received a *hangup*signal. This signal typically arises when a communication line is disconnected—for example, when a phone connection is cut off.

In base#number: base must be in [2,36]
In a number of the form `base#number`, the value of the base was larger than 36 or less than 2. The only valid range for bases is from 2 through 36.

Invalid subscript
A shell array was indexed with a subscript that was outside the defined bounds.

Illegal instruction
The shell received an illegal instruction signal. This signal typically occurs when a process tries to execute something that is not a valid machine instruction recognized by the hardware.

Misplaced subscript *array name*
The subscript for an array was missing or incorrect.

name **is not an identifier**
You attempted to use a non-alphanumeric *name*.

*name***: readonly variable**
The given *name* is a read-only variable, and cannot be removed or changed (see **readonly**).

*name***: no expansion of unset variable**
The shell is operating with **set –u**, and you used an unset variable in a substitution. For more information, see the **set** command.

No file descriptor available for redirection
When a file descriptor is redirected, the old value is remembered by the shell by a duplication to yet another file descriptor. The total number of file descriptors is limited by the system; hence, the shell may run out, even though your command appears to be using far fewer than the maximum number of descriptors.

Nested aliases
You have more than nine levels of aliases. For example:

```
alias a1=a2 a2=a3 a3=a4 ... a10=command
```

causes this error.

Pipe for coprocess
The shell cannot create a pipe for a coprocess. This might mean that your session or the system as a whole has already set up its maximum number of pipes.

...: restricted
If the shell has been invoked as a restricted shell, certain things are disallowed—for example, the **cd** command, setting **PATH**, and output redirection.

Temporary file error using here-document
sh tried to create a temporary file holding the contents of a <<*word* here-document. However, the temporary file could not be created. This may indicate a lack of space on the disk where temporary files are created.

Word after ... expanded to more than one argument
In a context where only one argument was expected, a construct expanded to more than one argument.

Limits

The maximum length of an executable file name, including subdirectories and extensions, is 1023 bytes.

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide.

The construct $[*arithmetic expression*] is an extension of the POSIX standard.

Related information

alias, **break**, **cd**, **continue**, **dot**, **echo**, **eval**, **exec**, **exit**, **export**, **fc**, **getopts**, **let**, **print**, **ps**, **pwd**, **read**, **readonly**, **return**, **set**, **shift**, **test**, **time**, **trap**, **true**, **typeset**, **ulimit**, **unalias**, **unset**, **whence**. **shedit**

Appendix I, "Format of the TZ environment variable," on page 1021 explains how to set the local time zone with the TZ environment variable.

shedit — Interactive command and history editing in the shell

Format

set –o *editmode*

EDITOR=*editprog*

VISUAL= *editprog*

Usage notes

POSIX uses a number of keys for such things as *erase* and *kill* processing. By default, the shell leaves command-line editing to POSIX, using these familiar editing keys. However, these functions are not particularly powerful or friendly. As

an alternative, the shell has built-in facilities for interactive command editing and file name generation that not only aid in composing new commands but also make it easy for you to modify and re-execute previous commands. This capability is distinct from that provided by the **fc** command, which passes previous command lines to a separate program for editing. The built-in facilities mimic the **emacs**, **gmacs**, or **vi** screen editors, and enable the following commands (see **set** and **vi** for details).

```
set –o emacs
set –o gmacs
set –o vi
```

These facilities are also enabled (with the corresponding option set) by assigning a value ending in **vi** to the environment variables EDITOR or VISUAL. (See **sh**.)

Unlike full-screen editors, shell editing uses a one-line window, extending from the end of the prompt to the next-to-last column. Multiline history entries are displayed with newlines represented as ^J.

The number of columns on the output device is obtained from the COLUMNS environment variable if defined; otherwise, it is assumed to be 80.

A command line that extends into the rightmost column can be scrolled horizontally. If you try to move the cursor beyond the edge of the window, the line is scrolled to approximately center the cursor in the window. The second last column displays a character marking a scrollable line: < indicates extra data off the left, > indicates extra data off the right, and * indicates extra data off both sides.

emacs/gmacs editing mode

When the **emacs/gmacs** editing mode has been enabled, ordinary printable characters from the keyboard are entered in the command line and echoed. Various control characters introduce command sequences for such things as moving the cursor, scrolling through the command history, and modifying the current command. The only difference between **emacs** and **gmacs** is in the handling of **Ctrl-T**.

The command sequences recognized are listed in functional groups. The notation **Meta–** represents **EscK**, followed by the letter. The terminology is historical. Many commands accept an optional preceding count which is entered in decimal as **Meta-***digits*, or as **Ctrl-**, which multiplies the current count (initially 1) by 4.

List of **cursor movement** combinations:

*n***Ctrl-B**
: Moves the cursor back *n* characters.

*n***Ctrl-F**
: Moves the cursor forward *n* characters.

Ctrl-A Moves the cursor to beginning of line.

Ctrl-E Moves the cursor to end of line.

*n***Meta–b**
: Moves the cursor back to the *n*th previous beginning of word (string of alphanumerics).

*n***Meta–f**
: Moves the cursor forward to *n*th beginning of word.

Ctrl–]*c* Moves the cursor forward to next character *c* on current line.

Meta–*space*
Sets mark at cursor position.

Ctrl-@ Sets mark at cursor position.

Ctrl-x Ctrl-X
Exchanges cursor position and mark.

List of **line search** combinations; these numbers display a different history line.

*n***Ctrl-P**
Selects the *n*th previous command line from history.

*n***Ctrl-N**
Selects the *n*th next command line from history.

Meta–<
Selects the earliest command line from history.

Meta–>
Selects the latest command line from history.

*n***Ctrl-R***stringEnter*
Selects the *n*th previous command line matching *string*. If *n* is zero, then select the next matching command after the current line.

List of **text change** combinations:

n erase Deletes *n* characters to the left of the cursor. This is the erase character.

*n***Backspace**
Deletes *n* characters to the left of the cursor.

*n***Ctrl-H**
Deletes *n* characters to the left of the cursor.

*n***Ctrl-D**
Deletes *n* characters to the right of the cursor. If the current line is empty, the shell is ended.

*n***Meta–Ctrl-H**
Deletes to the *n*th beginning of word before the cursor.

*n***Meta–h**
Deletes to the *n*th beginning of word before the cursor.

*n***Meta-d**
Deletes to the *n*th beginning of word after the cursor.

*n***Ctrl-K**
Deletes from the cursor to the end of line. If *n* is zero, then deletes from the beginning of line to the cursor.

kill Deletes the entire current line. This is the line kill character.

Ctrl-G Deletes the entire current line.

Ctrl-W
Deletes from cursor position to the mark (set with **Meta-***space* or **Ctrl-@**.

Ctrl-T In **emacs** mode, transposes the current character with the previous character and moves the cursor forward. If the cursor is at the end of the line, or in **gmacs** mode, transposes the previous two characters.

Ctrl-Y Restores the last text deleted in **emacs** mode.

Ctrl-C Capitalizes character under cursor.

Ctrl-^ Capitalizes character under cursor.

Meta-c
Capitalizes word to right of cursor.

Meta-l Lowercases word to right of cursor.

Meta-u
Uppercases word to right of cursor.

*n***Meta-.**
Inserts the *n*th word of the previous command. If *n* is not given or it is zero, inserts the last word of the previous command.

*n***Meta-_**
Inserts the *n*th word of the previous command. If *n* is not given or it is zero, inserts the last word of the previous command.

Meta-*
Replaces the current word with the list of files which would match that word with an * appended.

Meta-Esc
Used to complete a path name. If there is only one existing path name that matches as much as you've typed, the path name is completed and a space is added after the complete path name. If there are several matching path names, the shell expands what you've typed by adding all the characters that are common to all matching path names.

Meta-=
Lists all path names matching the current word.

List of **miscellaneous** combinations:

Ctrl-J Executes the current command line.

Ctrl-M
Executes the current command line.

Ctrl-L Re-displays the current command line.

Ctrl-O Remembers the next command line, executes the current command line, then selects the remembered line.

Ctrl-U Multiplies the count on the following command by 4 (for each **Ctrl-U**.

Ctrl-V Displays the version of the shell.

– Takes the next character literally. Thus, you can enter command and control characters in a command line or search string.

eof Terminates the shell. This is the end-of-file character.

Ctrl-D Terminates the shell.

Meta–*n*
Enters a count for the following command.

vi editing mode

When the **vi** editing facilities have been enabled, the shell is initially in input mode after each new prompt. Keyboard input is normally inserted at the current position in the current command line; the exceptions are the following action keys.

erase Deletes the character to the left of the cursor. This is the erase character.

Backspace
Deletes the character to the left of the cursor.

eof Terminates the shell. This is the end-of-file character.

Ctrl-D Terminates the shell.

Ctrl-W
Deletes the word (white-space delimited string) to the left of the cursor.

kill Deletes the current line. This is the line kill character.

Ctrl-X Deletes the current line.

Ctrl-J Deletes the current line.

Ctrl-M
Deletes the current line.

Enter Executes the current line.

Esc Switches from input mode to command mode.

If you press the **Esc** key, the shell enters command mode and keyboard input is interpreted as commands to reposition the cursor, scroll through the command history, delete or change text, or reenter input mode. In command mode, input is not echoed; it is acted upon. Many commands take an optional count, *n*, which is entered as a preceding decimal number (not echoed); the command is executed that number of times. Except where otherwise noted, *n* defaults to 1.

Ctrl-V Takes the next character literally; useful for entering any of these action keys as text.

\ Escapes the following action key. If the next character is any action key except **Ctrl-J**, **Ctrl-M**, or **Enter**, the **–** is erased and the escaped character is entered literally. Otherwise, the **–** is entered and the next character is treated normally.

Cursor movement

These commands reposition the cursor in the command line.

*n***h** Moves back *n* characters.

*n***1** Moves forward *n* characters.

0 Moves to the first character on the line.

^ Moves to the first nonblank character on the line.

$ Moves to the last character on the line.

*n***w** Moves to the beginning of the *n*th next word (string of alphanumerics, or of nonblank nonalphanumerics).

*n***W** Moves to the beginning of the *n*th next fullword (string of nonblanks).

*n***b** Moves to the *n*th previous beginning of word.

*n***B** Moves to the *n*th previous beginning of fullword.

*n***e** Moves to the *n*th next end of word.

*n***E** Moves to the *n*th next end of fullword.

*n***f***c* Moves to the *n*th next character *c*.

*n***F***c* Moves to the *n*th previous character *c*.

*n***t***c* Moves to the character before the *n*th next character *c*.

*n***T***c* Moves to the character after the *n*th previous character *c*.

*n***;** Repeats the previous **f**, **F**, **t**, or **T** command.

*n***,** Repeats the previous **f**, **F**, **t**, or **T** command, but in the opposite direction.

Line search

These commands change the current displayed command line.

*n***j** Selects the *n*th next command line from history.

n+ Selects the *n*th next command line from history.

*n***k** Selects the *n*th previous command line from history.

n– Selects the *n*th previous command line from history.

*n***G** Selects the command with history number *n*, or the latest command if *n* is omitted.

*/string***Enter**
Selects the first command line, searching backwards, that matches *string*. If *string* is omitted, the previous search string is used.

*?string***Enter**
Selects the first command line, searching forwards, that matches *string*. If *string* is omitted, the previous search string is used.

n Repeats the last string search ('/' or '**?**') command.

N Repeats the last string search, but in the opposite direction.

Text change

The following commands alter the text in the current command line. Some of these commands operate on a text block, defined by an immediately following cursor movement command. This is designated by *m* (for *movement*) in the text change command. The text block extends from the current cursor position to the new position determined by the movement command.

i Enters input mode, inserting text before the character under the cursor.

I Inserts before the first nonblank on line **(^i).**

a Moves the cursor forward one character and enter input mode, appending text after the character originally under the cursor.

A Appends to end of line **($a).**

*n***d***m* Deletes text block. If *n* is given, it is applied to the *movement*.

dd Deletes entire command line.

D Deletes from cursor to end of line **(d$).**

*n***x** Deletes *n* characters to right of cursor (*n***dl**).

*n***X** Deletes *n* characters to left of cursor (*n***dh**).

*n***c***m* Change text block; deletes block of text and enters input mode. If *n* is given, it is applied to the *movement*.

cc Change entire command line.

s Change entire command line.

*n***s** Change next *n* characters from cursor.

*n***p** Puts back, after the character under the cursor, *n* copies of the last block deleted by a text change command.

*n***P** Puts back, before the character under the cursor, *n* copies of the last block deleted by a text change command.

r*c* Replaces the single character under the cursor with the character *c*, and advances the cursor one position.

R Enters *replace mode*: a special case of input mode in which each character entered overwrites that under the cursor, and advances the cursor one position.

u Undoes the last text change to the current line. This is itself a text change command, and so acts as a toggle for the last change.

U Undoes all changes to the current line.

n Inverts the case of the next *n* characters, advancing the cursor over them.

*n***.** Repeats the last text change command. If *n* is given, it overrides the count originally given with the repeated command.

*n*_ Appends after the character under the cursor, the *n*th argument from the previous command line (default last), and enter input mode.

* Replaces the current word with the list of file names that matches the word with an * appended. If there is no match, an audible alarm sounds and the word is not changed. Otherwise, the cursor is positioned at the end of the list and input mode is entered.

\ Used to complete a path name. If there is only one existing path name that matches as much as you've typed, the path name is completed and a space is added after the complete path name. If there are several matching path names, the shell expands what you've typed by adding all the characters that are common to all matching path names.

= Lists all path names matching the current word.

Miscellaneous

*n***y***m* Yanks text block into the delete buffer. Does not alter the command line or cursor position, but makes the text block available to subsequent **put** or **p** commands. If *n* is given, it is applied to the movement.

yy Yanks the entire command line.

Y Equivalent to **y$**. Yanks the rest of the line.

Equivalent to **I#Enter**.

*n***v** Executes **fc –e ${VISUAL:–${EDITOR:–vi}}** *n*. If *n* is omitted, the history number of the current line is used.

Ctrl-L Redisplays the current line.

Ctrl-J Executes the current line.

cm Executes the current line.

Enter Executes the current line.

@*letter* Inserts the value of the alias named **_letter**. The symbol *letter* represents a single alphabetic character from the portable character set; implementations may support additional characters as an extension. If the alias **_letter** contains other editing commands, these commands are performed as part of the insertion. If the **_letter** alias is not enabled, this command has no effect.

Limits

Selecting a previous history line for editing while at a secondary prompt (that is, while entering a subsequent line of a new multiline command) yields unexpected results.

Related information

fc, **set**, **sh**, **vi**

shift — Shift positional parameters

Format

shift [*expression*]

tcsh shell: **shift** [*variable*]

Description

shift renames the positional parameters so that *i*+*n*th positional parameter becomes the *i*th positional parameter, where *n* is the value of the given arithmetic *expression*. If you omit *expression*, the default value is 1. The value of *expression* must be between zero and the number of positional parameters (**$#**), inclusive. The value of **$#** is updated.

shift is a special built-in shell command.

In the tcsh shell, without arguments, **shift** discards **argv[1]** and shifts the members of **argv** to the left. It is an error for **argv** not to be set or to have less than one word as value. With *variable*, **shift** performs the same function on *variable*. See "tcsh — Invoke a C shell" on page 689.

Examples

The commands:

```
set a b c d
shift 2
echo $*
```

produce:

```
c d
```

Localization

shift uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure because the *expression* had a negative value or was greater than the number of positional parameters.

Messages

Possible error messages include:

bad shift count *expr*
You specified an expression that did not evaluate to a number in the range from `0` to the number of remaining positional parameters.

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems.

Allowing an expression, rather than just a number, is an extension found in the z/OS UNIX shell.

Related information

set, **sh**, **tcsh**

sleep — Suspend execution of a process for an interval of time

Format

sleep *seconds*

Description

sleep continues running until the specified number of *seconds* has elapsed. **sleep** can delay execution of a program or produce periodic execution in conjunction with shell commands.

The *seconds* argument can be either a number of seconds, or a more general time description of the form *n*h*n*m*n*s, with the *n*h, *n*m, and the s being optional.

Examples

```
sleep 20h10m
```

sleeps for 20 hours and 10 minutes (or 72600 seconds).

Localization

sleep uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

2 Failure because you specified no *seconds* value or because *seconds* is an incorrect argument (for example, incorrect format).

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems.

Related information

date

skulker — Remove old files from a directory

Format

skulker [**–iw**][**–r**|**–R**] [**–l** *logfile*] *directory days_old*

Description

skulker finds files that are candidates for deletion in *directory*, based on comparing the file's access time to the age specified by *days_old*.

When you call **skulker** without any options, the files that are candidates for deletion are regular files found using the primaries as shown in the following **find** command line:

```
find directory -type f -atime +days_old -level 0 ! -name "*'*" ! -name "*
*" -print
```

The preceding **find** command has a deliberate newline inserted as part of the second -name request.

For example, specifying 5 for *days_old* causes the **find** command to find files that are equal to or older than five 24-hour intervals earlier than now.

Restriction: This script ignores path names that contain single quotes or newlines when determining the list of objects that are candidates for deletion.

The **skulker** script (which is a z/OS shell script in **/samples**) should be copied and can be modified to suit your particular needs. Possible locations for placing the script include **/bin** or **/usr/sbin**, especially if **skulker** is to be run from a UID(0) program. If **skulker** is to be run by users, **/usr/bin** is another possibility, but check

that the sticky bit is on in the directory. If the script is called from a privileged user (a superuser, a user with a UID of 0, or a user running with the RACF `trusted` or `privileged` attribute), it is important to protect the script from any modifications by a non-privileged user.

The code page in which a shell script is encoded must match the code page of the locale in which it is run. For a shell script to be shared by multiple users, they must all be in a locale that uses the same code page as the code page in which the shell script is encoded. If you have different users operating in various locales, you need multiple copies of the skulker shell script, one for each different locale code page. You can use the **iconv** command to convert the skulker shell script from one code page to another.

Options

–i Displays the files that are candidates for deletion, and prompts the user to stop or continue with file removal. Do not use this option if you are invoking **skulker** from a **cron** job. If **skulker** is invoked with **–i** from a **cron** job, no files will be deleted. A message will be mailed to the caller, showing the **skulker** output that includes the message “Request canceled".

–l *logfile*
Specifies a *logfile* to store a list of files that have been deleted, are candidates for deletion, or for which warnings have been mailed; and any errors that might have occurred.

–r Moves recursively through subdirectories, finding non-directory files that are equal to or older than the specified number of days. The files that are candidates for deletion are found using the primaries as shown in the following **find** command line:

```
find directory -atime +days_old ! -type d ! -name "*'*" ! -name "*
*" -print
```

The **find** command in the preceding example has a deliberate newline inserted as part of the second -name request.

The **-r** option is mutually exclusive with the **-R** option.

–R Moves recursively through subdirectories, finding both non-directory files and subdirectories that are equal to or older than the specified number of days. Any subdirectories that are found as candidates for deletion are only deleted if they are empty after all their contents (files, subdirectories and files in subdirectories) that are candidates for deletion have been deleted.

The files that are candidates for deletion are found using the primaries as shown in the following find command line:

```
find directory -atime +days_old ! -name directory ! -name "*'*" ! -name "*
*" -print
```

The ! -name *directory* primary prevents **skulker** from deleting the actual directory that was entered as a start point (for example, **/tmp**).

The **find** command in the preceding example has a deliberate newline inserted as part of the third -name request.

The **-R** option is mutually exclusive with the **-r** option.

–w Does not remove files, but sends a warning to the owner of each old file (using **mailx**) that the file is a candidate for deletion.

days_old
Specifies the age of the files you want to remove. For example, if you specify 100 for *days_old*, all files that were last accessed 100 or more days ago are marked as candidates for deletion.

directory
Specifies the directory in which to look for files.

By default, files are removed from the specified directory based on access time and their status as regular files, and are removed only from the directory specified (not from any subdirectories).

Examples

1. To remove all regular files from **/tmp** that were last accessed 100 or more days ago:

```
skulker /tmp/ 100
```

   The trailing slash in **/tmp/** is necessary if **/tmp** is a symbolic link and you want to list or remove files from the directory the link points to, rather than the symbolic link itself. If **/tmp** (or the directory specified) is not a symbolic link, the trailing slash has no effect.

2. To remove all regular files from **/tmp** that were last accessed 11 or more days ago:

```
> ls -lL /tmp
total 48
-rw-------   1 BILLYJC  SHUT           0 Nov 10 06:00 10.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 11 06:00 11.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 12 06:00 12.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 13 06:00 13.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 14 06:00 14.txt
-rw-------   1 SUPERID  SHUT           0 Nov 15 06:00 15.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 16 06:00 16.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 17 06:00 17.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 18 06:00 18.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 19 06:00 19.txt
> date
Mon Nov 29 11:17:20 EST 1999
> skulker -i /tmp/ 11
-rw-------   1 BILLYJC  SHUT           0 Nov 10 06:00 10.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 11 06:00 11.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 12 06:00 12.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 13 06:00 13.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 14 06:00 14.txt
-rw-------   1 SUPERID  SHUT           0 Nov 15 06:00 15.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 16 06:00 16.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 17 06:00 17.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 18 06:00 18.txt
Do you really want to delete these files?  If yes, answer [y|Y].
Any other response cancels your request.
y
Deleting files...
> ls -lL /tmp
total 48
-rw-------   1 SUPERID  SHUT           0 Nov 15 06:00 15.txt
-rw-------   1 BILLYJC  SHUT           0 Nov 19 06:00 19.txt
>
```

   Note that non-superuser BILLYJC (who issued the **skulker** command) was not able to delete the superuser's (SUPERID) file (`15.txt`), even though the **find** command issued from **skulker** returned `15.txt` as a file name to delete.

3. The **skulker** script can be run from a **cron** job. To use the **cron** daemon to run the **skulker** script at 3:15 a.m. every Monday through Friday:

```
> crontab
15 3 * * 1-5 /etc/skulker -l /usr/spool/cron/skulker.log /tmp/ 100
<control-D>
>
```

   This example removes all regular files from **/tmp** that were last accessed 100 or more days ago. By default, **cron** sends the stdout and stderr of the command in a mail message to the user who submitted the **cron** job.

4. To remove all files from **/tmp**, including subdirectories, that were last accessed 30 or more days ago:

```
skulker -R /tmp/ 30
```

Exit values

0 Successful completion

1 Either **skulker** did not find any files that are candidates for deletion, or an error occurred.

2 There was a usage error.

Usage notes

skulker only uses the objects access time to determine which objects are candidates for deletion. If you want to use other criteria such as the modify time or the change time, you can modify your own version of **skulker** to include that criteria. For instance, to modify your version to include the modify time (which, for example, is updated when the object is written to), add the primary

`-mtime +days_old`

to the **find** requests within **skulker**. To include the change time, add the primary

`-ctime +days_old`

to the **find** requests within **skulker**.

Messages

Possible messages include:

directory **is not a directory**
The object specified for *directory* is not a directory object.

find command returned non-zero exit status: *return code*
The **find** command returned a non-zero exit status: *return code*.

Error occurred during remove of *file***. Return code=***return code***.**
The **rm** or **rmdir** command failed with *return code* while attempting to delete *file*.

file **is in use, not removed.**
Some other process was using this file. *file* cannot be removed.

sort — Start the sort-merge utility

Format

sort [**–cmu**] [**–o** *outfile*] [**–t** *char*] [**–y**[*n*]] [**–z***n*] [**–bdfiMnr**] [**–k** *startpos*[,*endpos*]] ... [*file ...*]

sort [**–cmu**] [**–o** *outfile*] [**–t***char*] [**–y***n*] [**–z***n*] [**–bdfiMnr**] [**+***startposition* [**–***endposition*]] ... [*file ...*]

Description

sort implements a full sort-and-merge utility. By default, it sorts according to all the information in the record, in the order given in the record.

sort operates on input files containing records that are separated by the newline character. When you do not specify either the **–c** or **–m** option, **sort** sorts the concatenation of all input files and produces the output on standard output. If you do not specify any files, **sort** reads from the standard input (stdin). If you specify - as one of the file names, **sort** reads from the standard input (stdin).

The following options select particular operations:

–c Checks input files to ensure that they are correctly ordered according to the key position and sort ordering options specified, but does not modify or output the files. This option affects only the exit code.

–m Merges *file*s into one sorted output stream. This option assumes that each input file is correctly ordered according to the other options specified on the command line; you can check this with the **–c** option.

–u Ensures that output records are unique. If two or more input records have equal sort keys, **sort** writes only the first record to the output. When you use **–u** with **–c**, **sort** prints a diagnostic message if the input records have any duplicates.

When you do not specify either the **–c** or the **–m** option, **sort** sorts the concatenation of all input files and produces the output on standard output.

Options

–o *outfile*
Writes output to the file *outfile*. By default, **sort** writes output to the standard output. The output file can be one of the input files. In this case, **sort** makes a copy of the data to allow the (potential) overwriting of the input file.

–t *char* Indicates that the character *char* separates input fields. When you do not specify the **–t** option, **sort** assumes that any number of white space (blank or tab) characters separate fields.

–y[*n***]** Restricts the amount of memory available for sorting to *n* KB of memory (where a KB of memory is 1024 bytes). If *n* is missing, **sort** chooses a reasonable maximum amount of memory for sorting, dependent on the system configuration. **sort** needs at least enough memory to hold five records simultaneously. If you try to request less, **sort** automatically takes enough. When the input files overflow the amount of memory available, **sort** automatically does a polyphase merge (external sorting) algorithm,

which is, of necessity, much slower than internal sorting. *n* must be at least 2. *n* has a maximum value of 1024 and a default value of 56.

When you use **–u** with **–c**, **sort** prints a diagnostic message if the input records have any duplicates. Using the **–y** option may therefore improve sorting performance substantially for medium to large input files.

–z*n* Indicates that the longest input record (including the newline character) is *n* bytes in length. By default, record length is limited to LINE_MAX.

The following options control the way in which **sort** does comparisons between records in order to determine the order in which the records are placed on the output. The ordering options apply globally to all sorting keys except those keys for which you individually specify the ordering option. For more information about sorting keys, see "Sorting keys."

–b Skips, for comparison purposes, any leading white space (blank or tab) in any field (or key specification).

–d Uses *dictionary* ordering. With this option, **sort** examines only blanks, uppercase and lowercase letters, and numbers when making comparisons.

–f Converts lowercase letters to uppercase for comparison purposes.

–i Ignores, for comparison purposes, nonprintable characters.

–k [*startpos* **[,***endpos***]]**
Specifies a sorting key. For more information, see "Sorting keys."

–M Assumes that the field contains a month name for comparison purposes. Any leading white space is ignored. If the field starts with the first three letters of a month name in uppercase or lowercase, the comparisons are in month-in-year order. Anything that is not a recognizable month name compares less than `JAN`.

–n Assumes that the field contains an initial numeric value. **sort** sorts first by numeric value and then by the remaining text in the field according to options.

Numeric fields can contain leading optional blanks or optional minus (-) signs. **sort** does not recognize the plus (+) sign.

This option treats a field which contains no digits as if it had a value of zero. If more than one line contains no digits, the lines are sorted alphanumerically.

–r Reverses the order of all comparisons so that **sort** writes output from largest to smallest rather than smallest to largest.

Sorting keys

By default, **sort** examines entire input records to determine ordering. By specifying sorting keys on the command line, you can tell **sort** to restrict its attention to one or more parts of each record.

You can indicate the start of a sorting key with:

`-k m[.n][options]`

where *m* and the optional *n* are positive integers. You can choose *options* from the set **bdfiMnr** (described previously) to specify the way in which **sort** does

comparisons for that sorting key. Ordering options set for a key override global ordering options. If you do not specify any options for the key, the global ordering options are used.

The number *m* specifies which field in the input record contains the start of the sorting key. The character given with the **–t** option separates input fields; if this option is not specified, spaces or tabs separate the fields. The resulting sort key is from the *m*th field to the end of the record. The number *n* specifies which character in the *m*th field marks the start of the sorting key; if you do not specify *n*, the sorting key starts at the first character of the *m*th field.

If an ending position for a key is not specified, the sorting key extends from the starting position to the end of the input record. You can also specify an ending position for a key, with:

```
-k m[.n][options],p[.q][options]
```

where *p* and *q* are positive integers, indicating that the sort key ends with the with *q*th character of the *p*th field. If you do not specify *q* or if you specify a value of `0` for *q*, the sorting key ends at the last character of the *p*th field. For example:

```
-k 2.3,4.6
```

defines a sorting key that extends from the third character of the second field to the sixth character of the fourth field. The **b** option applies only the key start or key end for which it is specified;

```
-k 2
```

defines a sorting key that extends from the first character of the second field to the end of the record;

```
-k2 2
```

defines a sorting key that extends from the first character of the second field to the last character of the second field.

sort also supports a historical method of defining the sorting key. Using this method, you indicate the start of the sorting key with:

```
+m[.n][options]
```

which is equivalent to:

```
–k m+1[.n+1][options]
```

You can also indicate the end of a sorting key with:

```
–p[.q][options]
```

which when preceded with *+m*[*.n*] is equivalent to:

```
–k m+1[.n+1],p.0[options]
```

if q is specified and is zero. Otherwise,

```
–k m+1[.n+1],p+1[.q][options]
```

For example: +1.2 -3.5 defines a sorting key with a starting position that **sort** finds by skipping the first two characters of the next field and an ending position that **sort** finds by skipping the first three fields and then the first five characters of the next field. In other words, the sorting key extends from the third character of the

second field to the sixth character of the fourth field. This is the same key as defined under the **–k** option, described earlier.

With either syntax, if the end of a sorting key is not a valid position after the beginning key position, the sorting key extends to the end of the input record.

You can specify multiple sort key positions by using several **–k** options or several **+** and **–** options. In this case, **sort** uses the second sorting key only for records where the first sorting keys are equal, the third sorting key only when the first two are equal, and so on. If all key positions compare equal, **sort** determines ordering by using the entire record.

When you specify the **–u** option to determine the uniqueness of output records, **sort** looks only at the sorting keys, not the whole record. (Of course, if you specify no sorting keys, **sort** considers the whole record to be the sorting key.)

Examples

1. To sort an input file having lines consisting of the day of the month, white space, and the month, as in:

   ```
   30 December
   23    MAY
   25 June
   10     June
   ```

   use the command:

   ```
   sort -k 2M -k 1n
   ```

2. To merge two dictionaries, with one word per line:

   ```
   sort –m –dfi dict1 dict2 >newdict
   ```

Environment variables

sort uses the following environment variable:

TMPDIR
Contains the path name of the directory to be used for temporary files.

Files

sort uses the following file:

/tmp/stm*
Temporary files used for merging and **–o** option. You can specify a different directory for temporary files using the TMPDIR environment variable.

Localization

sort uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_NUMERIC**
- **LC_TIME**
- **NLSPATH**

The **–M** option works only if LC_TIME identifies a locale that contains the same month names as the POSIX locale.

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion. Also returned if **–c** is specified and the file is in correctly sorted order.

1 Returned if you specified **–c** and the file is not correctly sorted. Also returned to indicate a non-unique record if you specified **–cu**.

2 Failure due to any of the following:

- Missing key description after **–k**
- More than one **–o** option
- Missing *file* name after **–o**
- Missing character after **–t**
- More than one character after **–t**
- Missing *number* with **–y** or **–z**
- *endposition* given before a *startposition*
- Badly formed sort key
- Incorrect command-line option
- Too many key field positions specified
- Insufficient memory
- Inability to open the output file
- Inability to open the input file
- Error in writing to the output file
- Inability to create a temporary file or temporary file name

Messages

Possible error messages include:

Badly formed sort key position *x*
The key position was not specified correctly. Check the format and try again.

File *filename* **is binary**
sort has determined that *filename* is binary because it found a NULL (' ') character in a line.

Insufficient memory for ...
This error normally occurs when you specify very large numbers for **–y** or **–z** and there is not enough memory available for **sort** to satisfy the request.

Line too long: limit *nn* **— truncated**
Any input lines that are longer than the default number of bytes (LINE_MAX) or the number specified with the **–z** option are truncated.

Missing key definition after -k
You specified **–k**, but did not specify a key definition after the **–k**.

No newline at end of file
Any file not ending in a newline character has one added.

Nonunique key in record ...
With the **–c** and **–u** options, a non-unique record was found.

Not ordered properly at ...
With the **–c** option, an incorrect ordering was discovered.

Tempfile error on ...
The named temporary (intermediate) file could not be created. Make sure that you have a directory named **/tmp**, and that this directory has space to create files. You can change the directory for temporary files using the TMPDIR environment variable.

Tempnam() error
sort could not generate a name for a temporary working file. This should almost never happen.

Temporary file error (no space) for ...
Insufficient space was available for a temporary file. Make sure that you have a directory named **/tmp**, and that this directory has space to create files. You can change the directory for temporary files using the ROOTDIR and TMPDIR environment variables.

Too many key field positions specified
This implementation of **sort** has a limit of 64 key field positions.

Write error (no space) on output
Some error occurred in writing the standard output. Barring write-protected media and the like, this typically occurs when there is insufficient disk space to hold all of the intermediate data.

Portability

POSIX.2, X/Open Portability Guide.

Available on all UNIX systems, with only UNIX System V.2 or later having the full utility described here.

The **–M**, **–y**, and **–z** options are extensions of the POSIX standard.

Related information

awk, **comm**, **cut**, **join**, **uniq**

The **sortgen awk** script is a useful way to handle complex sorting tasks. It originally appeared in *The AWK Programming Language,* by Aho, Weinberger, and Kernighan. The POSIX.2POSIX.2 standard regards the historical syntax for defining sorting keys as obsolete. Therefore, you should use only the **–k** option in the future.

spell — Detect spelling errors in files

Format

spell [**–biluvx**] [**–d** *hashfile*] [**–f** *local*] [**–h** *history*] [**+***local*] [*file ...*]

Restriction: The **spell** utility is fully supported for compatibility with older UNIX systems. However, because it is no longer supported by POSIX.2 IEEE standard 1003.2-1992, this utility should be avoided for applications intended to be portable to other UNIX-branded systems.

Description

spell checks for misspelled words in each specified file. If you do not specify a file, it checks the standard input. A list of potentially misspelled words is produced on standard output.

Words are checked against a local word list and then against a hashed word list. The hashed word list included in this distribution contains virtually no proper names or technical terms. It is assumed that you will enter these words into your local word list (or into your machine's word list). Any capitalized word in the hash list must be capitalized in the input document; all other words are matched either capitalized or not. All word forms, including plurals, must be explicitly included in the hash list. This approach prevents the acceptance of nonsense words that can result from the algorithmic combination of legal roots with legal suffixes or prefixes, a phenomenon common to many other spelling checkers.

Options

–b Uses British spelling (such as “colour” instead of “color”). The dictionary file used is **/usr/lib/hashb** instead of **/usr/lib/hash**.

–d *hashfile*
Uses *hashfile* as the dictionary. *hashfile* is a hash list produced from a list of words using the **-i** option of **spell**. To use a list other than the default **/usr/lib/hash**, the **–d** option must be specified.

–f *local*
Uses the file *local* as a dictionary of local words, given one word per line. If you do not specify this option, the file **/usr/lib/lwords** is used as the local dictionary.

–h *history*
Appends a history of all misspelled words to the file **history**. This file can be used by a system administrator for dictionary maintenance or generating a local dictionary.

–i Creates a new hash list file or add words to an existing file, instead of checking for spelling errors. Words to be entered into the dictionary should be specified one per line with no white space on the line. Lines beginning with the **#** character are ignored as comments. Be sure that the words you are entering into the hash list are correctly spelled.

–l Produces a longer form of output. For each misspelled word, **spell** prints three tab-separated columns containing the misspelled word, the line number, and the file name.

–u Forces **spell** to accept any word that is in all uppercase. **spell** assumes that such words are acronyms.

–v Writes to **stdout** all words not literally in the dictionary. This is the default for this implementation because it doesn't apply suffix/prefix rules to derive words.

–x Writes each plausible word stem to **stdout**. Because this implementation of **spell** doesn't derive words, all words are their own word stems.

+ *local* Uses the file *local* as a dictionary of local words, given one word per line. This is synonymous with **–f**.

Examples

By default, **spell** does not sort the output. This maintains the order and number of occurrences of spelling errors. The following command checks for spelling errors, puts them in dictionary order, removes duplicates, and print them in a multicolumn format:

```
spell file | sort –dfu | c
```

Localization

spell uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Missing *hashfile* name after **–d**
- Missing *history* file name after **–h**
- Missing *local* file name after **–f**
- Inability to open the *local* file
- Receipt of user interrupt
- An error reading the dictionary file

A spelling mistake is not considered an error.

2 Incorrect command-line option

Files

spell uses the following files:

/usr/lib
The default location of user hash files.

/usr/lib/hash
The default dictionary file, in hashed form.

/usr/lib/hashb
The British dictionary file, in hashed form.

/usr/lib/lwords
The default location of the local words file. This need not exist.

Limits

Input lines in the text being checked are restricted to a maximum of 100 characters.

Portability

X/Open Portability Guide, UNIX systems.

The **–d**, **–f**, **–h**, **–i**, **–l**, and **–u** options are extensions of the POSIX standard.

Related information

sort, **vi**

---

split — Split a file into manageable pieces

Format

split [**–a** *n*] [**–l** *n*] [*file* [*prefix*]]
split **–b** *n*[**bkm**] [**–a** *n*] [*file* [*prefix*]]
split [**–***n*] [**–a** *n*] *file* [*prefix*]

Description

split breaks a file up into a set of files. It starts a new file every time it has copied 1000 lines.

split names the files that it creates as a prefix followed by a suffix. `x` is the prefix unless you specify a different *prefix* on the command line. Unless altered by the following options, the suffix begins as `aa` and is incremented with each new file. By default, therefore, the first file is `xaa` followed by `xab`, and so on.

Options

–a *n* Uses a suffix *n* letters long. The default is two.

–b *n*[**bkm**]
Splits the file every *n* units. The default unit size is bytes. When you follow *n* with **b**, **k**, or **m**, **split** uses a corresponding unit size of 512 bytes, 1K (1024 bytes), or 1 megabyte (1 048 576 bytes).

–l *n* Splits the file every *n* lines.

–*n* Is an obsolescent version of the **–l** option.

If the *file* is – (dash) or if no file is specified, **split** reads the standard input (**stdin**).

Localization

split uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:

- Error opening input or output file
- Missing number after **–a**
- Incorrect **–a** option
- Missing byte count after **–b**
- Invalid byte count specification
- Invalid count specification
- Unknown option
- Out of memory for binary split buffer
- Read error on input file
- Write error on output file
- Too many names generated

Portability

POSIX.2 User Portability Extension, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems,

The **b** suffix of the **–b** option is an extension to the POSIX.2POSIX.2 standard.

Related information

csplit

stop — Suspend a process or job

Format

stop [*pid ...*] [*job—identifier ...*]

tcsh shell: **stop** *%job | pid ...*

Description

stop is an alias for **kill –STOP**. Like **kill –STOP**, **stop** sends a SIGSTOP to the process you specify.

For more information, see “kill — End a process or job, or send it a signal” on page 374.

In the tcsh shell, **stop** stops the specified jobs or processes which are executing in the background. *job* can be a number, a string, '', %, + or - . There is no default *job*. Specifying stop alone does not stop the current job. See “tcsh — Invoke a C shell” on page 689.

Options

job-identifier
: Is the job identifier reported by the shell when a process is started with **&**. It is one way to identify a process. It is also reported by the **jobs** command. When using the job identifier with the **stop** command, the job identifier must be prefaced with a percent (%) sign. For example, if the job identifier is 2, the **stop** command would be entered as follows:

```
stop %2
```

pid
: Is the process ID that the shell reports when a process is started with **&**. You can also find it using the **ps** command. The *pid* argument is a number

that can be specified as octal, decimal, or hexadecimal. Process IDs are reported in decimal. **stop** supports negative values for *pid*.

If *pid* is negative but not -1, the signal is sent to all processes whose process group ID is equal to the absolute value of *pid*. The negative *pid* is specified in this way:

```
stop — –nn
```

where *nn* is the process group ID and can have a range of 2 to 7 digits (*nn* to *nnnnnnn*).

```
stop — –9812753
```

The format must include the — before the *–nn* in order to specify the process group ID.

If *pid* is `0`, the signal is sent to all processes in the process group of the invoker.

The process to be killed must belong to the current user, unless that user is the superuser.

Related information

kill, **jobs**, **sh**, **suspend**, **tcsh**

---

strings — Display printable strings in binary files

Format

strings [**–aBoxz**] [**–n** *number*] [**–t** *format*] [**-W** *option*[,*option*]...] [*file ...file ...*]

strings [**–**] [**–Boxz**] [**–t** *format*] [**-W** *option*[,*option*]...] [**–***number*] [*file ...file ...*]

Description

If the command line specifies a file name of –, **strings** reads the standard input. **strings** finds pieces of information in binary files. It is frequently used for looking through executable files to uncover items such as copyright notices, error messages, and undocumented features.

The command displays strings of printable characters that are at least four characters in length. Strings must be terminated by a NUL character or by a newline.

Options

–a This option has no effect in the z/OS environment. The entire file is examined, regardless of whether or not this option is specified.

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–n *number*
Displays strings of printable characters that are at least *number* characters in length. If you do not specify the **–n** option, strings acts as if **–n 4** had been specified.

–o For each string, displays as an octal value its offset in bytes from the beginning of the file. This option is the same as **–t** *o*.

–t *format*
For each string, displays its offset in bytes from the beginning of the file. The base of the offset is set to decimal, octal, or hexadecimal by specifying *format* as *d*, *o*, or *x*, respectively.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

–x For each string, displays as a hexadecimal value its offset in bytes from the beginning of the file. This option is the same as **–t** *x*.

–z Ignores the POSIX definition of a string and searches for any group of printable characters greater than four in length.

– Is the obsolete version of **–a**.

–*number*
Is the obsolete version of **–n** *number*.

Examples

1. To display printable EBCDIC strings in a binary file to the standard output (stdout):

   ```
   strings myBinaryFile
   ```

2. To display printable ASCII strings in a binary file to the standard output (stdout):

   ```
   strings -W filecodeset=ISO8859-1,pgmcodeset=IBM-1047 myBinaryFile
   ```

3. To display printable EBCDIC strings in a binary file, assuming that automatic conversion has been enabled but the binary file is incorrectly tagged as an UTF-8 text file:

   ```
   strings -B myMisTaggedFile
   ```

Localization

strings uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

strings uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Incorrect command-line option
- Insufficient memory
- The code set is not valid
- Could not turn off automatic conversion

- Could not perform requested text conversion

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide.

A Berkeley addition to most UNIX systems. Most Berkeley versions do not require the terminating NUL or newline.

The **–B**, **–o**, **–W**, **–x**, and **–z** options are extensions of the POSIX standard.

strip — Remove unnecessary information from an executable file

Format

strip *file*

Description

On some UNIX systems, **strip** removes debug information from an executable. On z/OS, the debug information can only be removed by recompiling. **strip** does not modify the contents of any executable file; it is functionally equivalent to **touch** *file*.

Localization

strip uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- *file* does not exist or could not be opened.
- The user does not have write permission for *file*
- An error occurred while reading *file*
- *file* is not an executable file
- *file* is executable, but appears corrupted

2 No *file* was specified on the command line

Messages

Possible error messages include:

executable file *file***: No such file or directory**
The input file does not exist. Check that the file name was entered correctly and that it exists.

file *file1***: Not an executable file**
strip only operates on executable files.

Write permission required to strip *file*
The user does not have write permission on the file.

executable file *file***: Permission denied**
The user does not have read permission on the file.

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems.

stty — Set or display terminal options

Format

stty [**–ag**] [*operand*]

Description

stty sets or reports the terminal I/O characteristics for the standard input device. **stty**, entered without options or operands, reports only the terminal I/O characteristics that differ from the defaults. **stty**, entered with *operand*s enables, disables, or selects the full range of terminal I/O characteristics.

The **stty** command affects whichever line discipline is in effect for your terminal.

Options

This command supports the following options:

–a Displays all of the terminal I/O characteristics.

–g Displays all of the terminal I/O characteristics in a format that can be used as input to the **stty** command.

The **–a** option gives you a clear readable description, whereas the **–g** option enables you to save and restore the terminal I/O characteristics.

stty entered with *operand*s enables, disables, or selects the full range of terminal I/O characteristics.

Control mode operands

The valid operands for setting control modes are:

parenb
Enable parity generation and detection. Not valid for z/OS line discipline. **–parenb** is always used. See “Usage notes” on page 666.

–parenb
Disable parity generation and detection.

parodd
Select odd parity. Not valid for z/OS line discipline. **–parodd** is always used. See “Usage notes” on page 666.

–parodd
Select even parity.

cs5 Select character size CS5. Not valid for z/OS line discipline. CS8 is always used. See "Usage notes" on page 666.

cs6 Select character size CS6. Not valid for z/OS line discipline. CS8 is always used. See "Usage notes" on page 666.

cs7 Select character size CS7. Not valid for z/OS line discipline. CS8 is always used. See "Usage notes" on page 666.

cs8 Select character size CS8.

number
Set the input and output baud rates to *number*. A *number* of zero hangs up the modem line.

ispeed *number*
Set the input baud rate to *number*. Not valid for z/OS line discipline. No special processing of zero is done. See "Usage notes" on page 666.

ospeed *number*
Set the output baud rate to *number*. Not valid for z/OS line discipline. No special processing of zero is done. See "Usage notes" on page 666.

hupcl Hang up the modem line on the last close.

–hupcl
Do not hang up the modem line on the last close.

hup Hang up the modem line on the last close.

–hup Do not hang up the modem line on the last close.

cstopb Use two stop bits per character. Not valid for z/OS line discipline. **–cstopb** is always used. See "Usage notes" on page 666.

–cstopb
Use one stop bit per character.

cread Enable the receiver.

–cread Disable the receiver. Not valid for z/OS line discipline. **cread** is always used. See "Usage notes" on page 666.

clocal Assume a line without modem control.

–clocal
Assume a line with modem control.

columns number
Set number of columns to number.

This should only be used if rlogin or telnet client does not support window size, or you are having trouble getting the correct size.

row number
Set number of rows to number.

This should only be used if rlogin or telnet client does not support window size, or you are having trouble getting the correct screen size.

Input mode operands

The valid operands for setting input modes are:

ignbrk
Ignore break on input.

–ignbrk
Do not ignore break on input.

brkint Signal INTR on break.

–brkint
Do not signal INTR on break.

ignpar Ignore parity errors.

–ignpar
Do not ignore parity errors.

parmrk
Mark parity errors.

–parmrk
Do not mark parity errors.

inpck Enable input parity checking.

–inpck
Disable input parity checking.

istrip Strip input characters to seven bits. This feature is required by the standards but IBM strongly recomments that you not use this setting. It will make it impossible to send EBCDIC alphanumeric characters to your shell session and you will have to take extreme measures to terminate the session.

–istrip Do not strip input characters to seven bits. This is the default and should not be changed.

inlcr Map newline to carriage return on input.

–inlcr Do not map newline to carriage return on input.

igncr Ignore carriage return on input.

–igncr Do not ignore carriage return on input.

icrnl Map carriage return to newline on input.

–icrnl Do not map carriage return to newline on input.

iuclc Map uppercase alphabetic characters to lowercase on input.

–iuclc Do not map uppercase alphabetic characters to lowercase on input.

ixon Enable START/STOP output control.

–ixon Disable START/STOP output control.

ixany Allow any character to restart input.

–ixany Do not allow any character to restart input.

ixoff Ask the system to send START/STOP characters to regulate the size of the input queue.

–ixoff Ask the system not to send START/STOP characters to regulate the size of the input queue.

Output mode operands

The valid operands for setting output modes are:

onlcr Converts newline characters to newline-carriage return sequences.

–onlcr Newline characters are displayed as newlines only.

opost Postprocess output.

–opost Do not postprocess output. Ignore all other output modes.

olcuc Map lowercase alphabetic characters to uppercase on output.

–olcuc Do not map lowercase alphabetic characters to uppercase on output.

ocrnl Map CR to NL on output.

–ocrnl Do not map CR to NL on output.

onocr Do not output CR at column 0.

–onocr
Output CR at column 0.

onlret The terminal newline key performs the CR function.

–onlret
The terminal newline key does not perform the CR function.

ofill Use fill characters for delays.

–ofill Use timing for delays.

ofdel Fill characters are DELs.

–ofdel Fill characters are NULs.

cr0 Sets the style of delay for CRs (CRDLY) to CR0.

cr1 Sets the style of delay for CRs (CRDLY) to CR1.

cr2 Sets the style of delay for CRs (CRDLY) to CR2.

cr3 Sets the style of delay for CRs (CRDLY) to CR3.

nl0 Select the style of delay for NL (NDLY) to NL0.

nl1 Select the style of delay for NL (NLDLY) to NL1.

tab0 Sets the style of delay for horizontal tabs (TABDLY) to TAB0.

tab1 Sets the style of delay for horizontal tabs (TABDLY) to TAB1.

tab2 Sets the style of delay for horizontal tabs (TABDLY) to TAB2.

tab3 Sets the style of delay for horizontal tabs (TABDLY) to TAB3.

bs0 Select the style of delay for backspace (BSDLY) to BS0.

bs1 Select the style of delay for backspace (BSDLY) to BS1.

ff0 Select the style of delay for form feeds (FFDLY) to FF0.

ff1 Select the style of delay for form feeds (FFDLY) to FF1.

vt0 Select the style of delay for vertical tabs (VTDLY) to VT0.

vt1 Select the style of delay for vertical tabs (VTDLY) to VT1.

Local mode operands

The valid operands for setting local modes are:

isig Enable character checking against the special control characters INTR, QUIT and SUSP.

–isig Disable character checking against the special control characters INTR, QUIT and SUSP.

icanon
Enable canonical input mode.

–icanon
Disable canonical input mode.

xcase Set canonical uppercase or lowercase presentation.

–xcase Do not set canonical uppercase or lowercase presentation.

iexten Enable any custom special control characters.

–iexten
Disable any custom special control characters.

echo Echo every character typed.

–echo Do not echo every character typed.

echoe Enable the ERASE character to visibly erase the latest character.

–echoe
Do not enable the ERASE character to visibly erase the latest character.

echok Echo newline after a KILL character.

–echok
Do not echo newline after a KILL character.

echonl
Echo newline (even when **echo** is disabled).

–echonl
Do not echo newline when **echo** is disabled.

noflsh Disable flush after INTR, QUIT, and SUSP.

–noflsh
Enable flush after INTR, QUIT, and SUSP.

tostop Send the **SIGTOU** signal for background output.

–tostop
Do not send the **SIGTOU** signal for background output.

Control character operands

In a double-byte environment, the *char* parameter to these operands must be a narrow (singlebyte) character.

The valid operands for assigning special control characters are:

min *number*
Set `min` to *number*.

time *number*
Set `time` to *number*.

eof *char*
Set end of file character to *char*.

eol *char*
Set end of line character to *char*.

erase *char*
Set ERASE character to *char*.

intr *char*
Set INTR character to *char*.

kill *char*
Set KILL character to *char*.

quit *char*
Set QUIT character to *char*.

susp *char*
Set SUSP character to *char*.

start *char*
Set START character to *char*.

stop *char*
Set STOP character to *char*.

Combination mode operands

The valid operands for setting combination modes are:

saved-settings
Set the terminal I/O characteristics to the saved settings produced by the **–g** option.

evenp Enable **parenb** and `cs7`; disable **parodd**. Not valid for z/OS line discipline. See "Usage notes" on page 666.

parity Enable **parenb** and `cs7`; disable **parodd**. Not valid for z/OS line discipline. See "Usage notes" on page 666.

oddp Enable **parenb**, `cs7` and **parodd**. Not valid for z/OS line discipline. See "Usage notes" on page 666.

–parity
Disable **parenb** and set **cs8**. Not valid for z/OS line discipline. See "Usage notes" on page 666.

–evenp
Disable **parenb** and set **cs8**. Not valid for z/OS line discipline. See "Usage notes" on page 666.

–oddp Disable **parenb** and set **cs8**. Not valid for z/OS line discipline. See "Usage notes" on page 666.

raw Enable raw input and output.

–raw or cooked
Disable raw input and output.

nl Enable **icrnl**.

–nl Disable **icrnl**; unset **inlcr** and **igncr**.

lcase Set **xcase**, **iuclc**, and **olcuc**.

–lcase Disable **xcase**, **iuclc**, and **olcuc**.

LCASE
Equivalent to **lcase**.

–LCASE
Equivalent to **–lcase**.

tabs Perserve tabs when printing.

–tabs or tab8
Expand to spaces when printing.

ek Reset ERASE and KILL characters to system defaults.

sane Reset all modes to reasonable values.

Usage notes

1. **stty** will operate successfully even if it is unable to perform one or more actions in a group of requested actions. For example, if a valid z/OS operand is requested with an invalid one, **stty** will operate successfully because it can perform the valid operand. The valid operand will then be satisfied.
2. If **stty** is only used with invalid z/OS operands or invalid operands in combination with valid operands that have already been satisfied, **stty** will fail.

Localization

stty uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Error setting termios attributes
- Unknown mode
- Missing number after option
- Argument out of range
- Bad number after option
- Internal error
- Error reading termios attributes
- Missing character after option
- Badly formed argument option character
- Missing speed after **ispeed** or **ospeed**
- Bad speed argument

Portability

POSIX.2, UNIX System V.

su — Change the user ID associated with a session

Format

su [–] [**–s**][*userid* [*arg ...*]]

Description

su starts a new shell and lets you operate in it with the privileges of a superuser or another user.

If you do not specify a user ID, **su** changes your authorization to that of the superuser. The resulting MVS user ID can be any UID(0) user ID that is in the security product database. The security product returns the first UID(0) user ID that is found; this user ID can change over time as the cached information of the security product is updated.

If you specify a user ID, **su** changes your authorization to that of the specified user ID. The new environment is built and then a new session is initiated. The new session is run as a child shell of the shell issuing the **su** command.

Any arguments specified by *arg* are passed to the child shell, so must be valid invocation flags or arguments that are accepted by the child shell.

su performs these functions:

- **Obtains your user profile information.** After validating that you have an OMVS segment in the user profile, the OMVS segment information is obtained.
- **Verifies authorization.** If a user ID is not specified, you must have the appropriate authorization to obtain superuser authority. You must be permitted to the BPX.SUPERUSER resource in the FACILITY class.

  If a user ID is specified, and you do not have read access to the SURROGAT class profile, BPX.SRV.*uuuuuuuu* (where *uuuuuuuu* is the MVS user ID associated with the target UID), you must enter the target user's password or password phrase when prompted. If a user ID is specified, and you have read access to the SURROGAT class profile for the target user, you can use the **-s** option, or press Enter at the password prompt.
-

  Changes the group ID. If a user ID is specified, the group ID is changed to that of the specified user's default group GID.

  If a user ID is specified, the supplementary group list is changed to that of the specified user.

  If the change of group ID or supplemental group list fails, the **su** command issues a message and continues.
- **Changes the user ID.** Your user ID might be changed to either the specified user ID or the superuser's user ID (UID 0).
  - When a user ID is specified, your MVS identity changes to the specified user ID, changing your access authority for MVS data sets in addition to changing to the new user's UID.
  - When a user ID is not specified, your MVS identity remains the same. This maintains your access authority to MVS data sets, while gaining superuser authority.
  - If you are already running under UID 0 and BPX.DAEMON is defined, issuing **su** with no *userid* will result in your UID being switched to

BPXROOT. If BPX.DAEMON is not defined, and you issue **su** with the *userid* while running under UID 0, your UID will remain set to 0. In both cases, access to the BPX.SUPERUSER resource in the FACILITY class will not be checked.

- **Sets up the shell environment.** If the login shell ('–' flag) is specified, the OMVS segment of the new user is used to set up the shell environment, similar to user login processing. When a user ID is not specified, the new UID(0) user as found by the security product is used. This includes setting the SHELL, HOME, and LOGNAME environment variables. PATH is set to the system default (`/bin`), TERM is preserved from the current environment, and STEPLIB is set to "none". Other environment variables are not inherited by the new shell.

  If the login shell is not specified, the OMVS segment of your user profile is used to set up the shell environment. The environment is set up to be as similar as possible to the environment of the shell issuing the **su** command. Existing values of HOME, LOGNAME, and PATH are preserved. If not set in the current shell environment, HOME and LOGNAME are set from the calling user's profile, and PATH is set to the system default (`/bin`). SHELL is set to calling user's profile value, or the default `/bin/sh`, if not defined.
- **Executes the new shell.** If login shell ('–' flag) is specified, prepend '–' to the shell's name. This indicates that the shell should read its login startup files (for example, `/bin/sh` will read `/etc/profile` and `$HOME/.profile`). The new shell is initialized to run as a child process of the shell issuing the **su** command. If the **su** command is run from a restricted shell (such as a shell that was started with the **–r** option), you will exit from the restricted shell and leave the protection of the trusted environment.

  Note:

  1. The new shell is always run in a new address space, even if you have _BPX_SHAREAS=YES set.
  2. If you use the OMVS interface when running a shell created by **su**, any attempt to execute TSO commands (PF6) results in the command running back in your TSO address space. When these TSO commands run, they run with your TSO identity, not the identity specified by **su**.

     If you are not using the OMVS interface (for example, you rlogin or telnet into the shell), you cannot use PF6 to execute a TSO command. As a result, there will be no TSO address space or identity. The alternative solution is to use **tso –t** or **tsocmd**, which allows you to run a TSO/E command with the current identity set by **su**.

To restore the previous session, enter **exit** or press <EscChar-D> (where EscChar is normally the cent sign). If you use rlogin or telnet to enter the shell, you hold down the Ctrl key while you press D. This action ends the child shell initiated by the **su** command and returns you to the previous shell, user ID, and environment. See *z/OS UNIX System Services User's Guide* for more information about exiting the shell environment.

Options

– Starts the new shell as a login shell. Sets the shell variables SHELL, HOME, and LOGNAME according to the new user's profile, and prepends a '–' to the shell name to indicate that the shell should read its login profiles. When a user ID is not specified, the new UID(0) user as found by the security product is used.

–s Does not prompt for password or password phrase. If a user ID is

specified, you must have read access to the SURROGAT class profile, BPX.SRV.*uuuuuuuu* (where *uuuuuuuu* is the MVS userid associated with the target UID).

Examples

To switch to the admin user ID, but maintain the current user's shell environment:

```
su admin
```

To authorize a user to switch to another user without entering a password or password phrase, grant them RACF SURROGAT authority:

```
RDEFINE SURROGAT BPX.SRV.ADMIN UACC(NONE)
PERMIT BPX.SRV.ADMIN CLASS(SURROGAT) ID(FRED) ACCESS(READ)
SETROPTS RACLIST(SURROGAT) REFRESH
```

Then, from Fred, issue:

```
su -s admin
```

To start a child shell with the login environment of the admin user ID:

```
su - admin
```

To run the `/usr/lib/backupall` script under the admin user ID and return to the parent shell environment when the script completes:

```
su admin /usr/lib/backupall
```

To run a remove shell command under the admin user ID and return to the parent shell environment when the command completes:

```
su admin -c "rm -rf /tmp/"
```

Usage notes

1. The new shell inherits the standard file descriptors from the **su** command, so commands can be piped to the stdin of the new shell and run under the new user.
2. If the OMVS NOECHO option is in effect, your password or password phrase is displayed.
3. Because **su** starts a new interactive shell, it should not be used from a batch interface such as BPXBATCH, unless you provide the commands to be executed under superuser via stdin to the **su** command.
4. After issuing **su -s** in the shell to switch to another user, the new user will not have the authority to issue any commands that require an implicit open() of a tty. This restriction includes calls which invoke the Binder (such as **cp -X** and **c89**) as well as explicit attempts at opening a file descriptor (such as `cat /dev/fd2`). An ICH408I message is written to the console to alert the user of the access violation.

Exit values

0 The command completed successfully

1 The user is not authorized to obtain superuser authority

2 Failure due to any of the following reasons:

- Unable to execute the shell
- The OMVS segment of the user's profile cannot be found
- Unable to set up the superuser environment

3 Failure due to any of the following reasons:
- Incorrect command syntax

Limitations

Only users who have RACF access permission to the superuser class can use **su** without specifying the user ID.

Portability

None. This command is an extension that comes with z/OS UNIX services.

Related information

sh, **ISHELL**

submit — Submit a batch job for background processing

Format

submit [**–jq**] [*filename* ...]

Description

The **submit** command sends a batch job to the primary job entry subsystem (JES) for processing. The *filename* argument can either be a UNIX path name, data set, or input from standard input (stdin).

- If the *filename* argument is a sequential data set, *filename* is specified as:
  ```
  "//'full.data.set.name'"
  ```
- If the *filename* argument is a partitioned data set, *filename* is specified as
  ```
  "//'full.pds.name(member)'"
  ```
  where *member* is the member name of the partitioned data set FULL.PDS.NAME.

If no argument is given, **submit** reads from standard input. When standard input is being used, enter '///' or Ctrl-D to end the input.

If the **submit** command is successful, the job ID of the submitted job and the file name are displayed as part of the output written to standard output, unless modified by the **-j** option.

The JCL must have a job card. If a job card is not present, the **submit** command will fail.

Options

–j Displays only the job ID when the **submit** command is successful.

–q Quiet mode. In quiet mode, all error messages are suppressed and the exit status is preserved.

Examples

1. To submit a job that resides in a z/OS UNIX file:
   ```
   submit buildjcl.jcl
   ```
   Output to standard output:

```
JOB JOB05990 submitted from path 'buildjcl.jcl'
```

2. To submit a job that resides in a partitioned data set:

```
submit "//'POSIX.RTL.UT13.JCL(TESTJCL)'"
```

   Output to standard output:

```
JOB JOB06075 submitted from data set 'POSIX.RTL.UT13.JCL(TESTJCL)'
```

3. To submit a job from standard input, you can specify the following command:

```
cat test.jcl | submit
```

   Output to standard output:

```
 JOB JOB21532 submitted from stdin
```

Exit values

0 All jobs were submitted successfully.
1 One or more jobs were not submitted.
2 Incorrect command-line arguments or options.

Usage notes

1. The **submit** shell command uses the REXX submit function, which is described in *z/OS Using REXX and z/OS UNIX System Services*.

Localization

The **submit** command is not sensitive to a user's locale. It is up to the user to provide input that is acceptable to JES.

Limitations

1. JOBNAME can only be specified from within the JCL.
2. Only fully qualified data set names are accepted.
3. This version of **submit** cannot be run directly from TSO.
4. If multiple job cards are present in a file, **submit** only displays the job ID of the last job submitted within that file.
5. If a PDS member is specified, and the data set exists but the member does not, it produces the following messages to standard output:

```
IRX0250E System abend code 013, reason code 00000024.
IRX0255E Abend in host command execio or address environment routine MVS.
IRX0670E EXECIO error while trying to GET or PUT a record.
```

   submit then attempts to submit an empty job, and produces message FSUMB409 on stderr.
6. Do not include ANSI control characters in data sets (for example, RECFM=FBA) that are submitted to JES because they will not be accepted.

sum — Calculate and display checksums and block counts

Format

sum [**–ciprtT**] [*file...*]

The **sum** utility is fully supported for compatibility with older UNIX systems. However, it is recommended that the **cksum** utility be used instead because it may provide greater functionality and is considered the standard for portable UNIX applications as defined by POSIX.2 IEEE standard 1003.2-1992.

Description

sum calculates and displays a checksum for each input *file*. A checksum is an error-checking technique used by many programs as a quick way to compare files that have been moved from one location to another to ensure that no data has been lost. It also displays the number of 512-byte blocks in each *file*.

If you do not specify any files, or if you specify **–** as the file name, **sum** reads standard input (stdin).

sum differs from **cksum** only in the format of the output.

- When _UNIX03 is YES, the output of **sum** has the space-separated form:
  ```
  checksum blockcount filename
  ```
- When _UNIX03 is unset or not YES, the output of **sum** has the tab-separated form:
  ```
  checksum    blockcount   filename
  ```

If a *file* operand is not specified, the path name and its leading white space is omitted.

Read error messages are controlled by the _UNIX03 variable.

- If **sum** fails with a read error and _UNIX03 is YES, it sends a diagnostic message to standard error, and will not show a checksum for that file.
- If _UNIX03 is unset or not YES, it displays the checksum up to that point and marks the output line with FSUM6199 [read].

sum continues processing files in either case.

All other error messages are sent to standard error.

Options

sum can calculate checksums in a variety of ways. The default checksum algorithm produces a 16-bit unsigned integer resulting from the arithmetic addition of each input byte. This checksum algorithm is not sensitive to byte order.

–c Uses a standard 16-bit cyclical redundancy check (CRC-16).

–i Uses the CCITT standard cyclic redundancy check (CRC-CCITT). Data communications network protocols often use a cyclic redundancy check to ensure proper transmission. This algorithm is more likely to produce a different sum for inputs which differ only in byte order.

–p Uses the POSIX.2 checksum algorithm.

–r Enables the use of an alternate checksum algorithm which has the advantage of being sensitive to byte order.

–t Produces a line containing the total number of blocks of data read, as well as the checksum of the concatenation of the input files.

–T Enables the automatic conversion of tagged files.

Environment variables

- **_UNIX03**

For more information about the effect of _UNIX03 on the **sum** command, see Appendix N, “Shell commands changed for UNIX03,” on page 1039.

Localization

sum uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TYPE**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to open input file
- Error reading the input file
- Error turning off the automatic conversion of the input file

2 Unknown command-line option

Portability

The default checksum algorithm is compatible with UNIX System V.2 and later. The **–r** algorithm is also available on UNIX System V.2 and is the default algorithm for Berkeley and Version 7. The **–c**, **–i**, and **–t** options are not available under UNIX.

Related information

cmp, **cksum**, **diff**, **ls**, **wc**

suspend — Send a SIGSTOP to the current shell

Format

suspend

tcsh shell: **suspend**

Description

suspend is an alias for **stop $$**, where **stop** is an alias of **kill –STOP** and **$$** expands to the current process of the shell. **suspend** sends a **SIGSTOP** to the current shell.

See "kill — End a process or job, or send it a signal" on page 374 for more information.

In the tcsch shell, **suspend** causes the tcsh shell to stop in its tracks, much as if it had been sent a stop signal with ^Z. See "tcsh — Invoke a C shell" on page 689.

Related information

kill, **sh**, **tcsh**

sysvar — Display static system symbols

Format

sysvar *var*

Description

The **sysvar** command allows users to obtain substitution text for system variables that are defined in the IEASYMxx member of SYS1.PARMLIB or in the system IPL parameters. The substitution text is printed to standard output (stdout). This could be used to substitute system variables in shell variables. For example:

```
system_name=$(sysvar SYSNAME)
```

Exit values

0 Successful completion
1 Failure because *var* is not a valid system variable
2 Failure because no *var* was specified

tabs — Set tab stops

Format

tabs [**+m**[*margin*]] [**–T** *term*] [**–** *number*]
tabs [**+m**[*margin*]] [**–T** *term*] **–t** *tablist*
tabs [**+m**[*margin*]] [**–T** *term*] *num1*[,*num2*,...]
tabs [**+m**[*margin*]] [**–T** *term*] *tabspec*

Description

tabs sends a series of characters to the standard output, designed to clear the terminal hardware's tab stops and then set new ones. The characters that are sent depend on the type of terminal you are using.

The first column of your terminal screen is column 1. If you set a tab stop at position *N* and then tab to that position, the next character displayed on the screen appears in column *N+1* of the line (that is, after the tab stop).

tabs may not be able to set the tab stops on some types of terminals. In this situation, it issues an error message and then exits with a status greater than zero. **tabs** with no arguments sets tab stops every 8 positions.

Options

+m[*margin*]
Sets the left margin to *margin*. It defaults to 10 if you do not specify a value. All tab positions are relative to the left margin. To find the actual tab positions, you add the value of *margin* to each tab position.

–T *type*
Indicates the type of terminal you have. The *term* argument is a site-specific name for your terminal type.

If you do not specify **–T**, **tabs** looks for an environment variable named TERM and uses its value for *type*. If TERM is not defined, **tabs** assumes a default terminal type.

–t *tablist*
Sets tab stops as specified by *tablist*. *tablist* consists of one or more positive decimal integers, separated by commas; the numbers in the list should be in strictly increasing order.

If only one number *N* is given, tabs are set every *N* columns. If more than one number is given, tabs are set at those column numbers.

*num1***[,***num2,...***]**
Sets tab stops to the given numbers. The numbers in the list should be positive decimal integers in strictly increasing order. Except for the first number, any number in the list may be preceded by a plus sign (+), in which case the number is considered to be an increment on the previous setting rather than a column position. For example,

```
tabs 4,8,12
tabs 4,+4,+4
```

are equivalent.

tabspec Can be one of **–a**, **–a2**, **–c**, **–c2**, **–c3**, **–f**, **–p**, **–s** or **–u** and sets tab stops at these positions:

–a 1,10,16,36,72

–a2 1,10,16,40,72

–c 1,8,12,16,20,55

–c2 1,6,10,14,49

–c3 1,6,10,14,18,22,26,30,34,38,42,46,50,54,58,62,67

–f 1,7,11,15,19,23

–p 1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61

–s 1,10,55

–u 1,12,20,44

Each *tabspec* is designed for a particular programming language. Assembler uses **–a**,**–a2**, and **–u**. COBOL uses **–c**, **–c2**, and **–c3**. FORTRAN, PL/I, and SNOBOL use **–f**, **–p**, and **–s**, respectively.

–*number*
Sets tab stops every *number* positions along the line. *number* must be a single-digit decimal number. If *number* is zero (**–0**), **tabs** clears all the tab stops and does not set new ones.

Environment variables

tabs uses the following environment variables:
TERM Contains the name of your terminal.
TERMINFO
Contains the path name of the terminfo database.

Localization

tabs uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Missing definition in the terminfo database

2 Usage error

3 Unknown terminal or cannot find the terminfo database

4 Illegal tabs

5 An error occurred

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

The **+m**, **–t**, and *tabspec* arguments are all extensions to the POSIX standard.

The **–t** argument is an extension to the X/Open standard.

Related information

stty

tail — Display the last part of a file

Format

tail [**–B**] [**–f**] [**-W** *option*[,*option*]...] [**–b** | **-c** | **-k** | **-l** | **-m** | **-n** [**±**]*number*] [*file*]

tail [**–B**] [**-W** *option*[,*option*]...] **±**[*number*][**b** | **c** | **k** | **l** | **m** | **n**][**f**] [*file*]

Description

tail without options displays the last ten lines of *file*. The display is useful for seeing the most recent entries in log files and any file where new information is added on the end.

The **tail** command is used with text files. To make a binary file input to the **tail** command, use the **–c** option. If a binary file is input without the **–c** option being specified, the entire file is sent to the screen.

If you do not specify a file, or if you specify - as the file name, **tail** reads from the standard input (stdin).

Options

±*number*
Is either of the following:

+*number*
Skips to line *number* and then displays the rest of the file. For example, `+100` prints from line 100 to the end of the file.

–*number*
Prints *number* lines from the end of the file. For example, `-20` prints the last 20 lines in the file.

You can precede or follow both +*number* and –*number* with one of the following letters to indicate the unit to be used:
- **b**–blocks
- **c**–bytes
- **k**–kilobytes
- **l** or **n**–lines
- **m**–megabytes

The default unit is lines.

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–f Monitors a file as it grows. Every two seconds, **tail** wakes up and prints any new data at the end of the file. This option is ignored if **tail** read from the standard input, and standard input is a pipe.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*

Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

Examples

1. To display the last 10 lines of a text file to the standard output (stdout):

   ```
   tail myTextFile
   ```

2. To display the last line of a text file and then monitor the file for updates (display new data written to the text file):

   ```
   tail -f -n -1  myTextFile
   ```

3. To display the last 200 bytes of a text file containing UTF-8 characters to the standard output (stdout), assuming that:
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are displaying an untagged public text file or a read-only text file):

     ```
     tail -W filecodeset=UTF-8,pgmcodeset=IBM-1047 -c -200 myUtf8File
     ```

4. To display a text file containing EBCDIC characters starting at line 25, assuming that automatic conversion has been enabled but the text file is incorrectly tagged as ASCII:

   ```
   tail -B -n +25 myMisTaggedFile
   ```

Localization

tail uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

tail uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Insufficient memory
- Write error on the standard output (stdout)
- Badly formed line or character count
- Missing number after an option
- Error reopening a file descriptor
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

2 Failure due to an unknown command-line option

Messages

Possible error messages include:

Badly formed line/character count *string*
In an option of the form **–n** *number* or **–***number*, the *number* was not a valid number.

Reopening file descriptor *number*
–f was used to follow a file as it grew. **tail** closed the file associated with the given file descriptor *number* and then tried to open it 2 seconds later. At this point, **tail** found it could not reopen the file for reading, and therefore could not follow the file any longer.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The POSIX standard included only the **–f**, **–c** **±***number*, and **–n** **±***number* options. The use of **b**, **c** and **l** as a **±***number* suffix is considered obsolete. All other options and suffixes are extensions of the POSIX standard.

Related information

cat, **head**, **more**

talk — Talk to another user

Format

talk *address* [*terminal*]

Description

Use the **talk** command to begin a two-way conversation with someone else logged in to the system. It reads from the standard input (stdin).

Options

address
Indicates the user with whom you want to talk. The most common form of *address* is the person's user name (as given by the **who** command), but other formats might be supported.

terminal
An optional identifier for use when the other user is logged in on more than one terminal. The format of the *terminal* identifier is the same as given by **who**.

Environment variables

talk uses the following environment variables:

TERM Contains the name of your terminal.

TERMINFO
Contains the path name of the terminfo database.

Localization

talk uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Usage notes

1. When you issue a **talk** command to request a conversation with another user, the other user receives a message of the form:

   ```
   Message from name
   talk: connection requested by your_address
   talk: respond with: talk your_address
   ```

   To set up the connection, your intended recipient must issue the system command

   ```
   talk your_address
   ```

   which establishes the two-way connection. After this connection has been established, both of you can type simultaneously. **talk** displays incoming messages from the other person in one part of the screen and outgoing messages in another part of the screen.

   Some terminals may not be able to split the screen into parts in this way. Depending on the terminal type, **talk** may try to simulate this effect. However, it may not be possible for both users to enter messages simultaneously. **talk** determines terminal type by looking for an environment variable named

TERM. If this variable exists, **talk** uses its value as a site-specific name giving a terminal type. If TERM doesn't exist, **talk** assumes a default type.

2. The character-erase and line-kill characters work as usual. Typing <Ctrl-L> refreshes both parts of the screen (for example, if some unusual character messes up the display).
3. The interrupt character (for example, <Ctrl-C>) terminates your **talk** session and breaks the connection. When one side breaks the connection, **talk** notifies the other side and exits.
4. The **mesg** command lets you refuse **talk** sessions. With:

   ```
   mesg n
   ```

   you can tell the system that you don't want to be interrupted by **talk** requests. If people try to establish a **talk** session with you, they are denied immediately; you are not informed about such requests. For more details, see **mesg**.

Exit values

The following exit status values are possible:

0 Successfully established and completed a transmission

>0 An error occurred, or you are trying to use **talk** on a terminal that cannot handle the way **talk** uses the screen

Portability

POSIX.2 User Portability Extension, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems.

Related information

mail, **mesg**, **who**, **write**

---

tar — Manipulate the tar archive files to copy or back up a file

Format

tar –cf[#*s***bvwlzOUXS**] *tarfile* [*blocksize*] [**–V** *volpat*] [*file* [**–C** *pathname*] ...]
tar –rf[#*s***bvwlzOUXS**] *tarfile* [*blocksize*] [**–V** *volpat*] [*file* [**–C** *pathname*] ...]
tar –tf[#*s***bvzEOUXS**] *tarfile* [*blocksize*] [**–L** *type*] [**–V** *volpat*] [*file* [**–C** *pathname*] ...]
tar –xf[#*s***AbvwpmozOUXS**] *tarfile* [*blocksize*] [**–V** *volpat*] [*file* [**–C** *pathname*] ...]

Description

tar reads, writes and lists archive files. An *archive file* is a single file containing one or more files, directories, or both. Archive files can be UNIX files or MVS data sets. A file stored inside an archive is called a *component file*; similarly, a directory stored inside an archive is called a *component directory*.

Restrictions: Note the following restrictions:

- MVS data sets cannot be specified for component files.
- **tar** does not support the use of generation data groups (GDGs).

Included with each component file and directory is recorded information such as owner and group name, permission bits, file attributes, and modification time. You

can therefore use a single archive file to transfer a directory structure from one machine to another, or to back up or restore groups of files and directories.

Archives created by **tar** are interchangeable with those created with the **pax** utility. Both utilities can read and create archives in the default format of the other (USTAR for **pax** and TAR for **tar**). To save extended USTAR attributes, the USTAR format (**-U**) must be used with **-X** option. Also the OS390 format can be used using the **-S** option. In general, the USTAR format with **-X** option and OS390 format records the most information and is recommended. Archives are generally named with suffixes such as .pax or .tar (or pax.Z and tar.Z for compressed files), but this is not required.

Table 31. Recommended options for the USTAR format

Intent	Option
To save only standard attributes	**tar -U**
To save all attributes to be restored on z/OS system	**tar -S**
To save all attributes to be restored on z/OS and non-z/OS systems	**tar -UX**

Tip: In order to preserve information such as extended attributes, external links, ACLs, file tag information, and links whose targets exceed 100 characters, either the USTAR format (**-U**) and **-X** option or the OS390 format using the **-S** option must be used. See the **-U** option for selecting the USTAR format. The **-O** and **-X** options and "z/OS-extended USTAR support" on page 548 contain information about enabling and disabling USTAR support.

You cannot use **tar** unless you specify **–f.**

Options

The four forms of the command shown in the syntax represent the main functions of **tar** as follows:

–c Creates an archive. Each named file is written into a newly created archive. Directories recursively include all components. Under the USTAR (**–U**) option, **tar** records directories and other special files in the tape archive; otherwise, it ignores such files. If **–** appears in place of any file name, **tar** reads the standard input for a list of files one per line. This allows other commands to generate lists of files for **tar** to archive.

Tip: In order to preserve information about extended attributes and external links, the USTAR format (**-U**) must be used. Additionally, to preserve ACLs, file tag information, and link names greater than 100 characters, the USTAR format (**-U**) and **-X** option must be used. The OS390 archive format can also be used with the **-S** option to store all the file attributes.

–r Writes the named files to the end of the archive. It is possible to have more than one copy of a file in a tape archive using this method. To use this form of the command with a tape, it must be possible to backspace the tape. Do not specify OS390 format to be appended to non-OS390 format archive or specify non-OS390 format to be appended to OS390 format archive.

Restriction: You cannot specify both the **–r** and the **–z** option at the same time.

–t Displays a table of contents. This option displays the names of all the files in the archive, one per line. If you specify one or more files on the command line, **tar** prints only those file names. The verbose (-v) option can be used to show the attributes of each component. For USTAR or OS390 format archives, the **-L E** option can be used to show the attributes and extended attributes of each component.

–x Extracts files from an archive. **tar** extracts each named file to a file of the same name. If you did not specify any files on the command line, all files in the archive are extracted. This extraction restores all file system attributes as controlled by other options.

You must specify one of the preceding basic options as the first character of an option string. You can add other characters to the option string. You can omit the leading dash on the first option string, but all subsequent options must be preceded with a dash. Other possible options in the option string are:

-A Restores ACL information when used with **–x** option.

-b Sets the number of 512-byte blocks used for tape archive read/write operations to *blocksize*. The *blocksize* argument must be specified, and *blocksize* can be specified only when **b** is in the option string. When reading from the tape archive, **tar** automatically determines the blocking factor by trying to read the largest permitted blocking factor and using the actual number read to be the *blocksize*.

For UNIX compatibility, the largest valid block size is 20 blocks; in USTAR mode, it is 63 blocks.

–C *pathname*
Is an unusual option because it is specified in the middle of your file list. When **tar** encounters a **–C** *pathname* option while archiving files, it changes the working directory (for **tar** only) to *pathname* and treats all following entries in your file list (including another **–C**) as being relative to *pathname*.

–E Although still supported for compatibility with previous versions of **tar**, this option has been replaced by **–L E**.

-f You must specify **-f**. The **-f** option uses the file *tarfile* for the tape archive rather than using the default. The *tarfile* argument must be specified, and *tarfile* can be specified only when **-f** is in the option string. The *tarfile* argument must precede the *blocksize* argument if both are present. If *tarfile* is the character –, then the archive format defaults to USTAR, standard input is used for reading archives, and the standard output is used for writing archives.

-l Writes an error message if all links are not resolved when files are added to the tape archive.

–L *type*
–L displays additional information when listing the contents of an archive. Only one type can be specified per **–L** option. However, **–L** can be specified multiple times. The types that can be displayed are:

A Displays extended ACL (access control list) data.

Specifying **tar –L** *A* does not automatically turn on the verbose table of contents format. You must also specify **–v** to display the chmod settings associated with the file.

For more information about ACLs, see the section on controlling access control lists in *z/OS UNIX System Services Planning* and "tar support for access control lists (ACLs)" on page 686.

E Same as verbose (**–v**) output, but additionally displays extended attributes. See "Output" on page 685 for more information. **–L E** is equivalent to the **tar –E**

T Displays file tag information. Does not automatically turn on the verbose **–v** option but can be used with **–v** or any other combination of table of contents display options. See "Output" on page 685 for more information.

-m Does not restore a file's modification time stamp when extracting it from an archive. The default behavior is to restore the time stamp from information contained in the archive.

-o When writing files to an archive, does not record owner and modes of directories in the archive. If this is specified when extracting from an existing **ar** archive, **tar** does not restore any owner and group information in the archive. The default is to record this information when creating a **tar** archive, and to restore it when extracting from the archive.

–O For USTAR formatted archive, this option turns off the extended USTAR support. **-O** is the default and user needs to use **-X** option to turn on extended USTAR support for USTAR archive.

For more information, see "z/OS-extended USTAR support" on page 548.

-p When extracting, restores the three high-order file permission bits, exactly as in the archive. They indicate the set-user-ID, set-group-ID, and sticky bit. For USTAR formatted archives, **p** also restores, if present, extended attributes and **-A** restores ACLs.

Tip: If **-O** is specified, it overrides **-p** for extended attributes. They will not be restored. **tar** restores the modes exactly as stored in the archive and ignores the UMASK. To use **-p** on UNIX systems, you must have appropriate privileges; **tar** restores the modes exactly as in the archive and ignores the UMASK.

-#s *-#s* is not supported by z/OS UNIX. The default archive file name used by **tar** is **/dev/mt/0m**. This option is the least general way to override this default. For a more general method, see the **-f** option. The file name generated by this option has the form **/dev/mt/#***s*. The # can be any digit between `0` and `7`, inclusive, to select the tape unit. The density selector *s* can be `l` (low), `m` (medium), or `h` (high).

-S Forces **tar** to use the OS390 format, which provides support to save all files attributes by default.

–X For USTAR formatted archives, **–X** enables extended USTAR support. This option has no affect for non-USTAR formatted archives. **tar –X** functions in the following manner:

- During archive writing, **-X** causes **tar** to preserve extended USTAR information.
- During archive listing, **-X** causes **tar** to display extended USTAR information. This is the default; **-O** can be used to disable extended USTAR support.
- During archive reading, **-X** enables **tar** to restore extended USTAR information. This is the default; **-O** can be used to disable extended USTAR support.

The environment variable _OS390_USTAR=Y, also turns on the extended USTAR information

Tip: To restore certain information, the user must also have the appropriate privileges and have specified the corresponding options. For example, you must specify **–p** to restore extended attributes and to restore ACLs.

For more information about extended attributes, see "z/OS-extended USTAR support" on page 548.

-U When creating a new tape archive with the **–c** option, forces **tar** to use the USTAR format. The default format used when creating a new archive is the original UNIX **tar** format. When you do not specify **–c**, **tar** can deduce whether the tape archive is in USTAR format by reading it, so you can use **U** to suppress a warning about USTAR format.

In order to save external links, extended attributes, and file tag information, and ACLs, the extended USTAR format must be used. To turn on the extended USTAR format, the **-U** and **-X** options must be specified. The OS390 format can also be used (**-S** option) to save all the file attributes by default.

-v Displays each file name, along with the appropriate action key letter as it processes the archive. With the **–t** form of the command, this option gives more detail about each archive member being listed and shows information about the members in the same format used by the **ls –l** command. You can also use the **–L** *type* option which provides the ability to display additional information such as extended attributes and file tag information. See "Output" for more information.

–V *volpat*
Provides automatic multivolume support. **tar** writes output to files—the names of which are formatted with *volpat*. Any occurrence of # in *volpat* is replaced by the current volume number. When you invoke **tar** with this option, it prompts for the first number in the archive set, and waits for you to type the number and a carriage return before proceeding with the operation. **tar** issues the same sort of message when a write error or read error occurs on the archive; this kind of error means that **tar** has reached the end of the volume and should go on to a new one.

-w Is used to confirm each operation, such as replacing or extracting. **tar** displays the operation and the file involved. You can then confirm whether you want the operation to take place. Typing in an answer that begins with "y" tells **tar** to do the operation; anything else tells **tar** to go on to the next operation.

-z Reads or writes, or both reads and writes, the tape archive by first passing through a compression algorithm compatible with that of **compress**.

Restriction: You cannot specify both the **–r** option and the **–z** option at the same time.

Output

When the **–v** or **–L E** (or **–E**) option is used with **–t** (table of contents), **tar** produces a verbose table of contents for the archive. The **–L T** option can also be used to additionally, or without the verbose output, display file tag information. The output for **–v** is similar to the output from the **ls –l** command with following exceptions:

- The following notation is used to represent hard, symbolic, and external links:

```
hlink external link to origfile
```

indicates that hlink is a hard link to origfile.

```
slink symbolic link to origfile
```

indicates that slink is a symbolic link to origfile.

```
elink external link to ORIG.FILE
```

indicates that elink is an external link to ORIG.FILE.

- For symbolic and external links, **pax** output always shows a file size of 0.

Refer to the description of **ls** for an explanation of the **ls –v**.

The output from the **–L E** (or **–E**) option has the same format as **–v** and additionally displays a column showing the extended attributes:

a Program runs APF-authorized if linked AC=1

p Program is considered program-controlled

s Program runs in a shared address space

l Program is loaded from the shared library region

Note: l is a lowercase L, not an uppercase i.

– attribute not set

The format of the **tar –L E** (or **–E**) output is variable in length and will be extended as necessary to display additional file characteristics that are not supported by **tar –v** (**ls –l**).

The format of the **tar –L T** output is similar to the output from **chtag –p**. If specified with **–v** or **–L E**, the output will be displayed on the same line of and before the **–v** output. When used without **–v**, only the file tag information and file names are displayed. For example:

```
/tmp> tar -L T -tf asciitagged.tar
m ISO8859-1   T=off text_am
t ISO8859-1   T=on  text_at
- untagged    T=off text_au
```

This option can be used with either **–v** or **–o E** (or both) to display additional verbose output. For example:

```
/tmp> tar -L T -tvf asciitagged.tar
m ISO8859-1  T=off -rw-r--r--  1 SteveS  Kings   9 Apr 30 22:31 text_am
t ISO8859-1  T=on  -rw r--r--  1 SteveS  Kings   9 Apr 30 22:31 text_at
- untagged   T=off -rw-r--r--  1 SteveS  Kings   9 Apr 30 22:06 text_au
```

tar support for access control lists (ACLs)

For **Archive Writing or Creating**:

ACL data is stored in USTAR formatted archives, when **-X** option is used. The OS390 format (**-S** option) also stores the ACL information.

tar –O can be used to disable the creation of special headers. This prevents **tar** from storing ACL data and other nonstandard information such as file tag data and long link names. However, there is no option to disable storing of ACL data only.

For **Archive Reading or Restoring:**

By default, ACL data will not be restored when reading or restoring files from an archive. However, for USTAR and OS390 formatted archives, you can use **tar –A** to restore ACL data.

For **Archive Listing (Table of Contents):**

For verbose output (**tar –v**), **+** is added to the end of the file permission bits for all files with extended ACLs. For example, *file2* and *dir1* have extended ACL entries:

```
> tar -tvf acldata.tar
-rwx------   1 STIERT   SHUT      294912 Nov  9 09:57 file1
-rwx------+  1 STIERT   SHUT      294912 Nov  9 09:57 file2
drwxr-xr-x+  2 STIERT   SHUT        8192 Mar 20  2000 dir1/
```

For more information about access control lists, see *z/OS UNIX System Services Planning*.

Usage notes

1. Use the **pax** command if you need to use multibyte patterns when searching for file names.
2. The POSIX 1003.1 standard defines formats for **pax** and **tar** archives that limit the length of the target of a link file to 100 characters or less.

   Note: In the case of a hard link, the target is the first occurrence of the hard link which is archived. Subsequent hard links refer to the first instance. Beginning with OS/390® Release 6, **pax** and **tar** provide extended USTAR support and the OS390 format that allows these links to be preserved when creating an archive and restored when reading an archive. See "z/OS-extended USTAR support" on page 548 for more information.
3. The POSIX 1003.1 standard defines formats for **pax** and **tar** archives that limit the size of a file that can be stored in a **pax** and **tar** archive to less than 8 gigabytes in size. If a file being archived is 8 gigabytes or greater, an error message is issued, and the file is skipped. The command continues, but will end with a nonzero exit status.
4. On the z/OS system, superuser privileges or read access to the appropriate FACILITY classes are required to create character special files, to restore user and group names, and to set certain extended attributes.
5. Path names in the tape archive are normally restricted to a maximum length of 100 bytes. However, in USTAR (-U) and OS390(-O) format, path names can be up to 255 bytes long.
6. When transferring archives between z/OS systems and other UNIX systems, note the following:
   a. File transfers (for example, using OPUT/OGET or ftp put/get) must be done using binary or image format. This is true, even for archives consisting only of text files.
   b. You might need to convert text files from EBCDIC to ASCII (or some other character set). You can use the **iconv** utility to convert files before or after archiving. When text files are being created or extracted, you can use the **pax –o** option to convert them.
7. Automatic conversion on files with file tag information is disabled when:
   - Reading files during creation of an archive
   - During writes while extracting files from an archive

That is, the settings of system and environment variables that turn automatic conversion on and off will have no affect on **tar**'s reading and writing of files. **pax** supports file tag options which support conversion of files based on their file tag settings.

Examples

1. The following command takes a directory and places it in an archive in compressed format:

   ```
   tar –cvzf archive directory
   ```

2. To identify all files that have been changed in the last week (7 days), and to archive them to the **/tmp/posix/testpgm** file, enter:

   ```
   find /tmp/posix/testpgm –type f –mtime –7 | tar –cvf testpgm.tar –
   ```

   –type –f tells **find** to select only files. This avoids duplicate input to **tar**.

3. In the following examples, archive **acidata.tar** contains file1, file2, and dir1. *file1* has no ACL data, *file2* has an access ACL, and *dir1* contains a file default, a directory default, and an access ACL. If you only specify option **–f**, your output will be:

   ```
   > tar -f acldata.tar
   file1
   file2
   dir1
   ```

   If you also specify **–L** *A*, ACL information will be displayed:

   ```
   > tar -L A -f acldata.tar
   file1
   file2
   user:WELLIE2:rw-
   group:SYS1:rwx
   ```

   Finally, if you add the verbose option, **–v**, you will see the chmod settings associated with the file:

   ```
   > tar -L A -vf acldata.tar
   -rwx------   1 STIERT   SHUT      294912 Nov  9 09:57 file1
   -rwx------+  1 STIERT   SHUT      294912 Nov  9 09:57 file2
   user:WELLIE2:rw-
   group:SYS1:rwx
   drwxr-xr-x+  2 STIERT   SHUT        8192 Mar 20  2000 dir1/
   user:RRAND:rwx
   user:WELLIE2:rw-
   group:SHUT:rwx
   fdefault:user:RRAND:rwx
   fdefault:group:SHUT:r-x
   default:user:ANGIEH:rwx
   default:group:SYS1:r--
   ```

Localization

tar uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Incorrect option
- Incorrect command-line arguments
- Out of memory
- Compression error
- Failure on extraction
- Failure on creation

Portability

4.2BSD

The **–U** option is an extension to provide POSIX USTAR format compatibility. The **–p** option is a common extension on BSD UNIX systems that is not available on UNIX System V systems. The **–O**, **–X**, and **–S** options are also extensions of POSIX standard.

Related information

cpio, **pax**

Also see the **pax** file format description in Appendix H, "File formats," on page 1003 for more information.

tcsh — Invoke a C shell

Format

tcsh [**–bcdeFfimnqstvVxX**]

tcsh –l

Note: **–l** is a lowercase L, not an uppercase i.

Description

The tcsh shell is an enhanced but completely compatible version of the Berkeley UNIX C shell, tcsh. It is a command language interpreter usable both as an interactive login shell and a shell script command processor. It includes a command-line editor, programmable word completion, spelling correction, a history mechanism, job control, and a C-like syntax.

You can invoke the shell by typing an explicit **tcsh** command. A login shell can also be specified by invoking the shell with the **–l** option as the only argument.

A login shell begins by executing commands from the system files `/etc/csh.cshrc` and `/etc/csh.login`. It then executes commands from files in the user's home directory: first `~/.tcshrc`, then `~/.history` (or the value of the *histfile* shell variable), then `~/.login`, and finally `~/.cshdirs` (or the value of the **dirsfile** shell variable). The shell reads `/etc/csh.login` after `/etc/csh.cshrc`.

Non-login shells read only `/etc/csh.cshrc` and `~/.tcshrc` or `~/.cshrc` on invocation.

Commands like **stty**, which need be run only once per login, typically go in the user's `~/.login` file.

In the normal case, the shell begins reading commands from the terminal, prompting with >. The shell repeatedly reads a line of command input, breaks it into words, places it on the command history list, and then parses and executes each command in the line. See "Command execution" on page 708.

A user can log out of a tcsh shell session by typing `^D`, **logout**, or **login** on an empty line (see **ignoreeof** shell variable), or via the shell's autologout mechanism. When a login shell terminates, it sets the *logout* shell variable to normal or automatic as appropriate, then executes commands from the files `/etc/csh.logout` and `~/.logout`.

Note: The names of the system login and logout files vary from system to system for compatibility with different csh variants; see "tcsh files" on page 731.

Restriction: If the tagged script is being run with automatic conversion enabled, the code page of the locale must be SBCS.

Options

If the first argument (argument 0) to the tcsh shell is - (hyphen), then it is a login shell. You can also specify the login shell by invoking the tcsh shell with the **–l** as the only argument.

The z/OS UNIX System Services tcsh shell accepts the following options on the command line:

–b Forces a break from option processing, causing any further shell arguments to be treated as non-option arguments. The remaining arguments will not be interpreted as shell options. This can be used to pass options to a shell script without confusion or possible subterfuge.

–c Reads and executes commands stored in the command shell (this option must be present and must be a single argument). Any remaining arguments are placed in the *argv* shell variable.

–d Loads the directory stack from `~/.cshdirs` whether or not it is a login shell.

–e Terminates shell if any invoked command terminates abnormally or yields a nonzero exit status.

–i Invokes an interactive shell and prompts for its top-level input, even if it appears to not be a terminal. Shells are interactive without this option if their inputs and outputs are terminals.

–l Invokes a login shell. Only applicable if **–l** is the only option specified.

Note: **–l** is a lowercase L not an uppercase i.

–m Loads `~/.tcshrc` even if it does not belong to the effective user.

–n Parses commands but does not execute them. This aids in debugging shell scripts.

–q Accepts SIGQUIT and behaves when it is used under a debugger. Job control is disabled.

–s Take command input from the standard input.

–t Reads and executes a single line of input. A \ (backslash) can be used to escape the newline at the end of this line and continue onto another line.

–v Sets the **verbose** shell variable so command input is echoed after history substitution.

–V Sets the **verbose** shell variable even before executing **~/.tcshrc**.

–x Sets the **echo** shell variable so commands are echoed immediately before execution.

–X Is to **–x** as **–V** is to **–v**.

After processing of option arguments, if arguments remain but none of the **–c**, **–i**, **–s**, or **–t** were given, the first argument is taken as the name of a file of commands, or script , to be executed. The shell opens this file and saves its name for possible resubstitution by $0. Since many systems use shells whose shell scripts are not compatible with this shell, the tcsh shell uses such a **standard** shell to execute a script whose character is not a #, that is, which does not start with a comment.

Remaining arguments are placed in the *argv* shell variable.

tcsh shell editing

In this topic, we first describe the Command-Line Editor. We then discuss Completion and Listing and Spelling Correction which describe two sets of functionality that are implemented as editor commands but which deserve their own treatment. Finally, the Editor Commands topic lists and describes the editor commands specific to the tcsh shell and their default bindings.

Command-line editor

Command-line input can be edited using key sequences much like those used in GNU Emacs or vi. The editor is active only when the edit shell variable is set, which it is by default in interactive shells. The **bindkey** built-in command can display and change key bindings. Emacs-style key bindings are used by default, but **bindkey** can change the key bindings to vi-style bindings.

The shell always binds the arrow keys to:
down down-history
up up-history
left backward-char
right forward-char

unless doing so would alter another single-character binding. To prevent these bindings, set the arrow key escape sequences to the empty string with **settc**.

Other key bindings are, for the most part, what **emacs** and **vi** users would expect and can easily be displayed by **bindkey**, so there is no need to list them here. Likewise, **bindkey** can list the editor commands with a short description of each.

Note: Editor commands do not have the same notion of a *word* as does the tcsh shell. The editor delimits words with any nonalphanumeric characters not in the shell variable wordchars. The tcsh shell recognizes only white space and some of the characters with special meanings to it, listed in “Command syntax” on page 699.

Completion and listing

The tcsh shell is often able to complete words when given a unique abbreviation. Type part of a word (for example **ls** */usr/lost*) and press the tab key to run the **complete-word** editor command. The shell completes the file name **/usr/lost** to **/usr/lost+found/**, replacing the incomplete word with the complete word in the input buffer. (Note the terminal / (forward slash); completion adds a / to the end of completed directories and a space to the end of other completed words, to speed typing and provide a visual indicator of successful completion. The *addsuffix* shell variable can be unset to prevent this.) If no match is found (for example, **/usr/lost+found** doesn't exist), the terminal bell rings. If the word is already complete (for example, there is a **/usr/lost** on your system, or you were thinking too far ahead and typed the whole thing), a / or space is added to the end if it isn't already there.

Completion works anywhere in the line, not just at the end; completed text pushes the rest of the line to the right. Completion in the middle of a word often results in leftover characters to the right of the cursor which need to be deleted.

Commands and variables can be completed in much the same way. For example, typing **em** *[tab]* would complete 'em' to 'emacs' if **emacs** were the only command on your system beginning with 'em'. Completion can find a command in any directory in the path or if given a full path name. Typing **echo** *$ar[tab]* would complete '$ar' to '$argv' if no other variable began with 'ar'.

The shell parses the input buffer to determine whether the word you want to complete should be completed as a file name, command or variable. The first word in the buffer and the first word following ';', '|', '|&', '&&' or '||' is considered to be a command. A word beginning with '$' is considered to be a variable. Anything else is a file name. An empty line is completed as a file name.

You can list the possible completions of a word at any time by typing ^D to run the **delete-char-or-list-or-eof** editor command. The tcsh shell lists the possible completions using the **ls-F** built-in and reprints the prompt and unfinished command line, for example:

```
> ls /usr/l['^D]
lbin/ lib/ local/ lost+found/
> ls /usr/l
```

If the *autolist* shell variable is set, the tcsh shell lists the remaining choices (if any) whenever completion fails:

```
> set autolist
> nm /usr/lib/libt[tab]
libtermcap.a@ libtermlib.a@
> nm /usr/lib/libterm
```

If *autolist* is set to *ambiguous*, choices are listed only if multiple matches are possible, and if the completion adds no new characters to the name to be matched.

A file name to be completed can contain variables, your own or others' home directories abbreviated with ~ (tilde; see File name substitution) and directory stack entries abbreviated with = (equal; see “Directory stack substitution” on page 707). For example:

```
> ls ~k[^D]
kahn kas kellogg
> ls ~ke[tab]
> ls ~kellogg/
```

```
or

> set local = /usr/local
> ls $lo[tab]
> ls $local/[^D]
bin/ etc/ lib/ man/ src/
> ls $local/
```

Variables can also be expanded explicitly with the **expand-variables** editor command.

delete-char-or-list-or-eof only lists at the end of the line; in the middle of a line it deletes the character under the cursor and on an empty line it logs one out or, if **ignoreeof** is set, does nothing. M-^D, bound to the editor command **list-choices**, lists completion possibilities anywhere on a line, and **list-choices** (or any one of the related editor commands which do or don't delete, list and log out, listed under **delete-char-or-list-or-eof**) can be bound to ^D with the **bindkey** built-in command if so desired.

The **complete-word-fwd** and **complete-word-back** editor commands (not bound to any keys by default) can be used to cycle up and down through the list of possible completions, replacing the current word with the next or previous word in the list.

The tcsh shell variable **fignore** can be set to a list of suffixes to be ignored by completion. Consider the following:

```
> ls
Makefile condiments.h~ main.o side.c
README main.c meal side.o
condiments.h main.c~
> set fignore = (.o \~)
> emacs ma[^D]
main.c main.c~ main.o
> emacs ma[tab]
> emacs main.c
```

'main.c~' and 'main.o' are ignored by completion (but not listing), because they end in suffixes in **fignore**. \ is needed in front of ~ to prevent it from being expanded to **home** as described under File name substitution. **fignore** is ignored if only one completion is possible.

If the **complete** shell variable is set to *enhance*, completion: 1.) ignores case and 2.) considers periods, hyphens and underscores ('.', '-' and '_') to be word separators and hyphens and underscores to be equivalent.

If you had the following files:

```
comp.lang.c comp.lang.perl comp.std.c++
comp.lang.c++ comp.std.c
```

and typed **mail -f** *c.l.c[tab]*, it would be completed to **mail -f** *comp.lang.c*, and ^D would list comp.lang.c and comp.lang.c++. **mail -f** *c..c++[^D]* would list comp.lang.c++ and comp.std.c++. Typing **rm** *a--file[^D]* in the following directory

```
A_silly_file a-hyphenated-file another_silly_file
```

would list all three files, because case is ignored and hyphens and underscores are equivalent. Periods, however, are not equivalent to hyphens or underscores.

Completion and listing are affected by several other tcsh shell variables: *recexact* can be set to complete on the shortest possible unique match, even if more typing might result in a longer match. For example:

```
> ls
fodder foo food foonly
> set recexact
> rm fo[tab]
```

just beeps, because 'fo' could expand to 'fod' or 'foo', but if we type another 'o',

```
> rm foo[tab]
> rm foo
```

the completion completes on 'foo', even though 'food' and 'foonly' also match. **autoexpand** can be set to run the **expand-history** editor command before each completion attempt, and **correct** can be set to complete commands automatically after one hits 'return'. **matchbeep** can be set to make completion beep or not beep in a variety of situations, and **nobeep** can be set to never beep at all. **nostat** can be set to a list of directories and patterns which match directories to prevent the completion mechanism from stat(2)ing those directories.

Note: The completion operation succeeds, but faster. The setting of **nostat** is evident when using the **listflags** variable. For example:

```
>set listflags=x>
ls-F /u/pluto
Dir1/exe1*
>set nostat=(/u/pluto/)
>ls-F /u/pluto
Dir1exe1
>
```

Although, you must be careful when setting **nostat** to keep the trailing / (forward slash).
listmax and **listmaxrows** can be set to limit the number of items and rows (respectively) that are listed without asking first. **recognize_only_executables** can be set to make the shell list only executables when listing commands, but it is quite slow.

Finally, the **complete** built-in command can be used to tell the shell how to complete words other than file names, commands and variables. Completion and listing do not work on glob-patterns (see File name substitution), but the **list-glob** and **expand-glob** editor commands perform equivalent functions for glob-patterns.

Spelling correction

The tcsh shell can sometimes correct the spelling of file names, commands and variable names as well as completing and listing them.

Individual words can be corrected for spelling with the **spell-word** editor command (typically bound to M-s and M-S where M = Meta Key or escape (ESC) key) and the entire input buffer with **spell-line** (typically bound to M-$). The **correct** shell variable can be set to 'cmd' to correct the command name or 'all' to correct the entire line each time return is typed.

When spelling correction is invoked in any of these ways and the shell thinks that any part of the command line is misspelled, it prompts with the corrected line:

```
> set correct = cmd
> lz /usr/bin
CORRECT>ls /usr/bin (y|n|e|a)?
```

where one can answer 'y' or space to execute the corrected line, 'e' to leave the uncorrected command in the input buffer, 'a' to abort the command as if ^C had been pressed, and anything else to execute the original line unchanged.

Spelling correction recognizes user-defined completions (see the **complete** built-in command). If an input word in a position for which a completion is defined resembles a word in the completion list, spelling correction registers a misspelling and suggests the latter word as a correction. However, if the input word does not match any of the possible completions for that position, spelling correction does not register a misspelling.

Like completion, spelling correction works anywhere in the line, pushing the rest of the line to the right and possibly leaving extra characters to the right of the cursor.

Spelling correction is not guaranteed to work the way one intends, and is provided mostly as an experimental feature.

Editor commands

bindkey lists key bindings and **bindkey -l** lists and briefly describes editor commands. Only new or especially interesting editor commands are described here. See **emacs** and **vi** for descriptions of each editor's key bindings.

The character or characters to which each command is bound by default is given in parentheses. ^*character* means a control character and M-*character* a meta character, typed as escape-character on terminals without a meta key. Case counts, but commands which are bound to letters by default are bound to both lower- and uppercase letters for convenience.

complete-word
: Completes a word as described in Completion and listing.

complete-word-back
: Like **complete-word-fwd**, but steps up from the end of the list.

complete-word-fwd
: Replaces the current word with the first word in the list of possible completions. can be repeated to step down through the list. At the end of the list, beeps and reverts to the incomplete word.

complete-word-raw
: Like **complete-word**, but ignores user-defined completions.

copy-prev-word
: Copies the previous word in the current line into the input buffer. See also **insert-last-word**.

dabbrev-expand
: Expands the current word to the most recent preceding one for which the current is a leading substring, wrapping around the history list (once) if necessary. Repeating **dabbrev-expand** without any intervening typing changes to the next previous word etc., skipping identical matches much like **history-search-backward** does.

delete-char (not bound)
Deletes the character under the cursor. See also **delete-char-or-list-or-eof**.

delete-char-or-eof (not bound)
Does **delete-char** if there is a character under the cursor or **end-of-file** on an empty file. See also **delete-char-or-list-or-eof**.

delete-char-or-list (not bound)
Does **delete-char** if there is a character under the cursor or list-choices at the end of the line. See also **delete-char-or-list-or-eof**.

delete-char-or-list-or-eof (^D)
Does **delete-char** if there is a character under the cursor, **list-choices** at the end of the line or **end-of-file** on an empty line. See also **delete-char-or-eof**, **delete-char-or-list** and **list-or-eof**.

down-history
Like **up-history**, but steps down, stopping at the original input line.

end-of-file
Signals an end of file, causing the tcsh shell to exit unless the **ignoreeof** shell variable is set to prevent this. See also **delete-char-or-list-or-eof**.

expand-history (M-space)
Expands history substitutions in the current word. See History substition. See also **magic-space**, **toggle-literal-history**, and the **autoexpand** shell variable.

expand-glob(^X-*)
Expands the glob-pattern to the left of the cursor. For example:

```
>ls test*[^X-*]
```

would expand to

```
>ls test1.c test2.c
```

if those were the only two files in your directory that begin with 'test'. See File name substitution.

expand-line (not bound)
Like **expand-history**, but expands history substitutions in each word in the input buffer.

expand-variables (^X-$)
Expands the variable to the left of the cursor. See Variable substitution.

history-search-backward (M-p, M-P)
Searches backwards through the history list for a command beginning with the current contents of the input buffer up to the cursor and copies it into the input buffer. The search string can be a glob-pattern (see File name substitution) containing '*', '?', '[]' or '{}'. **up-history** and **down-history** will proceed from the appropriate point in the history list. Emacs mode only. See also **history-search-forward** and **i-search-back**.

history-search-forward(M-n, M-N)
Like **history-search-backward**, but searches forward.

i-search-back (not bound)
Searches backward like **history-search-backward**, copies the first match into the input buffer with the cursor positioned at the end of the pattern, and prompts with 'bck: ' and the first match. Additional characters can be typed to extend the search. **i-search-back** can be typed to continue searching with the same pattern, wrapping around the history list if

necessary, (**i-search-back** must be bound to a single character for this to work) or one of the following special characters can be typed:

^W Appends the rest of the word under the cursor to the search pattern.

delete (or any character bound to backward-delete-char)
Undoes the effect of the last character and deletes a character from the search pattern if appropriate.

^G If the previous search was successful, aborts the entire search. If not, goes back to the last successful search.

escape Ends the search, leaving the current line in the input buffer.

Any other character not bound to **self-insert-command** terminates the search, leaving the current line in the input buffer, and is then interpreted as normal input. In particular, a carriage return causes the current line to be executed. Emacs mode only. See also **i-search-fwd** and **history-search-backward**.

i-search-fwd
Like i-search-back, but searches forward.

insert-last-word (M-_)
Inserts the last word of the previous line (!$) into the input buffer. See also **copy-prev-word**.

list-choices (M-D)
Lists completion possibilities as described under Completion and listing. See also **delete-char-or-list-or-eof**.

list-choices-raw (^X-^D)
Like **list-choices**, but ignores user-defined completions.

list-glob (^X-g, ^X-G)
Lists (via the **ls-F**) matches to the glob-pattern (see File name substitution) to the left of the cursor.

list-or-eof (not bound)
Does **list-choices** or **end-of-file** on an empty line. See also **delete-char-or-list-or-eof**.

magic-space (not bound)
Expands history substitutions in the current line, like **expand-history**, and appends a space. **magic-space** is designed to be bound to the spacebar, but is not bound by default.

normalize-command (^X-?)
Searches for the current word in PATH and, if it is found, replaces it with the full path to the executable. Special characters are quoted. Aliases are expanded and quoted but commands within aliases are not. This command is useful with commands which take commands as arguments, for example, **dbx** and **sh -x**.

normalize-path (^X-n, ^X-N)
Expands the current word as described under the *expand* setting of the **symlinks** shell variable.

overwrite-mode (unbound)
Toggles between input and overwrite modes.

run-fg-editor (M-^Z)
Saves the current input line and looks for a stopped job with a name equal to the last component of the file name part of the EDITOR or VISUAL environment variables, or, if neither is set, ed or vi. If such a job is found, it is restarted as if **fg %job** had been typed. This is used to toggle back and forth between an editor and the shell easily. Some people bind this command to ^Z so they can do this even more easily.

run-help (M-h, M-H)
Searches for documentation on the current command, using the same notion of **current command** as the completion routines, and prints it. There is no way to use a pager; **run-help** is designed for short help files. Documentation should be in a file named *command*.help, *command*.1, *command*.6, *command*.8 or *command*, which should be in one of the directories listed in the HPATH enviroment variable. If there is more than one help file only the first is printed.

self-insert-command (text characters)
In insert mode (the default), inserts the typed character into the input line after the character under the cursor. In overwrite mode, replaces the character under the cursor with the typed character. The input mode is normally preserved between lines, but the **inputmode** shell variable can be set to *insert* or *overwrite* to put the editor in that mode at the beginning of each line. See also **overwrite-mode**.

sequence-lead-in (arrow prefix, meta prefix, ^X)
Indicates that the following characters are part of a multi-key sequence. Binding a command to a multi-key sequence really creates two bindings: the first character to **sequence-lead-in** and the whole sequence to the command. All sequences beginning with a character bound to **sequence-lead-in** are effectively bound to **undefined-key** unless bound to another command.

spell-line (M-$)
Attempts to correct the spelling of each word in the input buffer, like **spell-word**, but ignores words whose first character is one of '-', '!', '^' or '%', or which contain '\', '*' or '?', to avoid problems with switches, substitutions and the like. See Spelling correction.

spell-word (M-s, M-S)
Attempts to correct the spelling of the current word as described under Spelling correction. Checks each component of a word which appears to be a path name.

toggle-literal-history (M-r, M-R)
Expands or unexpands history substitutions in the input buffer. See also **expand-history** and the **autoexpand** shell variable.

undefined-key (any unbound key)
Beeps.

up-history (up-arrow, ^P)
Copies the previous entry in the history list into the input buffer. If **histlit** is set, uses the literal form of the entry. Can be repeated to step up through the history list, stopping at the top.

vi-search-back (?)
Prompts with ? for a search string (which can be a glob-pattern, as with **history-search-backward**), searches for it and copies it into the input buffer. The bell rings if no match is found. Hitting return ends the search

and leaves the last match in the input buffer. Hitting escape ends the search and executes the match. vi mode only.

vi-search-fwd (/)
Like **vi-search-back**, but searches forward.

which-command (M-?)
Does a **which** (built-in command) on the first word of the input buffer. **which** displays the command that is executed by the shell after substitutions and path searching. The displayed command has passed access checks by the security product based on the effective ids of the user.

Command syntax

The tcsh shell splits input lines into words at blanks and tabs. The special characters '&', '|', ';', '<', '>', '(', and ')' and the doubled characters '&&', '||', '<<' and '>>' are always separate words, whether or not they are surrounded by white space.

When the tcsh shell's input is not a terminal, the character '#' is taken to begin a comment. Each # and the rest of the input line on which it appears is discarded before further parsing.

A special character (including a blank or tab) can be prevented from having its special meaning, and possibly made part of another word, by preceding it with a backslash (\) or enclosing it in single (**'**), double (**"**) or backward (' ` ') quotation marks. When not otherwise quoted a newline preceded by a \ is equivalent to a blank, but inside quotes this sequence results in a newline.

Furthermore, all substitutions (see “Substitutions” on page 700) except history substitution can be prevented by enclosing the strings (or parts of strings) in which they appear with single quotation marks or by quoting the crucial characters (for example, '$' or ' `' for variable substitution or command substitution respectively) with \. (alias substitution is no exception: quoting in any way any character of a word for which an alias has been defined prevents substitution of the alias. The usual way of quoting an alias is to precede it with a backslash.) History substitution is prevented by backslashes but not by single quotation marks. Strings quoted with double or backward quotation marks undergo Variable substitution and Command substitution, but other substitutions are prevented.

Text inside single or double quotation marks becomes a single word (or part of one). Metacharacters in these strings, including blanks and tabs, do not form separate words. Only in one special case (see Command substitution) can a double-quoted string yield parts of more than one word; single-quoted strings never do. Backward quotes are special: they signal command substitution, which might result in more than one word.

Quoting complex strings, particularly strings which themselves contain quoting characters, can be confusing. Remember that quotes need not be used as they are in human writing. It might be easier to quote not an entire string, but only those parts of the string which need quoting, using different types of quoting to do so if appropriate.

The **backslash_quote** shell variable can be set to make backslashes always quote \, **'**, and **"**. This might make complex quoting tasks easier, but it can cause syntax errors in csh (or tcsh) scripts.

Substitutions

This topic describes the various transformations the tcsh shell performs on input in the order in which they occur. The topic will cover data structures involved and the commands and variables which affect them. Remember that substitutions can be prevented by quoting as described in "Command syntax" on page 699.

History substitution

Each command, or **event**, input from the terminal is saved in the history list. The previous command is always saved, and the **history** shell variable can be set to a number to save that many commands. The **histdup** shell variable can be set to not save duplicate events or consecutive duplicate events.

Saved commands are numbered sequentially from 1 and stamped with the time. It is not typically necessary to use event numbers, but the current event number can be made part of the prompt by placing an exclamation point (!) in the **prompt** shell variable.

The shell actually saves history in expanded and literal (unexpanded) forms. If the **histlit** shell variable is set, commands that display and store history use the literal form.

The **history** built-in command can print, store in a file, restore and clear the history list at any time, and the **savehist** and **histfile** shell variables can be set to store the history list automatically on logout and restore it on login.

History substitutions introduce words from the history list into the input stream, making it easy to repeat commands, repeat arguments of a previous command in the current command, or fix spelling mistakes in the previous command with little typing and a high degree of confidence.

History substitutions begin with the character !. They can begin anywhere in the input stream, but they do not nest. The ! can be preceded by a \ to prevent its special meaning; for convenience, a ! is passed unchanged when it is followed by a blank, tab, newline, = or (. History substitutions also occur when an input line begins with ^. The characters used to signal history substitution (! and ^ (caret)) can be changed by setting the **histchars** shell variable. Any input line which contains a history substitution is printed before it is executed.

A history substitution can have an **event specification**, which indicates the event from which words are to be taken, a **word designator**, which selects particular words from the chosen event, and a **modifier**, which manipulates the selected words.

An event specification can be

n A number, referring to a particular event

–n An offset, referring to the even *n* before the current event

The current event. This should be used carefully in csf, where there is no check for recursion. tcsh allows 10 levels of recursion.

! The previous event (equivalent to **-**1)

s The most recent event whose first word begins with the string *s*

?*s*? The most recent event which contains the string *s*. The second ? can be omitted if it is immediately followed by a newline.

For example, consider this bit of someone's history list:

```
9 8:30 nroff -man wumpus.man
10 8:31 cp wumpus.man wumpus.man old
11 8:36 vi wumpus.man
12 8:37 diff wumpus.man.old wumpus.man
```

The commands are shown with their event numbers and time stamps. The current event, which we have not typed in yet, is event 13. !11 and !-2 refer to event 11. !! refers to the previous event, 12. !! can be abbreviated ! if it is followed by a : (colon). !n refers to event 9, which begins with *n*. !?old? also refers to event 12, which contains *old*. Without word designators or modifiers history references simply expand to the entire event, so we might type !cp to redo the copy command or !!|more if the **diff** output scrolled off the top of the screen.

History references can be insulated from the surrounding text with braces if necessary. For example, !vdoc would look for a command beginning with *vdoc*, and, in this example, not find one, but !{v}doc would expand unambiguously to vi wumpus.mandoc. Even in braces, history substitutions do not nest.

While csh expands, for example, !3d to event 3 with the letter d appended to it, tcsh expands it to the last event beginning with 3d; only completely numeric arguments are treated as event numbers. This makes it possible to recall events beginning with numbers. To expand !3d as in csh say !\3d.

To select words from an event we can follow the event specification by a : (colon) and a designator for the desired words. The words of an input line are numbered from 0, the first (typically command) word being 0, the second word (first argument) being 1, etc. The basic word designators are:

0 The first command word

n The *n*th argument

^ The first argument, equivalent to 1

$ The last argument

% The word matched by an ?*s*? search

x-y A range of words

–y Equivalent to 0–y

***** Equivalent to ^–$, but returns nothing if the event contains only 1 word

x* Equivalent to *x-$*

x- Equivalent to *x**, but omitting the last word ($)

Selected words are inserted into the command line separated by single blanks. For example, the **diff** command in the previous example might have been typed as **diff** *!!:1.old !!:1*(using :1 to select the first argument from the previous event) or **diff** *!-2:2 !-2:1*to select and swap the arguments from the **cp** command. If we didn't care about the order of the **diff** we might have said **diff** *!-2:1-2*or simply **diff** *!-2:**. The **cp** command might have been written **cp** *wumpus.man !#:1.old*, using # to refer to the current event. !n:- hurkle.man would reuse the first two words from the **nroff** command to say **nroff -man** *hurkle.man*.

The : separating the event specification from the word designator can be omitted if the argument selector begins with a '^', '$', '*', '%' or '-'. For example, our **diff** command might have been **diff** *!!^.old !!^* or, equivalently, **diff** *!!$.old !!$*. However, if !! is abbreviated !, an argument selector beginning with - (hyphen) will be interpreted as an event specification.

A history reference can have a word designator but no event specification. It then references the previous command. Continuing our **diff** example, we could have said simply **diff** *!^.old !^*or, to get the arguments in the opposite order, just **diff** *!**.

The word or words in a history reference can be edited, or **modified**, by following it with one or more modifiers, each preceded by a : (colon):

h Remove a trailing path name component, leaving the head.

t Remove all leading path name components, leaving the tail.

r Remove a file name extension .xxx, leaving the root name.

e Remove all but the extension

u Uppercase the first lowercase letter.

l Lowercase the first uppercase letter.

s/l/r Substitute *l* for *r*. *l* is simply a string like *r*, not a regular expression as in the eponymous **ed** command. Any character can be used as the delimiter in place of /; a \ can be used to quote the delimiter inside *l* and *r*. The character & in the *r* is replaced by *l*; \ also quotes &. If *l* is empty (""), the *l* from a previous substitution or the *s* from a previous ?*s*? event specification is used. The trailing delimiter can be omitted if it is immediately followed by a newline.

& Repeat the previous substitution

g Apply the following modifier once to each word.

a Apply the following modifier as many times as possible to a single word. 'a' and 'g' can be used together to apply a modifier globally. In the current implementation, using the 'a' and 's' modifiers together can lead to an infinite loop. For example, :as/f/ff/ will never terminate. This behavior might change in the future.

p Print the new command line but do not execute it.

q Quote the substituted words, preventing further substitutions.

x Like **q**, but break into words at blanks, tabs and newlines.

Modifiers are applied only to the first modifiable word (unless 'g' is used). It is an error for no word to be modifiable.

For example, the **diff** command might have been written as **diff** *wumpus.man.old !#^:r*, using :r to remove *.old* from the first argument on the same line (!#^). We could say **echo** *hello out there*, then **echo** *!*:u* to capitalize 'hello', **echo** *!*:au* to say it out loud, or **echo** *!*:agu* to really shout. We might follow **mail -s** *"I forgot my password" rot* with *!:s/rot/root* to correct the spelling of 'root' (but see Spelling correction for a different approach).

There is a special abbreviation for substitutions. ^, when it is the first character on an input line, is equivalent to *!:s^*. Thus, we might have said *^rot^root* to make the spelling correction in the previous example. This is the only history substitution which does not explicitly begin with !.

In csh as such, only one modifier can be applied to each history or variable expansion. In tcsh, more than one can be used, for example

```
% mv wumpus.man /usr/man/man1/wumpus.1
% man !$:t:r
man wumpus
```

In csh, the result would be *wumpus.1:r*. A substitution followed by a colon might need to be insulated from it with braces:

```
> mv a.out /usr/games/wumpus
> setenv PATH !$:h:$PATH
Bad ! modifier: $.
> setenv PATH !{-2$:h}:$PATH
setenv PATH /usr/games:/bin:/usr/bin:.
```

The first attempt would succeed in csh but fails in tcsh, because tcsh expects another modifier after the second colon instead of $.

Finally, history can be accessed through the editor as well as through the substitutions just described. The following commands search for events in the history list and compile them into the input buffer:

- **up-history**
- **down-history**
- **history-search-backward**
- **history-search-forward**
- **i-search-back**
- **i-search-fwd**
- **vi-search-back**
- **vi-search-fwd**
- **copy-prev-word**
- **insert-last-word**

The **toggle-literal-history** editor command switches between the expanded and literal forms of history lines in the input buffer. **expand-history** and **expand-line** expand history substitutions in the current word and in the entire input buffer respectively.

Alias substitution

The shell maintains a list of aliases which can be set, unset, and printed by the **alias** and **unalias** commands. After a command line is parsed into simple commands (see “Command execution” on page 708) the first word of each command, left-to-right, is checked to see if it has an alias. If so, the first word is replaced by the alias. If the alias contains a history reference, it undergoes history substitution as though the original command were the previous input line. If the alias does not contain a history reference, the argument list is left untouched.

Thus if the alias for **ls** were **ls -l** the command **ls** */usr*would become **ls -l** */usr*, the argument list here being undisturbed. If the alias for **lookup** were **grep** *!^ /etc/passwd* then **lookup bill** would become **grep** *bill /etc/passwd*. Aliases can be used to introduce parser metasyntax. For example, **alias print** *'pr \!* | lpr'* defines a **command** (**print**) which prints its arguments to the line printer.

Alias substitution is repeated until the first word of the command has no alias. If an alias substitution does not change the first word (as in the previous example) it is flagged to prevent a loop. Other loops are detected and cause an error.

Some aliases are referred to by the shell; see “tcsh built-in commands” on page 716.

Variable substitution

The tcsh shell maintains a list of variables, each of which has as value a list of zero or more words. The values of tcsh shell variables can be displayed and changed with the **set** and **unset** commands. The system maintains its own list of "environment" variables. These can be displayed and changed with **printenv**, **setenv** and **unsetenv**.

Variables can be made read-only with **set -r**. Read-only variables cannot be modified or unset; attempting to do so will cause an error. Once made read-only, a variable cannot be made writable, so **set -r** should be used with caution. Environment variables cannot be made read-only.

Some variables are set by the tcsh shell or referred to by it. For instance, the **argv** variable is an image of the shell's argument list, and words of this variable's value are referred to in special ways. Some of the variables referred to by the tcsh shell are toggles; the shell does not care what their value is, only whether they are set or not. For instance, the **verbose** variable is a toggle which causes command input to be echoed. The **-v** command line option sets this variable. Special shell variables lists all variables which are referred to by the shell.

Other operations treat variables numerically. The @ (at) command permits numeric calculations to be performed and the result assigned to a variable. Variable values are, however, always represented as (zero or more) strings. For the purposes of numeric operations, the null string is considered to be zero, and the second and subsequent words of multiword values are ignored.

After the input line is aliased and parsed, and before each command is executed, variable substitution is performed keyed by $ characters. This expansion can be prevented by preceding the $ with a \ except within double quotation marks (") where it always occurs, and within single quotation marks (') where it never occurs. Strings quoted by backward quotation marks or accents (`) are interpreted later (see Command substitution) so $ substitution does not occur there until later, if at all. A $ is passed unchanged if followed by a blank, tab, or end-of-line.

Input/output redirections are recognized before variable expansion, and are variable expanded separately. Otherwise, the command name and entire argument list are expanded together. It is thus possible for the first (command) word (to this point) to generate more than one word, the first of which becomes the command name, and the rest of which become arguments.

Unless enclosed in double quotation marks (") or given the :q modifier the results of variable substitution can eventually be command and file name substituted. Within ", a variable whose value consists of multiple words expands to a (portion of a) single word, with the words of the variable's value separated by blanks. When the :q modifier is applied to a substitution the variable will expand to multiple words with each word separated by a blank and quoted to prevent later command or file name substitution.

The following metasequences are provided for introducing variable values into the shell input. Except as noted, it is an error to reference a variable which is not set.

$*name***[***selector***]**

${*name***[***selector***]}**
Substitutes only the selected words from the value of name. The selector is subjected to $ substitution and can consist of a single number or two numbers separated by a - (hyphen). The first word of a variable's value is numbered 1. If the first number of a range is omitted it defaults to 1. If the last member of a range is omitted it defaults to *$#name*. The selector * selects all words. It is not an error for a range to be empty if the second argument is omitted or in range.

$0 Substitutes the name of the file from which command input is being read. An error occurs if the name is not known.

$*number*

${*number***}**
Equivalent to $argv[*number*].

$* Equivalent to $argv, which is equivalent to $argv[*].

The : (colon) modifiers described in History substition, except for :p, can be applied to the Variable substitution. More than one can be used. Braces might be needed to insulate a variable substitution from a literal colon just as with history substitution; any modifiers must appear within the braces. The following substitutions cannot be modified with : modifiers.

$?*name*

${?*name***}**
Substitutes the string `1` if *name* is set, `0` if it is not.

$0 Substitutes the name of the file from which command input is being read. An error occurs if the name is not known.

$?0 Substitutes `1` if the current input file name is known, `0` if it is not. Always `0` in interactive shells.

$#*name* **or ${#***name***}**
Substitutes the number of words in *name*.

**$#** Equivalent to '$#argv'.

$*%name*

${*%name***}**
Substitutes the number of characters in name.

$*%number*

${*%number***}**
Substitutes the number of characters in $argv[number].

$? Equivalent to $status.

$$ Substitutes the (decimal) process number of the (parent) shell.

$! Substitutes the (decimal) process number of the last background process started by this shell.

$< Substitutes a line from the standard input, with no further interpretation thereafter. It can be used to read from the keyboard in a shell script. While csh always quotation marks $<, as if it were equivalent to $<:q, tcsh does

not. Furthermore, when tcsh is waiting for a line to be typed the user can type an interrupt to interrupt the sequence into which the line is to be substituted, but csh does not allow this.

The editor command **expand-variables**, normally bound to ^X-$, can be used to interactively expand individual variables.

The remaining substitutions are applied selectively to the arguments of tcsh built-in commands. This means that portions of expressions which are not evaluated are not subjected to these expansions. For commands which are not internal to the tcsh shell, the command name is substituted separately from the argument list. This occurs very late, after input-output redirection is performed, and in a child of the main shell.

Command substitution

Command substitution is indicated by a command enclosed in ' ' '. The output from such a command is broken into separate words at blanks, tabs and newlines, and null words are discarded. The output is variable and command substituted and put in place of the original string.

Command substitutions inside double quotation marks (") retain blanks and tabs; only newlines force new words. The single final newline does not force a new word in any case. It is thus possible for a command substitution to yield only part of a word, even if the command outputs a complete line.

File name substitution

If a word contains any of the characters '*', '?', '[' or '{' or begins with the character '~' it is a candidate for file name substitution, also known as **globbing**. This word is then regarded as a pattern (glob-pattern), and replaced with an alphabetically sorted list of file names which match the pattern.

In matching file names, the character **.** (period) at the beginning of a file name or immediately following a / (forward slash), as well as the character / must be matched explicitly. The character * matches any string of characters, including the null string. The character ? matches any single character. The sequence [...] matches any one of the characters enclosed. Within [...], a pair of characters separated by - matches any character lexically between the two.

Some glob-patterns can be negated: The sequence [^...] matches any single character not specified by the characters and ranges of characters in the braces.

An entire glob-pattern can also be negated with ^:

```
> echo *
bang crash crunch ouch
> echo ^cr*
bang ouch
```

Glob-patterns which do not use '?', '*', or'[]' or which use '{}' or '^' are not negated correctly.

The metanotation **a{b,c,d}e** is a shorthand for abe ace ade. Left-to-right order is preserved: **/usr/source/s1/{oldls,ls}.c** expands to /usr/source/s1/oldls.c **/usr/source/s1/ls.c**. The results of matches are sorted separately at a low level to preserve this order, such as, like the following example, where **../{memo,*box}**

might expand to **../memo ../box ../mbox**. (Note that 'memo' was not sorted with the results of matching '*box'.) It is not an error when this construct expands to files which do not exist, but it is possible to get an error from a command to which the expanded list is passed. This construct can be nested. As a special case the words {, } and {} are passed undisturbed. The character ~ at the beginning of a file name refers to home directories. Standing alone, for example, ~, it expands to the invoker's home directory as reflected in the value of the home shell variable. When followed by a name consisting of letters, digits and - (hyphen) characters the shell searches for a user with that name and substitutes their home directory; thus **~ken** might expand to **/usr/ken** and **~ken/chmach** to **/usr/ken/chmach**. If the character ~ is followed by a character other than a letter or / or appears elsewhere than at the beginning of a word, it is left undisturbed. A command like **setenv** *MANPATH /usr/man:/usr/local/man:~/lib/man* does not, therefore, do home directory substitution as one might hope. It is an error for a glob-pattern containing '*', '?', '[' or '~', with or without '^', not to match any files. However, only one pattern in a list of glob-patterns must match a file (so that, for example, rm *.a *.c *.o would fail only if there were no files in the current directory ending in '.a', '.c', or '.o'), and if the nonomatch shell variable is set a pattern (or list of patterns) which matches nothing is left unchanged instead of causing an error.

The **noglob** shell variable can be set to prevent file name substitution, and the **expand-glob** editor command, normally bound to ^X-*, can be used to interactively expand individual file name substitutions.

Directory stack substitution

The directory stack is a list of directories, numbered from zero, used by the **pushd**, **popd** and **dirs** built-in commands for tcsh. **dirs** can print, store in a file, restore, and clear the directory stack at any time, and the **savedirs** and **dirsfile** shell variables can be set to store the directory stack automatically on logout and restore it on login. The **dirstack** shell variable can be examined to see the directory stack and set to put arbitrary directories into the directory stack.

The character = (equal) followed by one or more digits expands to an entry in the directory stack. The special case **=-** expands to the last directory in the stack. For example,

```
> dirs -v
0 /usr/bin
1 /usr/spool/uucp
2 /usr/accts/sys
> echo =1
/usr/spool/uucp
> echo =0/calendar
/usr/bin/calendar
> echo =-
/usr/accts/sys
```

The **noglob** and **nonomatch** shell variables and the **expand-glob** editor command apply to directory stack as well as file name substitutions.

Other substitutions

There are several more transformations involving file names, not strictly related to the “Directory stack substitution,” but mentioned here for completeness. Any file name can be expanded to a full path when the **symlinks** variable is set to *expand*. Quoting prevents this expansion, and the **normalize-path** editor command does it on demand. The **normalize-command** editor command expands commands in

PATH into full paths on demand. Finally, **cd** and **pushd** interpret - (hyphen) as the old working directory (equivalent to the tcsh shell variable **owd**). This is not a substitution at all, but an abbreviation recognized only by those commands. Nonetheless, it too can be prevented by quoting.

Command execution

The next three topics describe how the shell executes commands and deals with their input and output.

Built-in and non-built-in command execution

Built-in commands for tcsh are executed within the shell. If any component of a pipeline except the last is a built-in command, the pipeline is executed in a subshell.

Parenthesized commands are always executed in a subshell:

```
(cd; pwd); pwd
```

which prints the home directory, leaving you where you were (printing this after the home directory), while

```
cd; pwd
```

leaves you in the home directory. Parenthesized commands are most often used to prevent **cd** from affecting the current shell.

When a command to be executed is found not to be a built-in command the tcsh shell attempts to execute the command via **execve**. Each word in the variable path names a directory in which the tcsh shell will look for the command. If it is given neither a **-c** nor a **-t** option, the shell hashes the names in these directories into an internal table so that it will only try an **execve** in a directory if there is a possibility that the command resides there. This greatly speeds command location when a large number of directories are present in the search path. If this mechanism has been turned off (via **unhash**), if the shell was given a **-c** or **-t** argument or in any case for each directory component of path which does not begin with a /, the shell concatenates the current working directory with the given command name to form a path name of a file which it then attempts to execute.

If the file has execute permissions but is not an executable to the system (that is, it is neither an executable binary nor a script which specifies its interpreter), then it is assumed to be a file containing shell commands and a new shell is spawned to read it. The **shell** special alias can be set to specify an interpreter other than the shell itself.

Input or output

The standard input and standard output of a command can be redirected with the following syntax listed in Table 32.

Table 32. Standard input/output syntax for the tcsh shell

Syntax	Description
< *name*	Open file name (which is first variable, command and file name expanded) as the standard input.

Table 32. Standard input/output syntax for the tcsh shell (continued)

Syntax	Description
<< *word*	Read the shell input up to a line which is identical to *word*. *word* is not subjected to variable, file name or command substitution, and each input line is compared to *word* before any substitutions are done on this input line. Unless a quoting \, " , ' ' or ' ' ' appears in *word* variable and command substitution is performed on the intervening lines, allowing \ to quote $, \ and ' (single quotation mark). Commands which are substituted have all blanks, tabs, and newlines preserved, except for the final newline which is dropped. The resultant text is placed in an anonymous temporary file which is given to the command as standard input.
> *name* >! *name*> & *name* >&! *name*	The file *name* is used as standard output. If the file does not exist then it is created; if the file exists, its is overwritten and, therefore, the previous contents are lost. If the shell variable **noclobber** is set, then the file must not exist or be a character special file (for example, a terminal or **/dev/null**) or an error results. This helps prevent accidental destruction of files. In this case the ! forms can be used to suppress this check. The forms involving & (ampersand) route the diagnostic output into the specified file as well as the standard output. *name* is expanded in the same way as < input file names are.
>> *name* >>& *name*>> ! *name*> >&! *name*	Like >, but appends output to the end of *name*. If the shell variable *noclobber* is set, then it is an error for the file *not* to exist, unless one of the ! forms is given.

A command receives the environment in which the shell was invoked as modified by the input-output parameters and the presence of the command in a pipeline. Thus, unlike some previous shells, commands run from a file of shell commands have no access to the text of the commands by default; instead they receive the original standard input of the shell. The << mechanism should be used to present inline data. This permits shell command scripts to function as components of pipelines and allows the shell to block read its input. The default standard input for a command run detached is *not* the empty file **/dev/null**, but the original standard input of the shell. If this is a terminal and if the process attempts to read from the terminal, then the process will block and the user is notified (see "Jobs" on page 713).

Diagnostic output can be directed through a pipe with the standard output. Simply use the form |& instead of just |.

The shell cannot presently redirect diagnostic output without also redirecting standard output, but (command > output-file) >& error-file is often an acceptable workaround. Either output-file or error-file can be **/dev/tty** to send output to the terminal.

Features

Having described how the shell accepts, parses and executes command lines, we now turn to a variety of its useful features.

Control flow

The tcsh shell contains a number of commands which can be used to regulate the flow of control in command files (shell scripts) and (in limited by useful ways)

from terminal output. These commands all operate by forcing the shell to reread or skip in its input and, due to the implementation, restrict the placement of some of the commands.

The foreach, switch, and while statements, as well as the if-then-else form of the if statement, require that the major keywords appear in a single simple command on an input line.

If the shell's input is not seekable, the shell buffers up input whenever a loop is being read and performs seeks in this internal buffer to accomplish the rereading implied by the loop . (To the extent that this allows, backward gotos will succeed on non-seekable inputs.)

Expressions

The **if**, **while**, and **exit** built-in commands use expressions with a common syntax. The expressions can include any of the operators described in the next three topics. Note that the @ built-in command has its own separate syntax.

Logical, arithmetical, and comparison operators

These operators are similar to those of C and have the same precedence. They include:

```
|| && | ^ & == != =~ !~ <= >=
< > << >> + - * / % ! ~ ( )
```

Here the precedence increases to the right, '==' '!=' '=~' and '!~', '<=' '>=' '<' and '>', '<<' and '>>', '+' and '-', '*' / and '%' being in groups, at the same level. The '==' '!=' '=~' and '!~' operators compare their arguments as strings; all others operate on numbers. The operators '=~' and '!~' are like '!=' and '==' except that the right hand side is a glob-pattern (see File name substitution) against which the left hand operand is matched. This reduces the need for use of the **switch** built-in command in shell scripts when all that is really needed is pattern matching.

Strings that begin with `0` are considered octal numbers. Null or missing arguments are considered `0`. The results of all expressions are strings, which represent decimal numbers. It is important to note that no two components of an expression can appear in the same word; except when adjacent to components of expressions which are syntactically significant to the parser ('$' '|' '<' '>' '(' ')') they should be surrounded by spaces.

Command exit status

Commands can be executed in expressions and their exit status returned by enclosing them in braces ({}). The braces must be separated from the words of the command by spaces. Command executions succeed, returning true, that is, `1`, if the command exits with status `0`, otherwise they fail, returning false (`0`). If more detailed status information is required, then the command should be executed outside of an expression and the status shell variable examined.

File inquiry operators

Some of these operators perform true/false tests on files and related objects. They are of the form **-op** file, where op is one of:

a*c* An extended ACL of type *c* exists. Character *c* represents the type of ACL:

a Access ACL

d Directory default ACL

f File default ACL

Testing with suboptions *d* and *f* will always return false for files (files do not have default ACLs).

r Read access (as determined by security product and effective ids)

w Write access (as determined by security product and effective ids)

x Execute access (as determined by security product and effective ids)

X Executable in the path or shell built-in. For example, **–X ls** and **–X ls-F** are generally true, but **–X /bin/ls** is not. (This is determined by security product and effective ids.)

e Existence

Ea File has the APF extended attribute

Ep File has the program

Es File has the shared address space extended attribute

El File has the shared library extended attribute

o Ownership

x Zero size

s Nonzero size

f Plain file

d Directory

l Symbolic link

b Block special file

c Character special file

p Named pipe (fifo)

S Socket special file

u Set-user ID bit is set

g Set-group-ID bit is set

k Sticky bit is set

t t *file_descriptor* (which must be a digit) is an open file descriptor for a terminal device

L Applies subsequent operators in a multiple-operator test to a symbolic link instead of to the file to which the link points

file is command and file name expanded and then tested to see if it has the specified relationship to the real user. If file does not exist or is inaccessible or, for the operators indicated by *, if the specified file type does not exist on the current system, then all inquiries return false (`0`).

These operators can be combined for conciseness: **–xy file** is equivalent to **–x file && –y file**. For example, **–fx** is true (returns 1) for plain executable files, but not for directories.

L can be used in a multiple-operator test to apply subsequent operators to a symbolic link instead of to the file to which the link points. For example, **-lLo** is true for links owned by the invoking user. **Lr**, **Lw**, and **Lx** are always ture for links and false for non-links. **L** has a different meaning when it is the last operator in a multiple-operator test.

It is possible but not useful, and sometimes misleading, to combine operators which expect file to be a file with operators which do not (for example, **X** and **t**). Following L with a non-file operator can lead to particularly strange results.

Other operators return other information, that is not just `0` or `1`. They have the same format as before where op can be one of:

A Last file access time, as the number of seconds since epoch

A: Like **A**, but in timestamp format, that is, 'Fri May 14 16:36:10 1993'

M Last file modification time

M: Like **M**, but in timestamp format

C Last inode modification time

C: Like **C**, but in timestamp format

D Device number

I Inode number

F Composite file identifier, in the form **device : inode**

L The name of the file pointed to by a symbolic link

N Number of (hard) links

P Permissions, in octal, without leading zero

P: Like **P**, with leading zero

P mode
Equivalent to -P mode & file, that is, -P22 file returns `22` if file is writable by group and other, `20` if by group only, and `0` if by neither.

P mode:
Like **P mode**, with leading zero

U Numeric userid

U: Username, or the numeric user ID if the username is unknown

G Numeric group ID

G: Group name, or the numeric group ID if the group name is unknown

Z Size in bytes

m *file* Returns the security label of the file if one exists. Otherwise, returns false.

Only one of these operators can appear in a multiple-operator test, and it must be the last. **L** has a different meaning at the end of and elsewhere in a multiple-operator test. Because `0` is a valid return value for many of these operators, they do not return `0` when they fail: most return `-1`, and **F** returns : (colon).

File inquiry operators can also be evaluated with the **filetest** built-in command.

File inquiry operators for use with file tagging and the filetest built-in command

–B *file*

- True if the file is tagged as binary
- False if the file is not tagged or tagged as text
- Returns codeset if the file is tagged as mixed text and binary, that is, txtflag = OFF and codeset stored in file tag

–T *file*

- False if the file is not tagged or if it is tagged as txtflag = OFF
- Returns codeset if the file is tagged as text

Either **–B** *file* or **–T** *file* will allow a tcsh "if test" to evaluate to true when the file is tagged as indicated. These two operators will also allow tcsh to test for a specific codeset. For example,

```
if ( -T file == IBM-1047 )  #True if tagged as IBM-1047 text
if ( -B file )              #True if tagged as binary
```

Note: Code sets that are aliases of each other exist which might cause the test to fail, because the file inquiry operator might return an alias of the code set that you are testing.

Jobs

The shell associates a job with each pipeline. It keeps a table of current jobs, printed by the jobs command, and assigns them small integer numbers. When a job is started asynchronously with & (ampersand), the shell prints a line which looks like

```
[1] 1234
```

indicating that the job which was started asynchronously was job number 1 and had one (top-level) process, whose process id was 1234.

If you are running a job and want to do something else you can press the suspend key (typically ^Z), which sends a STOP signal to the current job. The shell will then normally indicate that the job has been 'Suspended' and print another prompt. If the **listjobs** shell variable is set, all jobs is listed like the **jobs** built-in command; if it is set to 'long' the listing is in long format, like **jobs -l**. You can then manipulate the state of the suspended job. You can put it in the background with the **bg** command or run some other commands and eventually bring the job back into the foreground with **fg**. (See also the **run-fg-editor** editor command.) A ^Z takes effect immediately and is like an interrupt in that pending output and unread input are discarded when it is typed. The **wait** built-in command causes the shell to wait for all background jobs to complete.

The ^] key sends a delayed suspend signal, which does not generate a STOP signal until a program attempts to read it, to the current job. This can be typed ahead when you have prepared some commands for a job that you want to stop after it has read them. The ^Y key performs this function in csh; in tcsh , ^Y is an editing command.

A job being run in the background stops if it tries to read from the terminal. Background jobs are typically allowed to produce output, but this can be disabled

by giving the command `stty tostop`. If you set the stty option, then background jobs will stop when they try to produce output like they do when they try to read input.

There are several ways to refer to jobs in the shell. The character % introduces a job name. If you want to refer to job number 1, you can name it as %1. Just naming a job brings it to the foreground; thus %' is a synonym for **fg** *%1*, bringing job 1 back into the foreground. Similarly, saying %1 & resumes job 1 in the background, just like **bg** *%1*. A job can also be named by an unambiguous prefix of the string typed in to start it: %ex would normally restart a suspended **ex** job, if there were only one suspended job whose name began with the string 'ex'. It is also possible to say %? string to specify a job whose text contains string , if there is only one such job.

The shell maintains a notion of the current and previous jobs. In output pertaining to jobs, the current job is marked with a + (plus) and the previous job with a - (hyphen). The abbreviations %+, %, and (by analogy with the syntax of the history mechanism) %% all refer to the current job, and %- refers to the previous job.

The job control mechanism requires that the stty option *new* be set on some systems. It is an artifact from a *new* implementation of the tty driver which allows generation of interrupt characters from the keyboard to tell jobs to stop. See stty and the **setty** tcsh built-in command for details on setting options in the new tty driver.

Status reporting

The tcsh shell learns immediately whenever a process changes state. It normally informs you whenever a job becomes blocked so that no further progress is possible, but only just before it prints a prompt. This is done so that it does not otherwise disturb your work. If, however, you set the shell variable **notify**, the shell will notify you immediately of changes of status in background jobs. There is also a shell command **notify** which marks a single process so that its status changes are immediately reported. By default notify marks the current process; simply say 'notify' after starting a background job to mark it.

When you try to leave the shell while jobs are stopped, you are warned that 'You have stopped jobs.' You can use the **jobs** command to see what they are. If you do this or immediately try to exit again, the shell will not warn you a second time and the suspended jobs are terminated.

Automatic, periodic, and timed events

There are various ways to run commands and take other actions automatically at various times in the life cycle of the shell.

- The **sched** built-in command puts commands in a scheduled-event list, to be executed by the shell at a given time.
- The **beepcmd**, **cwdcmd**, **periodic** and **precmd** special aliases can be set, respectively, to execute commands when the shell wants to ring the bell, when the working directory changes, every t-period minutes and before each prompt.
- The **autologout** shell variable can be set to log out of the shell after a given number of minutes of inactivity.
- The **mail** shell variable can be set to check for new mail periodically.
- The **printexitvalue** shell variable can be set to print the exit status of commands which exit with a status other than zero.

- The **rmstar** shell variable can be set to ask the user, when **rm *** is typed, if that is really what was meant.
- The **time** shell variable can be set to execute the **time** built-in command after the completion of any process that takes more than a given number of CPU seconds.
- The **watch** and **who** shell variables can be set to report when selected users log in or out, and the **log** built-in command reports on those users at any time.

National language system report

When using the system's multicultural support, the setlocale function is called to determine appropriate character classification and sorting. This function typically examines the LANG and LC_CTYPE environment variables; refer to the system documentation for further details.

Unknown characters (those that are neither printable nor control characters) are printed in the format *\nnn*.

The version shell variable indicates what options were chosen when the shell was compiled. Note also the **newgrp** built-in and **echo_style** shell variable and the locations of the shell's input files (see "tcsh files" on page 731).

Restriction: The tcsh shell currently does not support three locales. They are IBM-1388 (Chinese), IBM-933 (Korean) and IBM-937 (Traditional Chinese).

Handling signals

Login shells ignore interrupts when reading the file ~/.logout.The shell ignores quit signals unless started with **-q**. Login shells catch the terminate signal, but non-login shells inherit the terminate behavior from their parents. Other signals have the values which the shell inherited from its parent.

In shell scripts, the shell's handling of interrupt and terminate signals can be controlled with **onintr**, and its handling of hangups can be controlled with **hup** and **nohup**.

The shell exits on a hangup (see also the **logout** shell variable). By default, the shell's children do too, but the shell does not send them a hangup when it exits. **hup** arranges for the shell to send a hangup to a child when it exits, and **nohup** sets a child to ignore hangups.

Managing terminals

The shell uses three different sets of terminal (tty) modes: **edit**, used when editing, **quote**, used when quoting literal characters, and **execute**, used when executing commands. The shell holds some settings in each mode constant, so commands which leave the tty in a confused state do not interfere with the shell. The shell also matches changes in the speed and padding of the tty. The list of tty modes that are kept constant can be examined and modified with the **setty** built-in. Although the editor uses CBREAK mode (or its equivalent), it takes typed-ahead characters anyway.

The **echotc**, **settc** and **telltc** commands can be used to manipulate and debug terminal capabilities from the command line.

The tcsh shell adapts to window resizing automatically and adjusts the environment variables LINES and COLUMNS if set.

tcsh built-in commands

The following table lists the **tcsh** built-in commands, which are not **/bin/sh** built-ins.

@ (at)	**filetest**	**notify**	**source**
%	**glob**	**onintr**	**telltc**
alloc	**hashstat**	**popd**	**uncomplete**
bindkey	**hup**	**pushd**	**unhash**
builtins	**limit**	**rehash**	**unlimit**
bye	**log**	**repeat**	**unsetenv**
chdir	**login**	**sched**	**watchlog**
complete	**logout**	**setenv**	**where**
dirs	**ls-F**	**settc**	**which**
echotc	**notify**	**setty**	

Other **tcsh** built-in commands are also found in the z/OS shell. In some cases, they might differ in function; see the specific command description for a discussion of the **tcsh** version of the command.

: (colon)	**continue**	**fg**	**nice**	**stop**	**unset**
alias	**echo**	**history**	**nohup**	**suspend**	**wait**
bg	**eval**	**jobs**	**printenv**	**time**	**writedown**
break	**exec**	**kill**	**set**	**umask**	
cd	**exit**	**newgrp**	**shift**	**unalias**	

As well as built-in commands, the tcsh shell has a set of special aliases:

beepcmd
cwdcmd
periodic
precmd
shell

If set, each of these aliases executes automatically at the indicated time. They are initially undefined. For more information about aliases, see Alias substitution.

Descriptions of these aliases are as follows:

beepcmd
Runs when the shell wants to ring the terminal bell.

cwdcmd
Runs after every change of working directory. For example, if the user is working on an X window system using xterm and a re-parenting window manager that supports title bars such as twm and does

```
> alias cwdcmd 'echo -n "^[]2;${HOST}:$cwd ^G"'
```

then the shell will change the title of the running xterm to be the name of the host, a colon, and the full current working directory. A fancier way to do that is

```
> alias cwdcmd 'echo -n "^[]2;${HOST}:$cwd^G^[]1;${HOST}^G"'
```

This will put the hostname and working directory on the title bar but only the hostname in the icon manager menu. Putting a **cd, pushd** or **popd** in **cwdcmd** might cause an infinite loop.

periodic
Runs every **tperiod** minutes. This provides a convenient means for checking on common but infrequent changes such as new mail. For example, if one does

```
> set tperiod = 30
> alias periodic checknews
```

then the **checknews** program runs every 30 minutes. If **periodic** is set but **tperiod** is unset or set to 0, **periodic** behaves like **precmd**.

precmd
Runs just before each prompt is printed. For example, if one does

```
> alias precmd date
```

then **date** runs just before the shell prompts for each command. There are no limits on what **precmd** can be set to do, but discretion should be used.

shell Specifies the interpreter for executable scripts which do not themselves specify an interpreter. The first word should be a full path name to the interpreter. For example: **/bin/tcsh** or **/usr/local/bin/tcsh** (by default, this is set to **/bin/tcsh**).

tcsh shell and environment variables

The variables described in this topic have special meaning to the tcsh shell. The tcsh shell sets **addsuffix**, **argv**, **autologout**, **command**, **echo_style**, **edit**, **gid**, **group**, **home**, **loginsh**, **path**, **prompt**, **prompt2**, **prompt3**, **shell**, **shlvl**, **tcsh**, **term**, **tty**, **uid**, **user**, and **version** at startup. They do not change thereafter, unless changed by the user. The tcsh shell updates **cwd**, **dirstack**, **owd**, and **status** when necessary, and sets **logout** on logout.

The shell synchronizes **group**, **home**, **path**, **shlvl**, **term**, and **user** with the environment variables of the same names: whenever the environment variable changes the shell changes the corresponding shell variable to match (unless the shell variable is read-only) and vice versa. Although **cwd** and PWD have identical meanings, they are not synchronized in this manner.

The shell automatically interconverts the different formats of path and PATH.

Table 33. tcsh built-in shell variables

Variable	Purpose
addsuffix	If set, file name completion adds / to the end of directories and a space to the end of normal files.
ampm	This variable gives a user the ability to alter the time format in their tcsh prompt. Specifically, **ampm** will override the %T and %P formatting sequences in a user's prompt. If set, all times are shown in 12hour AM/PM format.
argv	The arguments to the shell. Positional parameters are taken from argv. For example, $1 is replaced by $argv. Set by default, but typically empty in interactive shells.
autocorrect	If set, the **spell-word** editor command is invoked automatically before each completion. (This variable is not implemented.)

Table 33. tcsh built-in shell variables (continued)

Variable	Purpose
autoexpand	If set, the **expand-history** editor command is invoked automatically before each completion attempt.
autolist	If set, possibilities are listed after an ambiguous completion. If set to *ambiguous*, possibilities are listed only when no new characters are added by completion.
autologout	Set to the number of minutes of inactivity before automatic logout. Automatic locking is an unsupported feature on the z/OS platform. If you specify a second parameter on the **autologout** statement (intending it to be for autolock), this parameter will be assigned to **autologout**. When the shell automatically logs out, it prints 'autologout', sets the variable logout to *automatic* and exits. Set to `60` (automatic logout after 60 minutes) by default in login and superuser shells, but not if the shell thinks it is running under a window system (the DISPLAY environment variable is set), or the tty is a pseudo-tty (pty). See also the **logout** shell variable.
backslash_ quote	If set, backslashes (\) always quote \, ' (single quotation mark) and " (double quotation mark). This might make complex quoting tasks easier, but it can cause syntax errors in csh scripts.
cdpath	A list of directories in which **cd** should search for subdirectories if they aren't found in the current directory.
command	If set, the command which was passed to the shell with the **-c** flag.
complete	If set to **enhance**, completion first ignores case and then considers periods, hyphens and underscores ('.', '-' and '_') to be word separators and hyphens and underscores to be equivalent.
correct	If set to *cmd*, commands are automatically spelling-corrected. If set to *complete*, commands are automatically completed. If set to *all*, the entire command line is corrected.
cwd	The full path name of the current directory. See also the **dirstack** and **owd** shell variables.
dextract	If set, **pushd** +*n* extracts the *n*th directory from the directory stack instead of rotating it to the top.
dirsfile	The default location in which **dirs -S** and **dirs -L** look for a history file. If unset, **~/.cshdirs** is used. Because only **~/.tcshrc** is normally sourced before **~/.cshdirs**, dirsfile should be set in **~/.tcshrc** instead of **~/.login**. For example: `set dirsfile = ~/.cshdirs`
dirstack	An array of all the directories on the directory stack. $dirstack[1] is the current working directory, $dirstack[2] the first directory on the stack, etc. Note that the current working directory is $dirstack[1] but =0 in directory stack substitutions, etc. One can change the stack arbitrarily by setting **dirstack**, but the first element (the current working directory) is always correct. See also the **cwd** and **owd** shell variables.
dunique	If set, **pushd** removes any instances of *name* from the stack before pushing it onto the stack.
echo	If set, each command with its arguments is echoed just before it is executed. For non-built-in commands all expansions occur before echoing. Built-in commands are echoed before command and file name substitution, since these substitutions are then done selectively. Set by the **-x** command line option.

Table 33. tcsh built-in shell variables (continued)

Variable	Purpose

echo_style	The style of the **echo** built-in. Can be set to:
	bsd Don't echo a newline if the first argument is **-n**.
	sysv Recognize backslashed escape sequences in echo strings.
	both Recognizes both the **-n** flag and backslashed escape sequences; the default.
	none Recognize neither.
	Set to *both* by default to the local system default.
	
	The following is an example of this variable's use:
	`> echo $echo_style`
	`bsd`
	`> echo "\n"`
	`\n`
	`> echo -n "test"`
	`test>`
	`> set echo_style=sysv`
	`> echo $echo_style`
	`sysv`
	`> echo "\n"`
	
	`> echo -n "test"`
	`-n test`
	`> set echo_style=both`
	`> echo $echo_style`
	`both`
	`> echo -n "test"`
	`test> echo "\n"`
	
	`>set echo_style=none`
	`> echo $echo_style`
	`none`
	`> echo -n "test"`
	`-n test`
	`> echo "\n"`
	`\n`
	`>`

edit	If set, the command-line editor is used. Set by default in interactive shells.
ellipsis	If set, the %c'/'%. and %C prompt sequences (see the **prompt** shell variable) indicate skipped directories with an ellipsis (...) instead of /.
fignore	Lists file name suffixes to be ignored by completion.
filec	In the tcsh shell, completion is always used and this variable is ignored.
gid	The user's real group ID.
group	The user's group name.
histchars	A string value determining the characters used in history substitution. The first character of its value is used as the history substitution character, replacing the default character ! (exclamation point). The second character of its value replaces the character ^ (caret) in quick substitutions.

Table 33. tcsh built-in shell variables (continued)

Variable	Purpose
histdup	Controls handling of duplicate entries in the history list. If set to *all* only unique history events are entered in the history list. If set to *prev* and the last history event is the same as the current command, then the current command is not entered in the history. If set to *erase* and the same event is found in the history list, that old event gets erased and the current one gets inserted. The *prev* and *all* options renumber history events so there are no gaps.
histfile	The default location in which **history -S** and **history -L** look for a history file. If unset, *~/.history* is used. **histfile** is useful when sharing the same home directory between different machines, or when saving separate histories on different terminals. Because only *~/.tcshrc* is normally sourced before *~/.history*, **histfile** should be set in *~/.tcshrc* instead of *~/.login*. An example: `set histfile = ~/.history`
histlit	If set, built-in and editor commands and the savehist mechanism use the literal (unexpanded) form of lines in the history list. See also the **toggle-literal-history** editor command.
history	The first word indicates the number of history events to save. The optional second word indicates the format in which history is printed; if not given, %h\t%T\t%R\n is used. The format sequences are described under **prompt**. (Note that %R has a variable meaning). Set to `100` by default.
home	Initialized to the home directory of the invoker. The file name expansion of ~ refers to this variable.
ignoreeof	If set to the empty string or 0 and the input device is a terminal, the **end-of-file** command (typically generated by the user by typing ^D on an empty line) causes the shell to print 'Use "logout" to leave tcsh.' instead of exiting. This prevents the shell from accidentally being killed. If set to a number *n*, the shell ignores n - 1 consecutive end-of-files and exits on the *n*th. If unset, 1 is used. That is, the shell exits on a single ^D.
implicitcd	If set, the shell treats a directory name typed as a command as though it were a request to change to that directory. If set to verbose, the change of directory is echoed to the standard output. This behavior is inhibited in non-interactive shell scripts, or for command strings with more than one word. Changing directory takes precedence over executing a like-named command, but it is done after alias substitutions. Tilde and variable expansions work as expected.
inputmode	If set to *insert* or *overwrite*, puts the editor into that input mode at the beginning of each line.
listflags	If set to *x*, *a* or *A*, or any combination thereof (for example, *xA*), they are used as flags to **ls-F**, making it act like **ls -xF**, **ls -Fa**, **ls -FA** or a combination (for example, **ls -FxA**): *a* shows all files (even if they start with a '.'), *A* shows all files but '.' and '..', and *x* sorts across instead of down. If the second word of listflags is set, it is used as the path to ls(1).
listjobs	If set, all jobs are listed when a job is suspended. If set to *long*, the listing is in long format.
listlinks	If set, the **ls-F** built-in command shows the type of file to which each symbolic link points. For an example of its use, see “ls-F built-in command for tcsh: List files” on page 746.

Table 33. tcsh built-in shell variables (continued)

Variable	Purpose
listmax	The maximum number of items which the **list-choices** editor ocmmand will list without asking first.
listmaxrows	The maximum number of rows of items which the list-choices editor command will list without asking first.
loginsh	Set by the shell if is a login shell. Setting or unsetting it within a shell has no effect. See also **shlvl**.
logout	Set by the shell to *normal* before a normal logout, *automatic* before an automatic logout, and *hangup* if the shell was killed by a hangup signal. See also the **autologout** shell variable.
mail	The names of the files or directories to check for incoming mail, separated by white space, and optionally preceeded by a numeric word. Before each prompt, if 10 minutes have passed since the last check, the shell checks each file and says 'You have new mail.' (or, if mail contains multiple files, 'You have new mail in name.') if the filesize is greater than zero in size and has a modification time greater than its access time. If you are in a login shell, then no mail file is reported unless it has been modified after the time the shell has started up, in order to prevent redundant notifications. Most login programs will tell you whether or not you have mail when you log in. If a file specified in mail is a directory, the shell will count each file within that directory as a separate message, and will report 'You have n mails.' or 'You have n mails in name.' as appropriate. This functionality is provided primarily for those systems which store mail in this manner, such as the Andrew Mail System. If the first word of mail is numeric it is taken as a different mail checking interval, in seconds. Under very rare circumstances, the shell might report 'You have mail.' instead of 'You have new mail.'
matchbeep	If set to *never*, completion never beeps. If set to *nomatch*, it beeps only when there is no match. If set to *ambiguous*, it beeps when there are multiple matches. If set to *notunique*, it beeps when there is one exact and other longer matches. If unset, *ambiguous* is used.
nobeep	If set, beeping is completely disabled.
noclobber	If set, restrictions are placed on output redirection to insure that files are not accidentally destroyed and that >> redirections refer to existing files, as described in Input or output.
noglob	If set, file name substitution and directory stack substitution are inhibited. This is most useful in shell scripts which do not deal with file names, or after a list of file names has been obtained and further expansions are not desirable.
nokanji	If set and the shell supports Kanji (see the **version** shell variable), it is disabled so that the meta key can be used.
nonomatch	If set, a file name substitution or directory stack substitution which does not match any existing files is left untouched instead of causing an error. It is still an error for the substitution to be malformed, that is, **echo [** still gives an error.
nostat	A list of directories (or glob-patterns which match directories; see File name substitution) that should not be stat(2)ed during a completion operation. This is typically used to exclude directories which take too much time to stat(2), for example */afs*.

Table 33. tcsh built-in shell variables (continued)

Variable	Purpose
notify	If set, the shell announces job completions asynchronously. The default is to present job completions just before printing a prompt.
owd	The old working directory, equivalent to the - (hyphen) used by **cd** and **pushd**. See also the **cwd** and **dirstack** shell variables.
path	A list of directories in which to look for executable commands. A null word specifies the current directory. If there is no path variable then only full path names will be executed. **path** is set by the shell at startup from the PATH environment variable or, if PATH does not exist, to a system-dependent default something like (/usr/local/bin /usr/bsd /bin /usr/bin .). The shell might put '.' first or last in path or omit it entirely depending on how it was compiled; see the **version** shell variable. A shell which is given neither the **-c** nor the **-t** option hashes the contents of the directories in path after reading *~/.tcshrc* and each time path is reset. If you add a new command to a directory in path while the shell is active, you might need to do a rehash for the shell to find it.
printexit- value	If set and an interactive program exits with a nonzero status, the shell prints 'Exit status'.
prompt2	The string with which to prompt in while and foreach loops and after lines ending in \ (backslash). The same format sequences can be used as in prompt (note the variable meaning of %R). Set by default to *%R?* in interactive shells.
prompt3	The string with which to prompt when confirming automatic spelling correction. The same format sequences can be used as in **prompt** (note the variable meaning of *%R*). Set by default to *CORRECT>%R (y|n|e|a)?* in interactive shells.
promptchars	If set to a two-character string, the %# formatting sequence in the prompt shell variable is replaced with the first character for normal users and the second character for the superuser.
pushdtohome	If set, **pushd** without arguments does **pushd ^**, like **cd**.
pushdsilent	If set, **pushd** and **popd** do not print the directory stack.
recexact	If set, completion completes on an exact match even if a longer match is possible.
recognize_ only_ executables	If set, command listing displays only files in the path that are executable.
rmstar	If set, the user is prompted before **rm *** is executed.
rprompt	The string to print on the right-hand side of the screen (after the command input) when the prompt is being displayed on the left. It recognises the same formatting characters as **prompt**. It will automatically disappear and reappear as necessary, to ensure that command input isn't obscured, and will only appear if the prompt, command input, and itself will fit together on the first line. If **edit** isn't set, then **rprompt** will be printed after the prompt and before the command input.
savedirs	If set, the shell does **dirs -S** before exiting.

Table 33. tcsh built-in shell variables (continued)

Variable	Purpose
savehist	If set, the shell does **history -S** before exiting. If the first word is set to a number, at most that many lines are saved. (The number must be less than or equal to history.) If the second word is set to **merge**, the history list is merged with the existing history file instead of replacing it (if there is one) and sorted by time stamp and the most recent events are retained. An example: `set savehist = ( 15 merge )`
sched	The format in which the sched built-in command prints scheduled events. If not given, %h\t%T\t%R\n is used. The format sequences are described under **prompt**; note the variable meaning of *%R*.
shell	The file in which the shell resides. This is used in forking shells to interpret files which have execute bits set, but which are not executable by the system (see "Built-in and non-built-in command execution" on page 708. Initialized to the (system-dependent) home of the shell.
shlvl	The number of nested shells. Reset to `1` in login shells. See also **loginsh**.
status	The status returned by the last command. If it terminated abnormally, then `0200` is added to the status. tcsh built-in commands which fail return exit status `1`, all other built-in commands return status `0`.
tcsh	The version number of the shell in the format R.VV.PP, where R is the major release number, VV the current version and PP the patch level.
term	The terminal type. Typically set in *~/.login*.
tperiod	The period, in minutes, between executions of the periodic special alias.
tty	The name of the tty, or empty if not attached to one.
uid	The user's login name.
user	The user's login name.
verbose	If set, causes the words of each command to be printed, after history substitution (if any). Set by the **–v** command line option.

Table 33. tcsh built-in shell variables (continued)

Variable	Purpose
version	The version ID stamp. It contains the shell's version number (see tcsh), origin, release date, vendor, operating system and machine (see VENDOR, OSTYPE, and MACHTYPE environment variables) and a comma-separated list of options which were set at compile time. Options which are set by default in the distribution are noted. **8b** The shell is eight bit clean; default. **7b** The shell is not eight bit clean. **nls** The system's multicultural support is used; default for systems with multicultural support. **If** Login shells execute **/etc/csh.login** before instead of after **/etc/csh.cshrc** and *~/.login* before instead of after **~/.tcshrc** and **~/.history**. **dl** '.' is put last in path for security; default. **nd** '.' is omitted from path for security. **vi** vi-style editing is the default instead of emacs. **dtr** Login shells drop DTR when exiting. **bye** **bye** is a synomym for logout and log is an alternate name for watchlog. **al** **autologout** is enabled; default. **kan** Kanji is used and the ISO character set is ignored, unless the nokanji shell variable is set. **sm** The system's malloc is used. **hb** The #!<program> <args> convention is emulated when executing shell scripts. **ng** The **newgrp** built-in is available. **rh** The shell attempts to set the REMOTEHOST environment variable. **afs** The shell verifies your password or password phrase with the Kerberos server if local authentication fails. The **afsuser** shell variable or the AFSUSER environment variable will override your local username if set. An administrator can enter additional strings to indicate differences in the local version.
visiblebell	If set, a screen flash is used instead of the audible bell. See **nobeep**. (`Currently not implemented.`)

Table 33. tcsh built-in shell variables (continued)

Variable	Purpose

watch	A list of user/terminal pairs to watch for logins and logouts. If either the user is *any* all terminals are watched for the given user and vice versa. Setting watch to (*any any*) watches all users and terminals. For example,
	`set watch = (george ttyd 1 any console $user any)`
	
	reports activity of the user george on ttyd1, any user on the console, and oneself (or a trespasser) on any terminal.
	
	Logins and logouts are checked every 10 minutes by default, but the first word of watch can be set to a number to check every so many minutes. For example,
	`set watch = (1 any any)`
	
	reports any login/logout once every minute. For the impatient, the **log** built-in command triggers a watch report at any time. All current logins are reported (as with the **log** built-in) when watch is first set.
	
	The **who** shell variable controls the format of watch reports.

who	The format string for watch messages. The following sequences are replaced by the given information: **%n** The name of the user who logged in/out. **%a** The observed action, i.e., 'logged on'. 'logged off', or 'replaced olduser on'. **%l** The terminal (tty) on which the user logged in/out. **%M** The full hostname of the remote host, or 'local' if the login/logout was from the local host. **%m** The hostname of the remote host up to the first '.' (period). The full name is printed if it is an IP address or an X Window System display. %M and %m are available only on systems that store the remote hostname in /etc/utmp. If unset, %n has %a %l from %m. is used, or %n has %a %l. on systems which do not store the remote hostname.
wordchars	A list of non-alphanumeric characters to be considered part of a word by the forward-word, backward word, etc. editor commands. If unset, *?_-.[]~= is used.

tcsh shell variables not described in the Table 33 on page 717 are described as follows:

prompt
The string which is printed before reading each command from the terminal. prompt can include any of the following formatting sequences, which are replaced by the given information:

%/ The current working directory.

%~ The current working directory, but with one's home directory represented by ~ and other users' home directories represented by ~user as per file name substitution. ~user substitution happens only if the shell has already used ~user in a path name in the current session.

%c[[0]*n*], %.[[0]*n*]
The trailing component of the current working directory, or *n* trailing components if a digit *n* is given. If *n* begins with `0`, the number of skipped components precede the trailing components in the format `/trailing`. If the ellipsis shell variable is set, skipped components are represented by an ellipsis so the whole becomes **...trailing**. ~ substitution is done as in %~~ , but the ~ component is ignored when counting trailing components.

%C Like **%c**, but without ^ substitution.

%h, %!, !
The current history event number.

%M The full hostname.

%m The hostname up to the first '.' (period).

%S (%s)
Start (stop) standout mode.

%B (%b)
Start (stop) boldfacing mode.

%U (%u)
Start (stop) underline mode.

%t, %@
The time of day in 12–hour AM/PM format.

%T Like %t, but in 24–hour format (but see the **ampm** shell variable).

%p The precise time of day in 12–hour AM/PM format, with seconds.

%P Like **%p**, but in 24–hour format (but see the **ampm** shell variable).

\c *c* is parsed as in **bindkey**.

^c *c* is parsed as in **bindkey**.

%% A single %.

%n The user name.

%d The weekday in 'Day' format.

%D The day in 'dd' format.

%w The month in 'Mon' format.

%W The month in 'mm' format.

%y The year in 'yy' format.

%Y The year in 'yyyy' format.

%l The tcsh shell's tty.

%L Clears from the end of the prompt to end of the display or the end of the line.

%$ Expands the shell or environment variable name immediately after the $.

%# > (or the first character of the **promptchars** shell variable) for normal users, # (or the second character of **promptchars**) for the superuser.

%{*string***%}**
Includes *string* as a literal escape sequence. It should be used only to change terminal attributes and should not move the cursor location. This cannot be the last sequence in **prompt**.

%? The return code of the command executed just before the prompt.

%R In **prompt2**, the status of the parser. In **prompt3**, the corrected string. In **history**, the history string.

The bold, standout and underline sequences are often used to distinguish a superuser shell. For example,

```
>set prompt = "%m [%h] %B[%@%b [%/] you rang?"
tut [37] [2:54] [/usr/accts/sys] you rang? _
```

Set by default to %# in interactive shells.

symlinks
Can be set to several different values to control symbolic link ('symlink') resolution:

- If set to *chase*, whenever the current directory changes to a directory containing a symbolic link, it is expanded to the real name of the directory to which the link points. This does not work for the user's home directory.
- If set to *ignore*, the shell tries to construct a current directory relative to the current directory before the link was crossed. This means that cding through a symbolic link and then **cd..'ing** returns one to the original directory. This only affects built-in commands and file name completion.
- If set to *expand*, the shell tries to fix symbolic links by actually expanding arguments which look like path names. This affects any command, not just built-ins. Unfortunately, this does not work for hard-to-recognize file names, such as those embedded in command options. Expansion can be prevented by quoting. While this setting is typically the most convenient, it is sometimes misleading and sometimes confusing when it fails to recognize an argument which should be expanded. A compromise is to use *ignore* and use the editor command normalize-path (bound by default to ^X-n) when necessary.

Some examples are in order. First, let's set up some play directories:

```
> cd /tmp
> mkdir from from/src to
> ln -s from/src to/dist
```

Here's the behavior with **symlinks** unset,

```
> cd /tmp/to/dist; echo $cwd
/tmp/to/dist
> cd ..; echo $cwd
/tmp/from
```

here's the behavior with symlinks set to *chase*,

```
> cd /tmp/to/dst; echo $cwd
/tmp/from/src
> cd ..; echo $cwd
/tmp/from
```

here's the behavior with symlinks set to *ignore*,

```
> cd /tmp/to/dist; echo $cwd
/tmp/to/dst
> cd ..; echo $cwd
/tmp/to
```

and here's the behavior with symlinks set to *expand*.

```
> cd /tmp/to/dist; echo $cwd
/tmp/to/dst
> cd ..; echo $cwd
/tmp/to
> cd /tmp/to/dist; echo $cwd
/tmp/to/dst
> cd ".."; echo $cwd
/tmp/from
> /bin/echo ..
/tmp/to
> /bin/echo ".."
..
```

expand expansion:

1. works just like *ignore* for built-ins like **cd**,
2. is prevented by quoting, and
3. happens before file names are passed to non-built-in commands.

time If set to a number, then the **time** built-in command executes automatically after each command which takes more than that many CPU seconds. If there is a second word, it is used as a format string for the output of the time built-in. The following sequences can be used in the format string:

%U The time the process spent in user mode in cpu seconds.

%S The time the process spent in kernel mode in cpu seconds.

%E The elapsed (wall clock) time in seconds.

%P The CPU percentage computed as (%U + %S) / %E.

%W The number of times the process was swapped.

%X The average amount in (shared) text space used in Kbytes.

%D The average amount in (unshared) data/stack space used in Kbytes.

%K The total space used (%X + %D) in Kbytes.

%M The maximum memory the process had in use at any time in Kbytes.

%F The number of major page faults (page needed to be brought from disk).

%R The number of minor page faults.

%I The number of input operations.

%O The number of output operations.

%r The number of socket messages received.

%s The number of socket messages sent.

%k The number of signals received.

%w The number of voluntary context switches (waits).

%c The number of involuntary context switches.

Only the first four sequences are supported on systems without BSD resource limit functions. The default time format is

```
Uu   %Ss %E %P %X+%Dk %I+%Oio   %Fpf+%Ww
```

for systems that support resource usage reporting.

The following table contains a list of tcsh environment variables.

Table 34. tcsh environment variables

Environment variable	Purpose
COLUMNS	A list of directories in which **cd** should search for subdirectories if they aren't found in the current directory.
DISPLAY	Used by X Window System. If set, the shell does not set **AUTOLOGOUT**.
EDITOR	The path name to a default editor. See also the VISUAL environment variable and the **run-fg-editor** editor command.
GROUP	Equivalent to the **group** shell variable.
HOME	Equivalent to the **HOME** shell variable.
HOST	Initialized to the name of the machine of the machine on which the shell is running, as determined by the **gethostname** system call.
HOSTTYPE	Initialized to the type of the machine on which the shell is running, as determined at compile time. This variable is obsolete and will be removed in a future version.
HPATH	A colon-separated list of directories in which the **run-help** editor command looks for a command documentation.
LANG	Gives the preferred character environment. See National language system report.
LC_CTYPE	If set, only CTYPE character handling is changed. See National language system report.
LINES	The number of lines in the terminal. See “Managing terminals” on page 715.
MACHTYPE	The machine type (microprocessor class or machine model), as determined at compile time.
NOREBIND	If set, printable characters are not rebound to **SELF-INSERT-COMMAND**. After a user sets NOREBIND, a new shell must be started. See National language system report.
OSTYPE	The operating system, as determined at compile time.
PATH	A colon-separated list of directories in which to look for executables. Equivalent to the **path** shell variable, but in a different format.
PWD	Equivalent to the **cwd** shell variable, but not synchronized to it; updated only after an actual directory change.

Table 34. tcsh environment variables (continued)

Environment variable	Purpose
REMOTE- HOST	The host from which the user has logged in remotely, if this is the case and the shell is able to determine it. (The z/OS tcsh shell is not currently compiled with REMOTEHOST defined; see the **version** shell variable.)
SHLVL	Equivalent to the **shlvl** shell variable.
TERM	Equivalent to the **term** shell varialbe.
USER	Equivalent to the **user** shell variable.
VENDOR	The vendor, as determined at compile time.
VISUAL	The path name to a default full-screen editor. See the **editor** environment variable and the **run-fg-editor** editor command.

Using tcsh shell variables to control automatic conversion

When the tcsh shell is redirecting stdin, stdout, or stderr, it will default to no automatic conversion of tagged files, and no tagging of files created by the redirection. The following tcsh shell variables will override this behavior:

_TAG_REDIR_IN=TXT
Redirected stdin will override the file's TXTFLAG, treating it as if it were tagged as:

TXTFLAG = ON, CCSID = existing file tag CCSID

This has no effect if CCSID = 0.

_TAG_REDIR_IN=BIN
Redirected stdin will override the file's TXTFLAG, treating it as if it were tagged as:

TXTFLAG = OFF, CCSID = existing file tag CCSID

This effectively disables automatic conversion.

_TAG_REDIR_OUT=TXT
Redirected stdout is tagged as:

TXTFLAG = ON, CCSID = program CCSID at the time of the first write (if not already tagged)

_TAG_REDIR_OUT=BIN
Redirected stdout is tagged as:

TXTFLAG = OFF, CCSID = program CCSID at the time of the first write (if not already tagged)

_TAG_REDIR_ERR=TXT
Redirected stderr is tagged as:

TXTFLAG = ON, CCSID = program CCSID at the time of the first write (if not already tagged)

_TAG_REDIR_ERR=BIN
Redirected stderr is tagged as:

TXTFLAG = OFF, CCSID = program CCSID at the time of the first write (if not already tagged)

The automatic conversion shell variable can be specified for one command, or for multiple commands within a tcsh shell session or shell script. If the variable is set in a user's .tcshrc file, then it will affect child shells, that is, nested shell scripts.

Note: Because the standard tcsh shell execution performs redirection before variable assignment, the syntax for specifying the shell variable for one command is `set var=value`. For example:

```
(set _TAG_REDIR_OUT=TXT; command >file)
```

You can also use these shell variables for commands in a pipeline. For example, they can be used to tag the standard output of each command that is writing to a pipeline or to tag the standard input of each command that is reading from a pipeline.

tcsh files

/etc/csh.cshrc
Read first by every shell.

/etc/csh.login
Read by login shells after `/etc/csh.cshrc`.

~/.tcshrc
Read by every shell after `/etc/csh.cshrc` or its equivalent.

~/.history
Read by login shells after **~/.tcshrc** if **savehist** is set. See also **histfile**.

~/.login
The shell reads ~/.login after **~/.tcshrc** and **~/.history**. See the *version* shell variable.

~/.cshdirs
Read by login shells after **~/.login** if **savedirs** is set. See also **dirsfile**.

~/.logout
Read by login shells at logout.

/bin/sh
Used to interpret shell scripts not starting with a #.

/tmp/sh*
Temporary file for < <.

tcsh shell: problems and limitations

Some limitations of the tcsh shell are:

- Words can be no longer than 1024 characters.
- The system limits argument lists to 10240 characters.
- The number of arguments to a command which involves file name expansion is limited to 1/6th the number of characters allowed in an argument list.
- Command substitutions can substitute no more characters than are allowed in an argument list.
- To detect looping, the shell restricts the number of alias substitutions on a single line to 20.

When a suspended command is restarted, the tcsh shell prints the directory it started in if this is different from the current directory. This can be misleading (that is, wrong) as the job might have changed directories internally.

Shell built-in functions are not stoppable/restartable. Command sequences of the form 'a ; b ; c' are also not handled gracefully when stopping is attempted. If you suspend 'b', the tcsh shell will then immediately execute 'c'. This is especially noticeable if this expansion results from an alias. It suffices to place the sequence of commands in ()'s to force it to a subshell, for example, (a ; b ; c).

Control over tty output after processes are started is primitive. In a virtual terminal interface much more interesting things could be done with output control.

Alias substitution is most often used to clumsily simulate shell procedures; shell procedures should be provided instead of aliases.

Commands within loops are not placed in the history list. Control structures should be parsed instead of being recognized as built-in commands. This would allow control commands to be placed anywhere, to be combined with |, and to be used with & and ; (semicolon) metasyntax.

foreach does not ignore here-documents when looking for its end.

It should be possible to use the : (colon) modifiers on the output of command substitutions.

The screen update for lines longer than the screen width is very poor if the terminal cannot move the cursor up (terminal type 'dumb').

It is not necessary for HPATH and NOREBIND to be environment variables.

Glob-patterns which do not use '?', '*' or '[]' or which use '{}' or '~' are not negated correctly.

The single-command form of **if** does output redirection even if the expression is false and the command is not executed.

ls-F includes file identification characters when sorting file names and does not handle control characters in file names well. It cannot be interrupted.

The *visiblebell* shell variable is currently not implemented.

In file name and programmed completion, the 'C' completion rule word list type does not correctly select completion from the given directory.

There are three locales (code pages) which the tcsh shell will not correctly support: IBM-1388 (Chinese), IBM-933 (Korean) and IBM-937 (Traditional Chinese).

If you want to help maintain and test tcsh, send mail to listserv@mx.gw.com with the text 'subscribe tcsh '.

Related information

: (colon), **@ (at)**, **alias**, **bg**, **break**, **cd**, **continue**, **echo**, **eval**, **exec**, **exit**, **fg**, **history**, **jobs**, **kill**, **newgrp**, **nice**, **nohup**, **printenv**, **set**, **shift**, **stop**, **suspend**, **time**, **umask**, **unalias**, **unset**, **wait**

@ (at) built-in command for tcsh: Print the value of tcsh shell variables

Format

- @
- @ *name* = expr
- @ *name*[*index*] = expr
- @ *name*+ + |– –
- @ *name*[*index*]+ + |– –

Description

@ (at) in the tcsh shell prints the value of tcsh shell variables.

Options

@ in the tcsh shell supports the following options:

name **= expr**
: Assigns the value of expr to name.

name[*index*] **= expr**
: Assigns the value of expr to the *index*'th component of *name*. Both *name* and its *index*'th component must already exist.

  For both *name* **= expr** and *name*[*index*] **= expr** , **expr** might contain the operators *, +, etc. as in C. If **expr** contains <, >, &, or " then at least part of **expr** must be placed within (). The syntax of **expr** has nothing to do with that described under Expressions.

  expr must evaluate to a numeric expression. Therefore, use **set** instead of @ to assign array variables.

*name***+ + |– –**
: Increments (++) or decrements (– –) *name*.

name[*index*]**+ + |– –**
: Increments (++) or decrements (– –) *name*'s *index*'th component.

Usage notes

1. The space between @ and name is required.
2. The spaces between name and = and between = and **expr** are optional.
3. Components of **expr** must be separated by spaces.

Related information

tcsh

% (percent) built-in command for tcsh: Move jobs to the foreground or background

Format

% [*job*] [*&*]

Description

%, is a synonym for the **fg** built-in command.

- % (percent) without arguments will bring the current job to the foreground.
- % specified with a job number attempts to bring that particular job to the foreground.
- % *job &* will move the specified job to the background. This syntax works the same as the **bg** built-in command. If no job is specified, the current job is moved to the background.

  Note: Jobs that are current will have a **+** next to the status column in jobs command output. See "Jobs" on page 713.

Related information

jobs, **tcsh**

alloc built-in command for tcsh: Show the amount of dynamic memory acquired

Format

alloc *argument*

Description

alloc shows the amount of dynamic memory acquired, broken down into used and free memory. **alloc** used with an argument, shows the number of free and used blocks in each size category. The categories start at size 8 and double at each step.

Note: **alloc** is supported, but the output is not meaningful on z/OS.

Related information

tcsh

bindkey built-in command for tcsh: List all bound keys

Format

bindkey [-l | -d | -e | -v | -u]

bindkey [-a] [-b] [-k] [-r] [– –] *key*

bindkey [-a] [-b] [-k] [-c | -s] [– –] *key command*

Description

bindkey specified alone (without options, *key*, or *key command*) lists all bound keys and the editor command to which each is bound.

bindkey specified with *key* (with or without options) lists the editor command to which key is bound.

bindkey specified with *key command* (with or without options) binds the editor *command* to *key*.

Options

–l Lists all commands and a short description of each.

–d Binds all keys to the standard bindings for the default editor.

–e Binds all keys to the standard GNU Emacs-like bindings.

–v Binds all keys to the standard vi-like bindings.

–a Lists or changes key-bindings in the alternative key map. This is the key map used in vi command mode.

–b *key* is interpreted as a control character written ^*character* (^A) or C-*character* (C-A), a meta character written M-character (M-A), or an extended prefix key written X-character (X-A).

–k *key* is interpreted as a symbolic arrow key name, which can be one of 'down', 'up', 'left' or 'right'.

–r Removes key's binding. Be careful: **bindkey -r** does not bind key to **self-insert-command**, it unbinds *key* completely.

–c *command* is interpreted as a built-in or external command instead of an editor command.

–s *command* is taken as a literal string and treated as terminal input when *key* is typed. Bound keys in *command* are themselves reinterpreted, and this continues for ten levels of interpretation.

– – Forces a break from option processing, so the next word is taken as *key* even if it begins with '-'.

Usage notes

1. *key* can be a single character or a string. If a command is bound to a string, the first character of the string is bound to **sequence-lead-in** and the entire string is bound to the command.
2. Control characters in *key* can be literal (they can be typed by preceding them with the editor command **quoted-insert**, normally bound to ^V) or written caret-character style, for example, ^A. Delete is written ^? (caret-question mark). *key* and *command* can contain backslashed escape sequences (in the style of System V echo) as follows:

\a Bell

\b Backspace

\e Escape

\f Form feed

\n Newline

\r Carriage return

\t Horizontal tab

\v Vertical tab

nnn The EBCDIC character corresponding to the octal number *nnn*

The \ character nullifies the special meaning of the following characters, notably \/ and ^.

Related information

tcsh

---

builtins built-in command for tcsh: Prints the names of all built-in commands

Format

builtins

Description

builtins prints the names of all built-in commands.

Related information

tcsh

---

bye built-in command for tcsh: Terminate the login shell

Format

bye

Description

A synonym for the **logout** built-in command. (See the **version** shell variable.)

Related information

logout

---

chdir built-in shell command for tcsh: Change the working directory

Format

chdir

Description

A synonym for the **cd** built-in command.

Related information

cd, **tcsh**

---

complete built-in command for tcsh: List completions

Format

complete [*command* [*word*/*pattern*/*list*[:*select*]/[[*suffix*]/] ...]]

Description

complete, without arguments, lists all completions. With *command*, **complete** lists completions for command. With *command* and *word* etc., **complete** defines completions.

Arguments

command

command can be a full command name or a glob-pattern. See File name substitution. It can begin with – to indicate that completion should be used only when *command* is ambiguous.

word *word* specifies which word relative to the current word is to be completed, and can be one of the following:

- **c** Current-word completion. *pattern* is a glob-pattern which must match the beginning of the current word on the command line. *pattern* is ignored when completing the current word.
- **C** Like **c**, but includes *pattern* when completing the current word.
- **n** Next-word completion. *pattern* is a glob-pattern which must match the beginning of the previous word on the command line.
- **N** Like **n**, but must match the beginning of the word two before the current word.
- **p** Position-dependent completion. *pattern* is a numeric range, with the same syntax used to index shell variables, which must include the current word.

list The list of possible completions, which can be one of the following:

- **a** Aliases
- **b** Bindings (editor commands)
- **d** Directories
- **D** Directories which begin with the supplied path prefix
- **e** Environment variables
- **f** File names
- **F** File names which begin with the supplied path prefix
- **g** Group names
- **j** Jobs
- **l** Limits
- **n** Nothing
- **s** Shell variables
- **S** Signals
- **t** Plain (text) files
- **T** Plain (text) files which begin with the supplied path prefix
- **v** Any variables
- **u** User names
- **x** Like **n**, but prints select when **list-choices** is used

X Completions

$var Words from the variable **var**

(...) Words from the given list

... Words from the output of command

select *select* is an optional glob-pattern. If given, only words from *list* which match select are considered and the **fignor**e shell variable is ignored. The last three types of completion might not have a select pattern, and **x** uses select as an explanatory message when the **list-choices** editor command is used.

suffix *suffix* is a single character to be appended to a successful completion. If null, no character is appended. If omitted (in which case the fourth delimiter can also be omitted), a slash is appended to directories and a space to other words.

Examples

1. Some commands take only directories as arguments, so there is no point in completing plain files. For example:

   ```
   > complete cd 'p/1/d/'
   ```

   completes only the first word following **cd** (*p/1*) with a directory.

2. **p**-type completion can be used to narrow down command completion. For example:

   ```
   > co[^D]
   complete compress
   > complete -co* 'p/0/(compress)/'
   > co[^D]
   > compress
   ```

   This completion completes commands (words in position *0*, *p/0*) which begin with *co* (thus matching *co**) to *compress* (the only word in the list). The leading - indicates that this completion is to be used only with ambiguous commands.

3. This is an example of **n**-type completion. Any word following *find* and immediately following *-user* is completed from the list of users.

   ```
   > complete find 'n/-user/u/'
   ```

4. This demonstrates **c**-type completion. Any word following *cc* and beginning with *-I* is completed as a directory. *-I* is not taken as part of the directory because we used lowercase **c**.

   ```
   > complete cc 'c/-I/d/'
   ```

5. Different *lists* are useful with different commands:

   ```
   > complete alias 'p/1/a/'
   > complete man 'p/*/c/'
   > complete set 'p/1/s/'
   > complete true 'p/1/x:Truth has no options./'
   ```

   These complete words following **alias** with aliases, **man** with commands, and **set** with shell variables. **true** doesn't have any options, so **x** does nothing when completion is attempted and prints 'Truth has no options.' when completion choices are listed.

   The **man** example, and several other examples that follow, could just as well have used *c/** or *n/** as *p/**.

6. Words can be completed from a variable evaluated at completion time,

```
> complete ftp 'p/1/$hostnames/'
> set hostnames = (rtfm.mit.edu tesla.ee.cornell.edu)
> ftp [^D]
rtfm.mit.edu tesla.ee.cornell.edu
> ftp [^C]
> set hostnames = (rtfm.mit.edu tesla.ee.cornell.edu uunet.uu.net)
> ftp [^D]
rtfm.mit.edu tesla.ee.cornell.edu uunet.uu.net
```

or from a command run at completion time:

```
> complete kill 'p/*/'ps | awk \{print\ \$1\}'/'
> kill -9 [^D]
23113 23377 23380 23406 23429 23529 23530 PID
```

The **complete** command does not itself quote its arguments, so the braces, space and $ in {print $1} must be quoted explicitly.

7. One command can have multiple completions:

```
> complete dbx 'p/2/(core)/' 'p/*/c/'
```

This example completes the second argument to **dbx** with the word *core* and all other arguments with commands. The positional completion is specified before the next-word completion. Since completions are evaluated from left to right, if the next-word completion were specified first it would always match and the positional completion would never be executed. This is a common mistake when defining a completion.

8. The select pattern is useful when a command takes only files with particular forms as arguments. For example,

```
> complete cc 'p/*/f:*.[cao]/'
```

completes *cc* arguments only to files ending in **.c**, **.a**, or **.o**. *select* can also exclude files, using negation of a glob-pattern as described under File name substitution.

9. One might use

```
> complete rm 'p/*/f:^*.{c,h,cc,C,tex,1,man,l,y}/'
```

to exclude precious source code from **rm** completion. Of course, one could still type excluded names manually or override the completion mechanism using the **complete-word-raw** or **list-choices-raw** editor command.

10. The **D, F** and **T**lists are like **d, f** and **t** respectively, but they use the select argument in a different way: to restrict completion to files beginning with a particular path prefix. For example, the Elm mail program uses **=** as an abbreviation for one's mail directory. One might use

```
> complete elm c@=@F:$HOME/Mail/@
```

to complete *elm -f* = as if it were *elm -f ~/Mail/*. We used @ instead of / to avoid confusion with the select argument, and we used $HOME instead of ~ because home directory substitution only works at the beginning of a word.

11. *suffix* is used to add a nonstandard suffix (not space or '/' for directories) to completed words. For example,

```
> complete finger 'c/*@/$hostnames/' 'p/1/u/@'
```

completes arguments to *finger* from the list of users, appends an @, and then completes after the @ from the **hostnames** variable. Note the order in which the completions are specified.

12. A more complex example:

```
complete find \
'n/-name/f/' 'n/-newer/f/' 'n/-{,n}cpio/f/' \
'n/-exec/c/' 'n/-ok/c/' 'n/-user/u/' \
'n/-group/g/' 'n/-fstype/(nfs 4.2)/' \
'n/-type/(b c d f l p s)/' \
'c/-/(name newer cpio ncpio exec ok user \
group fstype type atime ctime depth inum \
ls mtime nogroup nouser perm print prune \
size xdev)/' \
'p/*/d/'
```

This completes words following -name, -newer, -cpio or ncpio (note the pattern which matches both) to files, words following -exec or -ok to commands, words following user and group to users and groups respectively and words following -fstype or -type to members of the given lists. It also completes the switches themselves from the given list (note the use of c-type completion) and completes anything not otherwise completed to a directory.

Programmed completions are ignored if the word being completed is a tilde substitution (beginning with ~) or a variable (beginning with $). **complete** is an experimental feature, and the syntax might change in future versions of the shell. See also the **uncomplete** built-in command.

Related information

tcsh, **uncomplete**

---

dirs built-in command for tcsh: Print the directory stack

Format

dirs [**-l**] [**-n**|**-v**]

dirs -S|**-L** [*file name*]

dirs -c

Description

dirs used alone prints the directory stack in the following format: The top of the stack is at the left and the first directory in the stack is the current directory. For example:

```
 > cd <========== # Change to home dir
 > pushd /bin <== # Change dir to /bin and add /bin to dir stack
 /bin ~
 > pushd /tmp <== # Change dir to /tmp and add /tmp to dir stack
 /tmp /bin ~
 > dirs <======== # Display current dir stack
 /tmp /bin ~
 > dirs -l <===== # Display in expanded (long) format
 /tmp /bin /u/erinf
 > dirs -v <===== # Display in verbose format
 0 /tmp
 1 /bin
 2 ~
 > popd <======== # Change dir back to /bin and remove /tmp from dir stack
 /bin ~
 >pwd
 /bin
Note:  dir=directory
```

Options

–l Output is expanded explicitly to home or the path name of the home directory for the user.

-n Entries are wrapped before they reach the edge of the screen.

-v Entries are printed one per line, preceded by their stack positions.

If more than one of **-n** or **-v** is given, **-v** takes precedence.

-S Saves the directory stack to file name as a series of **cd** and **pushd** commands.

-L The tcsh shell sources file name, which is presumably a directory stack file saved by the **-S** option or the **savedirs** mechanism. In either case, **dirsfile** is used if file name is not given and **~/.cshdirs** is used if dirsfile is unset.

Login shells do the equivalent of **dirs -L** on startup and, if **savedirs** is set, you should issue **dirs -S** before exiting. Because only **~/.tcshrc** is normally sourced before **~/.cshdirs**, **dirsfile** should be set in **~/.tcshrc** instead of **~/.login**.

–c Clear the directory stack.

Related information

tcsh

---

echotc built-in command for tcsh: Exercise the terminal capabilities in args

Format

echotc [**-sv**] **arg** ...

Description

echotc takes advantage of the terminal capabilities in args. For example, **echotc** cm 3 10 sends it to column 3 and row 10.

If arg is *baud*, *cols*, *lines*, *meta* or *tabs*, **echotc** prints the value of that capability (either yes or no, which indicates that the terminal does or does not have that capability). You might use this to make the output from a shell script less verbose on slow terminals, or limit command output to the number of lines on the screen:

```
> set history=`echotc lines`
> @ history--
```

Termcap strings might contain wild cards which will not echo correctly. Use double quotation marks when setting a shell variable to a terminal capability string, as in the following example which places the date in the status line:

```
> set standout=`echotc sō
> set end_standout=`echotc sē
> echo -n "$standout"; date; echo -n "$end_standout"
Mon Oct 25 10:06:48 EDT 1999
>
```

Note: The date, as indicated, is printed out in standard output.

The **infocmp** command can be used to print the current terminal description in termcap format (instead of terminfo format).

Options

-s Nonexistent capabilities return the empty string instead of causing an error.

-v Messages are verbose.

Related information

tcsh

---

filetest built-in command for tcsh: Apply the op file inquiry operator to a file

Format

filetest *-op file –*

Description

filetest applies *op* (which is a file inquiry operator) to each file and returns the results as a space-separated list. For more information about file inquiry operators, see File inquiry operators.

Examples

1. To use the **filetest** command to retrieve the security label: :

```
> filetest -m myfile
SYSLOW
```

2. To test for a specific security label using an if statement:

```
if ( -m myfile == "SYSLOW" ) then
       echo  "myfile has seclabel of SYSLOW"
endif
```

Related information

tcsh

---

glob built-in command for tcsh: Write each word to standard output

Format

glob *wordlist*

Description

glob is like **echo**, but \ (backslash) escapes are not recognized and words are delimited by null characters in the output. **glob** is useful for programs that want to use the shell to file name expand a list of words.

Related information

echo, **tcsh**

hashstat built-in command for tcsh: Print a statistic line on hash table effectiveness

Format

hashstat

Description

hashstat prints a statistics line indicating how effective the internal hash table has been at locating commands (and avoiding exec's). An exec is attempted for each component of the path where the hash function indicates a possible hit, and in each component which does not begin with a / (forward slash).

z/OS systems have a vfork() command, however, tcsh is not compiled to use it. Typically on machines without vfork, **hashstat** prints only the number and size of hash buckets, but on z/OS systems, a **hashstat** print out would be similar to the following display:

```
> hashstat
> hashstat 512 hash buckets of 8 bits each
>
```

Related information

tcsh

hup built-in command for tcsh: Run command so it exits on a hang-up signal

Format

hup [*command*]

Description

With *command*, **hup** runs the command such that it will exit on a hangup signal and arranges for the shell to send it a hang-up signal when the shell exits. Commands can set their own response to hangups, overriding **hup**. Without an argument (allowed only in a shell script), **hup** causes the shell to exit on a hangup for the remainder of the script.

Related information

nohup, **tcsh**

limit built-in command for tcsh: Limit consumption of processes

Format

limit [**–h**] [*resource* [*maximum-use*]]

Description

limit limits the consumption by the current process and each process it creates in order to not individually exceed maximum-use on the specified resource. If no *maximum-use* is given, then the current limit is printed; if no *resource* is given, then all limitations are given. If the **-h** flag is specified, the hard limits are used instead of the current limits. The hard limits impose a ceiling on the values of the current limits. All hard limits can be raised only by a process which has superuser authority but a user can lower or raise the current limits within the legal range. If a user attempts to make a soft limit "unlimited", and their effective UID is not 0, then **limit** (or **unlimit**) sets the soft limit to the current hard limit value.

Resources include:

addressspace
: The maximum address space size for the process, measured in kilobytes. If the limit is exceeded, malloc() and mmap() functions will fail. Also, automatic stack growth will fail. An attempt to set the address space size limit lower than the current usage or higher than the existing hard limit will fail.

coredumpsize
: The size of the largest core dump file that will be created. A value of 0 (zero) prevents file creation. Dump file creation will stop at this limit.

cputime
: The maximum amount of CPU time, in seconds, to be used by each process. If the limit is exceeded, a SIGXCPU signal is sent to the process and the process is granted a small CPU time extension to allow for signal generation and delivery. If the extension is used up, the process is terminated with a SIGKILL signal. An attempt to set the CPU limit lower than that already used will fail.

datasize
: The data size limit is the maximum size of the break value for the process, in units of 1024 bytes. This resource always has unlimited hard and soft limits.

descriptors
: The maximum number of open file descriptors allowed for the process. This number is one greater than the maximum value that can be assigned to a newly created descriptor. Any function that attempts to create a new file descriptor beyond the limit will fail. An attempt to set the open file descriptors limit lower than that already used will fail.

filesize The largest single file which can be created by a process. A value of 0 (zero) prevents file creation. If the size is exceeded, a SIGXFSZ signal is sent to the process. If the process is blocking, catching, or ignoring SIGXFSZ, continued attempts to increase the size of a file beyond the limit will fail.

memlimit
: The amount of storage, in megabytes, above the 2 gigabyte bar that a process is allowed to have allocated and unhidden at any given time. An attempt to set the storage size limit lower than the current usage or higher than the existing hard limit will fail.

stacksize
The maximum size of the automatically-extended stack region for a process. The stack is a per-thread resource that has unlimited hard and soft limits.

maximum-use can be given as a (floating point or integer) number followed by a scale factor. For *cputime* the default scaling is seconds, while m for minutes or h for hours, or a time of the form mm:ss giving minutes and seconds can be used. For *memlimit*, the default scaling is in megabytes. For all limits for which the scale is not specified, the default scale is k or kilobytes (1024 bytes); a scale factor of m or megabytes can also be used.

For both *resource* names and scale factors, unambiguous prefixes of the names suffice.

Usage notes

If the command fails because of an attempt to set a resource limit lower than the current amount in use or higher than the existing hard limit, the resulting error message might indicate an invalid argument.

Related information

tcsh, **ulimit**, **unlimit**

Also see **setrlimit()** in *z/OS XL C/C++ Runtime Library Reference*.

log built-in command for tcsh: Print the watch tcsh shell variable

Format

log

Description

log prints the **watch** shell variable and reports on each user indicated in **watch** who is logged in, regardless of when a user last logged in.

Restriction: The z/OS tcsh shell is compiled to use **watchlog**. If you attempt to use **log** on a z/OS system, you will get an error that says "Command not found".

Related information

tcsh, **watchlog**

login built-in command for tcsh: Terminate a login shell

Format

login

Description

login terminates a login shell, replacing it with an instance of **/bin/login**. This is one way to log off and is included for compatibility with **sh**.

Related information

logout, **tcsh**

---

logout built-in command for tcsh: Terminate a login shell

Format

logout

Description

logout terminates a login shell. It is especially useful if **ignoreeof** is set.

Related information

login, **tcsh**

---

ls-F built-in command for tcsh: List files

Format

ls-F [*-switch ...*] [*file ...*]

Description

In the tcsh shell, **ls-F** lists files like **ls -F**, but works much faster. It identifies each type of special file in the listing with a special character:

/	Directory
*	Executable
#	Block device
%	Character device
|	Named pipe
=	Socket
@	Symbolic link

If the **listlinks** shell variable is set, symbolic links are identified in more detail on systems that have them.

@	Symbolic link to a non-directory
>	Symbolic link to a directory
&	Symbolic link to nowhere

listlinks also slows down **ls-F**.

If you use files that are set up as follows:

```
#creating a file
   touch file1
#creating a symbolic link to the file
   ln -s file1 link1
#creating a directory
   mkdir dir1
#creating a symbolic link to the directory
   ln -s dir1 linkdir1
#creating a symbolic link to a file that doesn't exist
   ln -s noexist linktonowhere
```

when you issue an **ls-F** with **listlinks** unset, you will get the following output:

```
> ls-F
dir1/ file1 link1@ linkdir1@ linktonowhere@
>
```

with **listlinks** set:

```
> set listlinks>
 ls-F
dir1/ file1 link1@ linkdir1> linktonowhere&
>
```

If the **listflags** shell variable is set to x, a or A, or any combination thereof (for example, xA), they are used as flags to **ls-F**, making it act like **ls -xF, ls -Fa, ls -FA** or a combination **ls -Fx**A. On z/OS systems, **ls -C** is the default. However, on machines where **ls -C** is not the default, **ls-F** acts like **ls -CF**, unless **listflags** contains an x, in which case it acts like **ls -xF**.

See "tcsh — Invoke a C shell" on page 689.

Usage notes

To view an online description for the **ls-F** command, you must type **ls-F** without the dash. To see the man page, for example, issue:

```
man lsF
```

Related information

ls, **tcsh**

notify built-in command for tcsh: Notify user of job status changes

Format

notify [*%job ...*]

Description

notify causes the shell to notify the user asynchronously when the status of any of the specified jobs (or, without *%job*, the current job) changes, instead of waiting until the next prompt. *job* can be a number, a string, '', %, + or '-' as described in "Jobs" on page 713. See also the **notify** shell variable.

Related information

tcsh

onintr built-in command for tcsh: Control the action of the tcsh shell on interrupts

Format

onintr [**-** | *label*]

Description

onintr controls the action of the shell on interrupts. Without arguments, **onintr** restores the default action of the shell on interrupts, which is to terminate shell scripts or to return to the terminal command input level. With '-', causes all interrupts to be ignored. With *label*, causes the shell to execute a **goto** *label* when an interrupt is received or a child process terminates because it was interrupted.

onintr is ignored if the shell is running detached and in system startup files, where interrupts are disabled anyway.

Related information

goto, **tcsh**

---

popd built-in command for tcsh: Pop the directory stack

Format

popd [**-p**] [**-l**] [**-n** | **-v**] [+*n*]

Description

popd without options, pops the directory stack and returns to the new top directory. With a number +*n*, discards the *n*'th entry in the stack. All forms of **popd** print the final directory stack, just like **dirs**. The **pushdsilent** shell variable can be set to prevent this.

Options

–l Output is expanded explicitly to home or the path name of the home directory for the user.

-n Entries are wrapped before they reach the edge of the screen.

-p Overrides **pushdsilent**.

-v Entries are printed one per line, preceded by their stack positions.

If more than one of **-n** or **-v** is given, **-v** takes precedence.

Related information

tcsh

---

pushd built-in command for tcsh: Make exchanges within directory stack

Format

pushd [**-p**] [**-l**] [**-n** | **-v**] [*name* | +*n*]

Description

pushd with options, exchanges the top two elements of the directory stack. If **pushdtohome** is set, **pushd** without arguments does *pushd* ~, like **cd**. With *name*, **pushd** pushes the current working directory onto the directory stack and changes to name. If name is '-', it is interpreted as the previous working directory (see File

name substitution). If **dunique** is set, **pushd** removes any instances of *name* from the stack before pushing it onto the stack. With a number *+n*, **pushd** rotates the *n*'th element of the directory stack around to be the top element and changes to it. If **dextract** is set, however, **pushd** *+n* extracts the *n*'th directory, pushes it onto the top of the stack and changes to it. So, instead of just rotating the entire stack around, **dextract** lets the user have the *n*'th directory extracted from its current position, and pushes it onto the top. For example:

```
> pushd /tmp
/tmp ~
> pushd /bin
/bin /tmp ~
> pushd /u
/u /bin /tmp ~
> pushd /usr
/usr /u /bin /tmp ~
> pushd +2
/bin /tmp ~ /usr /u
> set dextract
> dirs
/bin /tmp ~ /usr /u
> pushd +2
~ /bin /tmp /usr /u
>
```

Finally, all forms of **pushd** print the final directory stack, just like **dirs**. The **pushdsilent** tcsh shell variable can be set to prevent this.

Options

–l Output is expanded explicitly to home or the path name of the home directory for the user.

-n Entries are wrapped before they reach the edge of the screen.

-p Overrides **pushdsilent**.

-v Entries are printed one per line, preceded by their stack postions.

If more than one of **-n** or **-v** is given, **-v** takes precedence.

Related information

cd, **tcsh**

rehash built-in command for tcsh: Recompute internal hash table

Format

rehash

Description

rehash causes the internal hash table of the contents of the directories in the **path** variable to be recomputed. This is needed if new commands are added to directories in path while you are logged in. This should only be necessary if you add commands to one of your own directories, or if a systems programmer changes the contents of one of the system directories. Also flushes the cache of home directories built by tilde (~) expansion.

Related information

hashstat, tcsh

repeat built-in command for tcsh: Execute command count times

Format

repeat *count command*

Description

The specified *command* is executed *count* times. **repeat** is subject to the same restrictions as the command in the one line **if** statement. I/O redirections occur exactly once, even if *count* is 0.

Related information

tcsh

sched built-in command for tcsh: Print scheduled event list

Format

sched

sched *hh:mm command*

sched *n*

Description

sched used alone prints the scheduled-event list. The sched shell variable can be set to define the format in which the scheduled-event list is printed. **sched** *hh:mm command* adds command to the scheduled-event list. For example:

```
>sched 11:00 echo It\'s eleven o\'clock.
```

causes the shell to echo 'It's eleven o'clock.' at 11 a.m. The time can be in 12-hour a.m. or p.m. format

```
>sched 5pm set prompt='[%h] It\'s after 5; go home: >'
```

or it can be relative to the current time:

```
>sched +2:15 /usr/lib/uucp/uucico -r1 -sother
```

A relative time specification cannot use a.m. or p.m. format together. The third form removes item *n* from the event list:

```
> sched
1 Wed Apr 4 15:42 /usr/lib/uucp/uucico -r1 -sother
2 Wed Apr 4 17:00 set prompt=[%h] It's after 5; go home: >
> sched -2
> sched
1 Wed Apr 4 15:42 /usr/lib/uucp/uucico -r1 -sother
```

A command in the scheduled-event list is executed just before the first prompt is printed after the time when the command is scheduled. It is possible to miss the exact time when the command is to be run, but an overdue command will execute

at the next prompt. A command which comes due while the shell is waiting for user input is executed immediately. However, normal operation of an already-running command will not be interrupted so that a scheduled-event list element can be run.

This mechanism is similar to, but not the same as, the **at** command on some UNIX systems. Its major disadvantage is that it might not run a command at exactly the specified time. Its major advantage is that because **sched** runs directly from the shell, it has access to shell variables and other structures. This provides a mechanism for changing one's working environment based on the time of day.

Related information

tcsh

setenv built-in command for tcsh: Set environment variable name to value

Format

setenv [*name* [*value*]]

Description

setenv without arguments, prints the names and values of all environment variables. Given *name*, sets the environment variable name to *value* or, without *value*, to the null string.

Related information

tcsh

settc built-in command for tcsh: Tell tcsh shell the terminal capability cap value

Format

settc *cap value*

Description

settc tells the tcsh shell to believe that the terminal capability cap (as defined in **termcap**) has the value *value*. No sanity checking is done. Concept terminal users might have to **settc** *xn no* to get proper wrapping at the rightmost column.

Related information

tcsh

setty built-in command for tcsh: Control tty mode changes

Format

setty [**-d** | **-q** | **-x**] [**-a**] [+ | -]*mode*]

Description

setty controls which tty modes (see the **stty** command description which contains lists of mode operands, such as **echoe** and **echok**) the shell does not allow to change. Without arguments, **setty** lists the modes in the chosen set which are fixed on (+mode) or off (-mode). The available modes, and thus the display, vary from system to system. With +mode, -mode or mode, fixes mode on or off or removes control from mode in the chosen set. For example, **setty** *+echok echoe* fixes echok mode on and allows commands to turn echoe mode on or off, both when the shell is executing commands.

Options

–a List all tty modes in the chosen set whether or not they are fixed.

[-d | -q | -x]
Tells **setty** to act on the edit, quote or execute set of tty modes respectively; without **-d, -q** or **-x**, execute is used.

Related information

tcsh

source built-in command for tcsh: Read and execute commands from name

Format

source [**-h**] *name* [*args ...*]

Description

Using **source**, the shell reads and executes commands from *name*. The commands are not placed on the history list. If any arguments are given, they are placed in **argv**. **source** commands can be nested; if they are nested too deeply the shell might run out of file descriptors. An error in a source at any level terminates all nested source commands.

Options

–h Commands are placed on the history list instead of being executed, much like **history -L**.

Related information

history, **tcsh**

telltc built-in command for tcsh: List terminal capability values

Format

telltc

Description

telltc lists the values of all terminal capabilities.

Related information

tcsh

uncomplete built-in command for tcsh: Remove completions whose names match pattern

Format

uncomplete *pattern*

Description

uncomplete removes all completions whose names match the specified pattern. For example, **uncomplete** * removes all completions. It is not an error for nothing to be uncompleted.

Related information

complete, **tcsh**

unhash built-in command for tcsh: Disable use of internal hash table

Format

unhash

Description

unhash disables use of the internal hash table to speed location of executed programs.

Related information

tcsh

unlimit built-in command for tcsh: Remove resource limitations

Format

unlimit [**-h**] [*resource*]

Description

unlimit removes the limitation on *resource* or, if no resource is specified, all resource limitations.

The hard limit can be lowered to any value that is greater than or equal to the soft limit. All hard limits can be raised only by a process which has superuser authority. This behavior is identical to **ulimit** in the z/OS shell. If a user attempts to remove the soft limit on a resource, and their effective UID is not 0, then **unlimit** sets the soft limit to the current hard limit value.

Options

–h Corresponding hard limits are removed. Only the superuser can use this option.

Related information

limit, **tcsh**, **ulimit**

Also see **setrlimit()** in *z/OS XL C/C++ Runtime Library Reference*.

unsetenv built-in command for tcsh: Remove environmental variables that match pattern

Format

unsetenv *pattern*

Description

unsetenv removes all environment variables whose names match pattern. For example, **unsetenv** * removes all environment variables; we **strongly** recommend against this. It is not an error if nothing is removed.

Related information

setenv, **tcsh**

watchlog built-in command for tcsh: Print the watch shell variable

Format

watchlog

Description

watch is an alternate name for the **log** built-in command. It prints the **watch** shell variable and reports on each user indicated in **watch** who is logged in, regardless of when a user last logged in.

See the **version** shell variable.

Related information

log, **tcsh**

where built-in command for tcsh: Report all instances of command

Format

where *command*

Description

where reports all known instances of *command*, including aliases, built-ins and executables in path.

Related information

tcsh, **which**

which built-in command for tcsh: Display next executed command

Format

which *command*

Description

which displays the command that is executed by the shell after substitutions and path searching. This command correctly reports tcsh aliases and built-ins. The displayed command has passed access checks by the security product based on the effective user IDs. See also the **which-command** editor command.

Related information

tcsh, **where**

tee — Duplicate the output stream

Format

tee [**–ai**] [*file ...file ...*]

Description

tee clones an output stream. It copies the standard input to each output file as well as to the standard output.

Options

–a Appends to (rather than overwrites) each output file.

–i Ignores interrupt signals, making it suitable for use as a background process.

Examples

The following command runs the program **prog** and pipes the program's standard output into **tee**:

```
prog | tee file
```

As a result, **tee** writes the output to both the standard output and the specified file.

Localization

tee uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Out of memory when allocating I/O buffers
- I/O error reading or writing to a file
- Error creating an output file
- Error opening an output file for appending

2 Failure due to incorrect command-line option

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems.

Related information

cat, **script**

test — Test for a condition

Format

test *expression* [*expression*]

Description

test checks for various properties of files, strings, and integers. It does not produce any output other than error messages, but returns the result of the test as the exit status.

The second form of the test command [*expression*] is synonymous with the first. For more information about [[...]], see rewoco in the **ssh** command description.

The following is a list of recognized operands:

The command line is a Boolean expression. The simplest expression is a string that is true if the string is nonempty (that is, has nonzero length). More complex expressions are composed of operators and operands, each of which is a separate argument (that is, surrounded by white space). The operators imply the number and type of their operands. The operators taking a *file* operand evaluate as false (without error) if the file does not exist.

The following is a list of recognized operands:

–Aa *file*
True if *file* has an extended access ACL entry.

–Ad *file*
True if *file* is a directory with a directory default ACL.

–Af *file*
True if *file* is a directory with a file default ACL.

–b *file* True if *file* is a block special file (block special files are not supported)

–B *file* True if the file is tagged as binary (not text)

–c *file* True if *file* is a character special file

–d *file* True if *file* is a directory

–e *file* True if *file* exists

–Ea *file*
True if the file has the APF extended attribute

–Ep *file*
True if the file has the program control extended attribute

–Es *file*
True if the file has the shared address space extended attribute

–El *file* True if the file has the shared library extended attribute

–f *file* True if *file* is an ordinary file

–g *file* True if the set-group-ID attribute of *file* is on

–h *file* True if *file* is a symbolic link

–k *file* True if the "sticky" bit is on *file* is on

–L *file* True if *file* is a symbolic link

–Ma *file*
True if the file has any Multilevel Security seclabel.

–n *string*
True if the length of *string* is greater than zero

–p *file* True if *file* is a FIFO (named pipe)

–r *file* True if *file* is readable (based on the security product's check against the effective user/group)

–s *file* True if size of the *file* is nonzero

–t *fd* True if the numeric file descriptor *fd* is open and associated with a terminal

–T *file* True if the file is tagged as text

–u *file* True if the set-user-ID attribute of *file* is on

–w *file* True if *file* is writable (based on the security product's check against the effective user/group)

–x *file* True if *file* is executable (based on the security product's check against the effective user/group)

–z *string*
True if the length of the *string* is zero

string True if *string* is not a null string

string1 **=** *string2*
True if *string1* and *string2* are identical

string **!=** *string*
True if *string1* and *string2* are not identical

number1 **–eq** *number2*
True if *number1* and *number2* are equal

Within the shell, either number can be an arbitrary *shell* arithmetic expression; the same applies for the other five numerical comparisons that follow. Both *number1* and *number2* must be integers.

number1 **–ge** *number2*
True if *number1* is greater than or equal to *number2*

number1 **–gt** *number2*
True if *number1* is greater than *number2*

number1 **–le** *number2*
True if *number1* is less than or equal to *number2*

number1 **–lt** *number2*
True if *number1* is less than *number2*

number1 **–ne** *number2*
True if *number1* is not equal to *number2*

file1 **–nt** *file2*
True if *file1* is newer than *file2*

file1 **–ot** *file2*
True if *file1* is older than *file2*

file1 **–ef** *file2*
True if *file1* has the same device and inode number as *file2*

file **–CS codeset**
True if the file is tagged with the codeset

file **–Ml** *seclabel*
True if the file has the multilevel security seclabel *seclabel*. False if the file does not have a seclabel that matches *seclabel*

expr1 **–a** *expr2*
Logical AND; true if both *expr1* and *expr2* are true

expr1 **–o** *expr2*
Logical OR; true if either *expr1* and *expr2* is true

! *expr* Logical negation; true if *expr* is false

(*expr* **)**
Binding; true if *expr* is true

The precedence of the operators in descending order is: unary operators, comparison operators, logical AND, logical OR.

The second form of the test command:

```
[ expression ]
```

is synonymous with the first.

Usage notes

1. **test** is a built-in shell command.
2. **test** can compare variables; however, if the variable is null, the expression may be incorrect for **test**. For example:

   ```
   NULL=
   test $NULL = "so"
   ```

   does not work, because the z/OS shell expands this to:

   ```
   test = "so"
   ```

   which is not a valid expression for **test**. A way to get around this is to prepend some value to both strings, as in:

```
test x$NULL = x"so"
```

Failure to quote variable expansions is a common mistake. For example:

```
test $NULL != string
```

If NULL is undefined or empty, this results in:

```
test != string
```

which is not a valid test expression. This problem can be fixed by enclosing $NULL in quotes.

These two examples perform basically the same function; that is, they protect the command against a variable having a possible null value.

Examples

The following command reports on whether the first positional parameter contains a directory or a file:

```
if [ -f $1 ]
then
        echo $1 is a file
elif [ -d $1 ]
then
        echo $1 is a directory
else
        echo $1 neither file nor directory
fi
```

This example illustrates the use of **test**, and is not intended to be an efficient method.

Localization

test uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 The *expression* was true
1 The *expression* was false
2 The *expression* was badly formed

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–k**, **–L**, **–nt**, **–ot**, **–ef**, **–a**, and **–o** operators plus the use of parentheses to group operators together are all extensions of the POSIX standard.

Related information

expr, **find**, **let**, **ls**, **sh**

tic — Put terminal entries in the terminfo database

Format

tic [**–v**]*number* [**–c**] *file*

Description

tic creates the terminfo database. It puts the compiled terminal entries in the directory **/usr/share/lib/terminfo**. If the TERMINFO environment variable is set, the results are placed in the directory specified by the TERMINFO environment variable rather than in the directory **/usr/share/lib/terminfo.**

The Curses application uses the terminfo database, which contains a list of terminal descriptions. This enables you to manipulate a terminal's display regardless of the terminal type. For information about defining the terminfo database, see the section on customizing the terminfo database in*z/OS UNIX System Services Planning*.

For more information about curses, see *z/OS C Curses*.

Options

–v*Number*
: Writes trace entries on the progress of **tic**. *Number* is an integer that indicates the level of verbosity. Levels 1, 2, 5, 7, 8, and 9 or greater are supported.

–c
: Specifies that the input terminal specifications are to be checked for correctness, but the terminfo database is not to be updated. If an incorrect terminal specification is encountered, a message identifying the error is written to **stdout**. The checking continues until all of the input terminal specifications have been processed.

file_name
: Specifies the name of a file containing the terminal specifications. Only a single file name can be specified. The files supported by z/OS Curses are identical to the specifications with the exception that the source code must be EBCDIC rather than ASCII.

  If the files are copied from an MVS data set into the z/OS UNIX file system, the MVS data set must be in record format VB. If a file name is not specified, terminal specifications are read from the **terminfo.src** file. (The **terminfo.src** file is in the directory **/samples**.)

  The **.ti** files are located in the **/samples** directory.

Examples

A sample command is:

```
tic /samples/ibm.ti
```

There is no output to the shell.

Environment variables

tic uses the following environment variable:

TERMINFO
Contains the path name of the terminfo database.

Related information

infocmp

---

time — Display processor and elapsed times for a command

Format

time [**–p**] *command-line*

tcsh shell: **time** [*command*]

Description

time runs the command given as its argument and produces a breakdown of total time to run (`real`), total time spent in the user program (`user`), and total time spent in system processor overhead (`sys`).

Times given are statistical, based on where execution is at a clock tick. Output is written to standard error.

time is a built-in shell command.

In the tcsh shell, **time** executes *command* (which must be a simple command, not an alias, a pipeline, a command list, or a parenthesized command list) and prints a time summary as described under the tcsh **time** variable (see "tcsh — Invoke a C shell" on page 689). If necessary, an extra shell is created to print the time statistic when the *command* completes. Without *command*, **time** prints a time summary for the current shell and its children.

Option

–p Guarantees that the historical format of the **time** command is output.

Localization

time uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_NUMERIC**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

If **time** successfully invokes *command-line*, it returns the exit status of *command-line*. Otherwise, possible exit status values are:

0 Successful completion
1 An error occurred in the **time** utility
2 Failure due to an invalid command-line option

2 Invalid command-line argument
126 **time** found *command* but could not invoke it
127 **time** could not find *command*

Portability

POSIX.2 User Portability Extension, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems.

Related information

sh, **tcsh**

---

times — Get process and child process times

Format

times [**–p**]

Description

times displays user and system times accumulated by the shell and commands run as children of the shell. Times are displayed in minutes and seconds. User time is CPU time spent in user programs. System time is CPU time spent in the operating system on behalf of the user process.

Options

–p Formats the output in seconds without units. For example, 1 minute and 3.7 seconds is displayed as:

```
63.47
```

Times are displayed in minutes and seconds. User time is processor time spent in user programs. System time is processor time spent in the operating system on behalf of the user process. The output layout is:

```
shell user time         shell system time
child user time         child system time
```

Usage notes

times is a built-in shell command.

Localization

times uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

2 Failure that resulted in a usage message, usually due to an incorrect command-line option

Portability

X/Open Portability GuideX/Open Portability Guide.

The **–p** option is an extension to the XPG standard.

Related information

sh, **time**

---

touch — Change the file access and modification times

Format

touch [**–acm**] [**–f** *agefile*] [**–r** *agefile*] [**–t** *time*] *file ...*

touch [**–acm**] *time file ...*

Description

The **touch** command changes certain dates for each *file* argument. By default, **touch** sets both the date of last file modification and the date of last file access to the current time. It maintains the correct release times for software and is useful with the **make** command.

Options

–a Sets only the access time.

–c Does not create any *file* that does not exist. Normally, **touch** creates such files.

–m Sets only the modification time.

If you do not specify **–a** or **–m**, **touch** behaves as though you specified both.

To tell **touch** to use a time other than the current, use one of the following options:

–f *agefile*
Is an obsolete version of the **–r** option.

–r *agefile*
Sets the access and modification times (as indicated by the other options) to those times kept for *agefile*.

–t *time* Specifies a particular time using this format:

`[[[[cc]yy]mm]dd]hhmm [.ss]`

where:

- *cc* is the first two digits of the year (optional)
- *yy* is the last two digits of the year (optional)
- *mm* is the number of the month (01—12) (optional)
- *dd* is the day of the month (optional)
- *hh* is the hour in 24-hour format (required)

- *mm* is the minutes (required)
- *ss* is the seconds (optional)

An obsolete (but still supported) version of this command lets you omit the **–t**, but the format is:

[[mm]dd]hhmm[.ss]

or:

mmddhhmmyy[.ss]

Examples

1. To set the modification time of **newfile** to the present, enter:
   ```
   touch newfile
   ```
2. To set the modification time of **oldfile** to 13:05 on July 3, 1994, enter:
   ```
   touch –t 9407031305 oldfile
   ```
3. To set the modification time of **newfile** to that of **oldfile**, enter:
   ```
   touch –r oldfile newfile
   ```

Environment variables

touch uses the following environment variable:

TZ Contains the time zone that **touch** is to use when interpreting times.

Appendix I, "Format of the TZ environment variable," on page 1021 explains how to set the local time zone with the TZ environment variable.

Localization

touch uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to access the desired file
- Too early a date was specified
- Inability to create a file
- Inability to change a file's times

2 Failure that resulted in a usage message, including:
- Unknown command-line option
- Only one of **–t**, **–f**, or **–r** is allowed
- **–r** was missing the *agefile*
- **–t** was missing its argument
- Incorrect date string

Messages

Possible error messages include:

Age file inaccessible
Indicates that time could not be found for the file given with the **–f** or **–r** option either because that file does not exist or because the requesting user is not granted the appropriate permission for the file.

Missing age file argument
You specified **–f** or **–r**, but did not give a file name after it.

Years earlier than year incorrect
Your system recognizes dates only back to the given *year*. **touch** does not accept dates before that time.

Bad date conversion

Only one –r, –f, or –t flag allowed

Missing the date or time argument

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems.

Related information

cp, **date**

Appendix I, "Format of the TZ environment variable," on page 1021 explains how to set the local time zone with the TZ environment variable.

tput — Change characteristics of terminals

Format

tput [**–T** *type*] *capname*[*parm1...parm9*]

tput [**–T** *type*] **–S**

Description

tput lets you change your terminal's characteristics. The *capname* arguments indicate how you want to change the characteristics. Possible capnames are:

`clear` Clears the screen

`init` Initializes your terminal

`reset` Resets your terminal

tput does its work by outputting appropriate character sequences to the standard output. These character sequences are terminal-specific.

Usually, **tput** looks for an environment variable named **TERM**. If **TERM** exists, **tput** uses its value as the terminal type. If it doesn't exist, **tput** assumes a default terminal type.

Options

–T *type*
Identifies the type of your terminal. This overrides the TERM environment variable.

The second format of this command provides extensions for XPG/System V. This format of **tput** accepts an additional option, **–S**.

–S Takes input from standard input, one capability/capname per line. A blank line terminates input.

An additional capname is supported for System V:

longname
Returns the long descriptive name of the terminal.

An extension to provide System V capabilities allows *capname* to be a capability from the terminfo database. If the capability requires arguments, they appear after the *capname* option.

Localization

tput uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Environment variables

tput uses the following environment variables:

TERM Contains the current terminal type.

TERMINFO
Can be used to override the default database.

Exit values

0 **tput** successfully wrote an appropriate character sequence to change the terminal's characteristics, or a Boolean terminfo variable is true.

1 A Boolean terminfo variable is false.

2 Failure that generated a usage message such as:
- *capname* was not a recognized keyword
- You specified an incorrect command-line option

3 **tput** has no information about the terminal type given by **–T** or **TERM**.

4 The requested capname cannot be performed on your type of terminal.

>4 An error occurred.

Portability

POSIX.2 User Portability Extension, UNIX systemsUNIX systems.

Related information

stty, **tabs**

tr — Translate characters

Format

tr [**–c** | **C**] [**-s**] *string1 string2*
tr **–s** [**–c** | **C**] *string1*
tr **–d** [**–c** | **C**] *string1*
tr **–ds** [**–c** | **C**] *string1 string2*

Description

tr copies data read from the standard input to **stdout**, substituting or deleting characters as specified by the options and *string1* and *string2*. *string1* and *string2* are considered to be sets of characters. In its simplest form, **tr** translates each character in *string1* into the character at the corresponding position in *string2*.

Note: **tr** works on a character basis, not on a collation element basis. Thus, for example, a range that includes the multicharacter collation element `ch` in regular expressions, does not include it here.

Options

–c If the variable **_UNIX03** is unset or is not set to YES, the behavior of **-c** option complements the set of characters specified by *string1*. This means that **tr** constructs a new set of characters, consisting of all the characters not found in *string1* and uses this new set in place of *string1*.

If the variable **_UNIX03**=YES is set, the behavior of **-c** option complements the set of values specified by *string1*. This means that **tr** constructs a new set and the complements of the values specified by *string1* (the set of all possible binary values, except for those actually specified in the *string1* operand) are placed in this new set in ascending order by binary value. The new set is used in place of *string1*.

-C Complements the set of characters specified by *string1*. This means that **tr** constructs a new set and the complements of the characters specified by *string1* (the set of all characters in the current character set, as defined by the current setting of **LC_CTYPE**, except for those actually specified in the *string1* operand) are placed in this new set in ascending collation sequence, as defined by the current setting of **LC_COLLATE**. This behaves the same as **-c** when the variable **_UNIX03** is unset or is not set to YES.

–d Deletes input characters found in *string1* from the output.

–s **tr** checks for sequences of a *string1* character repeated several consecutive times. When this happens, **tr** replaces the sequence of repeated characters with one occurrence of the corresponding character from *string2*; if *string2* is not specified, the sequence is replaced with one occurrence of the repeated character itself. For example:

```
tr –s abc xyz
```

translates the input string aaaabccccb into the output string of xyzy.

If you specify both the **–d** and **–s** options, you must specify both *string1* and *string2*. In this case, *string1* contains the characters to be deleted, whereas *string2* contains characters that are to have multiple consecutive appearances replaced with one appearance of the character itself. For example:

```
tr –ds a b
```

translates the input string abbbaaacbb into the output string bcb.

The actions of the **–s** option take place after all other deletions and translations.

String options

You can use the following conventions to represent elements of *string1* and *string2*:

character
: Any character not described by the conventions that follow represents itself.

ooo
: An octal representation of a character with a specific coded value. It can consist of one, two, or three octal digits (01234567). Double-byte characters require multiple, concatenated escape sequences of this type, including the leading \ for each byte.

character
: The \ (backslash) character is used as an escape to remove the special meaning of characters. It also introduces escape sequences for nonprinting characters, in the manner of C character constants: \b, \f, \n, \r, \t, and \v.

c1–c2
: In the POSIX locale, as long as neither endpoint is an octal sequence of the form *ooo*, this represents all characters between characters *c1* and *c2* (in the current locale's collating sequence) including the end values. For example, 'a–z' represents all the lowercase letters in the POSIX locale, whereas 'A–Z' represents all that locale's uppercase letters. One way to convert lowercase and uppercase is with the following filter:

  ```
  tr 'a-z' 'A-Z'
  ```

  This is not, however, the recommended method; use the [:*class*:] construct instead.

  If the second endpoint precedes the starting endpoint in the collation sequence, it causes an error.

  If either or both of the range endpoints are octal sequences of the form *ooo*, this represents the range of specific coded values between the two range endpoints, inclusive.

  This construct *c1–c2* is only applied in POSIX locale.

  Note: The current locale has a significant effect on results when specifying subranges using this method. If the command is required to give consistent results irrespective of locale, the use of construct c1-c2 should be avoided.

[*c*n*]
: This represents *n* repeated occurrences of character *c*. (If *n* has a leading

zero, **tr** assumes it is octal; otherwise, it is assumed to be decimal.) You can omit the number for the last character in a subset. This representation is valid only in *string2*.

[:*class***:]**
This represents all characters that belong to the character class *class* in the locale indicated by **LC_CTYPE**. When the class `[:upper]` or `[:lower:]` appears in *string1* and the opposite class, `[:lower:]` or `[:upper:]` appears in *string2*, **tr** uses the **LC_CTYPE** `tolower` or `toupper` mappings in the same relative positions.

[=*c***=]** This represents all characters that belong to the same equivalence class as the character *c* in the locale indicated by **LC_COLLATE**. Only international versions of the code support this format.

Usage notes

When *string2* is shorter than *string1*, **tr** does not pad *string2*. The remaining characters in *string1* will not be translated. For example:

```
tr  '0123456789'  'd'
```

only translates '0' to 'd', '123456789' remain unchanged.

Coding the example in the following way:

```
tr  '0123456789'  '[d*]'
```

translates all digits to the letter 'd'.

Examples

This example creates a list of all words (strings of letters) found in file1 and puts it in file2:

```
tr –cs "[:alpha:]" "[\n*]" <file1 >file2
```

Environment variables

tr uses the following environment variable: **_UNIX03**.

For more information about the effect of _UNIX03 on this command, see Appendix N, “Shell commands changed for UNIX03,” on page 1039.

Localization

tr uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure because of unknown command line option, or too few arguments

Portability

POSIX.2, X/Open Portability Guide.

tr is compatible with earlier versions of both the UNIX Version 7 and System V variants of this command, but with extensions (C escapes, handles ASCII NUL, globalization).

trap — Intercept abnormal conditions and interrupts

Format

trap ['*handler*'] [*event ...*]

Description

trap intercepts certain kinds of exception conditions. Any signal may be intercepted by specifying an event corresponding to the signal number.

With an event of `ERR`, **trap** invokes the handler after receiving any having a nonzero exit status. The exception to this is conditions in **if**, **while**, and **until** statements. This trap is not inherited within a function.

With a trap number of `0` or `EXIT`, **trap** invokes the handler during exit from the shell. Within a function, it is invoked during exit from the function.

Any other event corresponds to a signal number or signal name. (See **kill** for a table of valid signal numbers and their names.) If a signal is being ignored when you enter the shell, the shell continues to ignore it without regard to any traps.

Because system initialization sets the value of the SIGIOERR signal to `ignore`, this signal cannot be set by **trap**.

The *handler* argument is a command list. It is usually more than one word, and so you must quote it to appear as a single argument. It is scanned when the trap function is initially invoked. When the trap condition is raised, the shell scans the command list again and runs the commands. A missing argument or an argument of `-` (dash) resets the default trap condition. A null argument ('') causes the trap condition to be ignored.

If there are no arguments at all, **trap** prints a list of all the traps and their commands.

Usage notes

trap is a special built-in shell command.

Examples

1. On error or exit, this example deletes a temporary file created during command execution.

   ```
   trap 'rm –f /tmp/xyz$$; exit' ERR EXIT
   ```

   When an interrupt signal is received, the example prompts whether to abort, and exits if the answer is `y`.

```
trap 'read REPLY?"ABORT??"
        case $REPLY in
        y)      exit 1;;
        esac'   2
```

2. This example saves your shell history file (specified by the value you give the HISTFILE environment variable) before timing you out, so you can restore it when you log on again.

```
trap 'cp $HISTFILE $HOME/old_hist.bak; exit' ALRM
```

Localization

trap uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Incorrect signal name
- Incorrect signal number

2 Incorrect command-line argument

Messages

Possible error messages include:

name **not a valid trap name**
You specified an unrecognized trap name. The usual cause of this error is a typing mistake on the command line.

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide.

Related information

sh

true — Return a value of 0

Format

true [*argument ...*]

Description

true simply yields an exit status of zero (success). It ignores any arguments given on the command line. This can be surprisingly useful—for example, when you are evaluating shell expressions for their side effects.

Usage notes

true is a built-in shell command.

Localization

true uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

Since **true** always succeeds, the only possible exit status is:

0 Successful completion

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems.

Related information

sh

---

tso — Run a TSO/E command from the shell

Format

tso [**–o**] [**–t**] *TSO_command*

Description

tso runs a TSO/E command from the shell using the TSO/E service routine or the OMVS interface.

Restriction: The **tso** command cannot be used to issue authorized TSO commands when the TSO/E command service is used. See tsocmd if that is required.

Options

–o Specifies that the command be issued through the OMVS interface.

–t Specifies that the command be issued through the TSO/E service routine. If a mini-TSO/E environment is to be established, use environment variables to specify the allocations that you need.Because the **tso** command uses an exec() of itself to clean up at completion , the **tso** command must be run using a valid PATH environment variable or be run using its full path name, `/bin/tso`.

If you do not specify an option, the following rules determine how to run the TSO/E command:

- If stdout is not a tty, the TSO/E service routine is used because it is possible that the command output will be redirected to a file or piped to another command.
- If the controlling tty supports 3270 passthrough mode, the OMVS interface is used.
- If neither rule is applicable, then the TSO/E service routine is used.

Examples

1. To use OPUT to copy an MVS data set to a file in your current directory, issue:

   ```
   tso –t "oput 'source.c(hello)' 'hello.c' "
   ```

   If you do not specify **–t**, the command is run in your TSO/E session through OMVS, if possible. This copies the file to a file relative to the working directory of your TSO/E session, which is typically your home directory.

   Quotes are used around the command to avoid shell parsing.

2. To use OPUTX to copy all members of a PDS to your current directory, issue:

   ```
   tso –t "oputx source.c . lc suffix(c)"
   ```

   If you do not specify the **–t** option, the command is run in your TSO/E session through OMVS, if possible. This copies the file to a file relative to the working directory of your TSO/E session which is typically your home directory.

   Quotes are used around the command to avoid shell parsing.

   Because OPUTX uses ISPF, allocations for the ISPF DD names must be performed to run this command. The following is an example of the environment variables that are set to perform these allocations. This can be included in your .profile for convenience. Make sure the export statements start in column one. The data set names might differ on your system.

   ```
   # Assign the DD names to allocate
   #
   export TSOALLOC=ispprof:ispplib:ispmlib:isptlib:ispllib:ispslib:\
   isptabl:isplog:sysexec
   #
   # Allocate an empty, temporary ISPF profile data set
   #
   export ispprof="alloc new unit(sysvio) space(1,1) cyl dir(5) \
   recfm(f,b) lrecl(80) blksize(3120)"
   #
   # Allocate an empty, temporary ISPF table data set
   #
   export isptabl="alloc new unit(sysvio) space(1,1) cyl dir(5) \
   recfm(f,b) lrecl(80) blksize(3120)"
   #
   # Allocate the ISPF log to SYSOUT
   #
   export isplog="alloc sysout(a) recfm(v,a) lrecl(125) blksize(129)"
   #
   # Allocate the OpenMVS and ISPF panel data sets to ISPPLIB
   #
   export ispplib=SYS1.SBPXPENU:SYS1.ISP.SISPPENU
   #
   # Allocate the OpenMVS and ISPF message data sets to ISPMLIB
   #
   export ispmlib=SYS1.SBPXMENU:SYS1.ISP.SISPMENU
   #
   # Allocate the ISPF table data set to ISPTLIB
   #
   export isptlib=SYS1.ISP.SISPTENU
   #
   # Allocate the ISPF skeleton data set to ISPSLIB
   #
   export ispslib=SYS1.ISP.SISPSENU
   ```

```
#
# Allocate any load library to ISPLLIB if ISPF is in LINKLIST/LPA
#
export ispllib=SYS1.LINKLIB
#
# Allocate the OpenMVS EXEC data set to SYSEXEC
#
export sysexec=SYS1.SBPXEXEC
```

Environment variables

If the **tso** command is to be run through the TSO/E service routine, you might need to perform allocations or other customization for the TSO/E environment. These tasks can be specified using environment variables. You can use the following environment variables:

SYSEXEC
Specifies the allocation specification for the SYSEXEC DD name. If the **TSOALLOC** variable is set, this variable is not automatically used.

SYSPROC
Specifies the allocation specification for the SYSPROC DD name. If the **TSOALLOC** variable is set, this variable is not automatically used.

TSOALLOC
Specifies the names of the environment variables that contain allocation specifications. The names are separated by colons. Case is respected; lowercase letters are treated as lowercase. The names of the environment variables also correspond to the name of the DD name to be allocated. The DD name is always treated as uppercase but the variable name can be specified in mixed case to avoid possible conflict with similar environment variable names.

The HOLD attribute is supported for SYSOUT allocation in the BPXWDYN text interface and TSOALLOC environment variable.

TSOOUT or tsoout
Specifies the allocation attributes for SYSTSPRT. The format of the variable is in bpxwdyn format without a dd name. For example:

```
export tsoout="alloc path('/dev/tty') pathopts(owronly) filedata(text)"
```

Rule: If both TSOOUT and tsoout are used, TSOOUT takes precedence.

TSOPREFIX
Specifies a prefix for temporary data sets that need to be cataloged. Lowercase letters are treated as uppercase letters. If you do not specify this variable, the user's login name (user ID) is used.

TSOPROFILE
Resets the profile with the arguments that you specify when running the TSO/E command. (The specified arguments replace the default values.) For example, to set the TSO prefix and to turn off message IDs, issue:

```
export TSOPROFILE="prefix(wjs) nomsgid"
```

The value of this variable is passed to the TSO/E PROFILE command as is. If the PROFILE command fails, the requested command is not run. The output from the PROFILE command is sent to stdout along with the PROFILE command that was issued.

An allocation specification can be either a list of cataloged data set names separated by colons or a data set allocation request. If a list of data set names is used, lowercase letters are treated as uppercase and the data set names must be fully qualified.

Specify a request for data allocation by beginning the specification with the keyword *alloc* followed by keywords or keyword-value pairs in a format similar to the TSO/E ALLOCATE command. Keys are separated by blanks. A complete listing of keys can be found in *z/OS Using REXX and z/OS UNIX System Services*. Following is a list of keys:

DA (*data set name* **[(***member name***)]) | DSN (***data set name* **[(***member name***)])**
Data set name to allocate. The name must be fully qualified and can include a member name. Quotes can be used but are ignored.

MOD | NEW | OLD | SHR
Specifies the status of the data set.

CATALOG | DELETE | KEEP | UNCATALOG
Specifies the data set disposition.

TRACKS
Specifies that space be allocated in units of tracks.

CYL Specifies that space be allocated in units of cylinders

DIR(*directory blocks***)**
Specifies the number of directory blocks.

SPACE(*primary***[,***secondary***])**
Specifies that primary and (optionally) secondary space be allocated.

VOL(*volume serial***)**
Specifies the VOLSER.

UNIT(*unit name***)**
Specifies the unit name, device type, or unit address.

SYSOUT[(*class***)]**
Specifies that a sysout data set is to be allocated and optionally defines the output class.

HOLD
Specifies that the output data is to be held until released by user or operator.

WRITER(*external writer name***)**
Specifies the external writer.

FORMS(*forms name name***)**
Specifies the print form.

DEST(*destination***)**
Specifies the output destination.

COPIES(*number of copies***)**
Specifies the number of copies to be printed.

DUMMY
Specifies that a dummy data set be allocated.

BLKSIZE(*block size***)**
Specifies the block size.

LRECL(*record length***)**
Specifies the logical record length.

DSORG(PS | PO | DA)
Specifies the data set organization.

RECFM(*format***[,***format...***])**
Specifies the record format. The values are A, B, D, F, M, S, T, U, and V. You can combine several of these values.

STORCLAS(*storage class***)**
Specifies the storage class.

MGMTCLAS(*management class***)**
Specifies the management class

DATACLAS(*data class***)**
Specifies the data class.

RECORG(LS)
Specifies that a VSAM linear data set be created.

DSNTYPE(LIBRARY | PDS | HFS)
Specifies the data set type.

SPIN(UNALLOC)
Specifies that a sysout data set be spun off at allocation.

NORECALL
Specifies that the allocation request be failed if the data set is migrated.

PATH('*pathname***')**
Specifies that the allocation is for a file in the z/OS UNIX file system.

PATHOPTS(*pathopt***[,***pathopt***]...)**
Specifies a list of path options: **ORDWR OEXCL OSYNC OTRUNC OCREAT OWRONLY ORDONLY OAPPEND ONOCTTY ONONBLOCK**.

PATHMODE(*pathmode***[,***pathmode***]...)**
Specifies a list of path modes: **SIRUSR SIWUSR SIXUSR SIRWXU SIRGRP SIWGRP SIXGRP SIRWXG SIROTH SIWOTH SIXOTH SIRWXO SISUID SISGID SISVTX**

PATHDISP(KEEP | DELETE[,KEEP | DELETE])
Specifies the normal and abnormal file disposition.

FILEDATA(TEXT | BINARY)
Specifies whether the data is to be treated as text or binary.

Messages

0–254 Successful completion

255 The return code is outside the range 0–254 or the **tso** command ended in error

Related information

tsocmd

tsocmd — Run a TSO/E command from the shell (including authorized commands)

Format

tsocmd *TSO_command*

Description

tsocmd runs a TSO/E command from the shell using the TSO/E terminal monitor program (IKJEFT01). Unlike the **tso** command, the **tsocmd** command can be used to issue authorized TSO/E commands. (For more information about the **tso** command, see "tso — Run a TSO/E command from the shell" on page 772). Because the TSO/E TMP is run in a separate address space and process from the **tsocmd** command, TSO/E commands that are issued do not affect the environment that the **tsocmd** is issued from.

See *z/OS TSO/E Programming Services* for more information about the TSO/E TMP.

Usage notes

1. The BPXWRFT=YES environment variable can be set to cause file descriptors to be inherited by the TSO command processor. When it is set, file descriptors 10-99 are inherited.

Examples

1. To issue the authorized RACF command RDEFINE, issue:

   ```
   tsocmd "RDEFINE FACILITY BPX.FILEATTR.PROGCTL UACC(NONE)"
   ```

   Quotation marks are used around the command to avoid shell parsing.
2. To use OGET to copy from a file in your current directory to an MVS data set, issue:

   ```
   tsocmd "oget hello.c 'source.c(hello)'"
   ```

   Quotation marks are used around the command to avoid shell parsing.
3. The examples in the **tso** command also apply to **tsocmd** where one replaces the string '**tso -t**' with the string '**tsocmd**'. See the examples in the **tso** command section ("Examples" on page 773) for more information.

Environment variables

Depending on the **tsocmd** command being issued, you might need to perform allocations or other customization for the TSO/E environment. Those tasks can be specified using environment variables. You can use the following environment variables:

BPXWRFD
: Specifying YES in a REXX program before the TSO process is started causes the TSO process to inherit open file descriptors 10 through 99.

SYSEXEC
: Specifies the allocation specification for the SYSEXEC DD name. If the **TSOALLOC** variable is set, this variable is not automatically used.

SYSPROC
: Specifies the allocation specification for the SYSPROC DD name. If the **TSOALLOC** variable is set, this variable is not automatically used.

TSOALLOC
Specifies the names of the environment variables that contain allocation specifications. The names are separated by colons. Case is respected; lowercase letters are treated as lowercase. The names of the environment variables also correspond to the name of the DD name to be allocated. The DD name is always treated as uppercase but the variable name can be specified in mixed case to avoid possible conflict with similar environment variable names.

The HOLD attribute is supported for SYSOUT allocation in the BPXWDYN text interface and TSOALLOC environment variable.

TSOPROFILE
Resets the profile with the arguments that you specify when running the TSO/E command. (The specified arguments replace the default values.) For example, to set the TSO prefix and to turn off message IDs, issue:

```
export TSOPROFILE="prefix(wjs) nomsgid"
```

The value of this variable is passed to the TSO/E PROFILE command as is. If the PROFILE command fails, the requested command is not run. The output from the PROFILE command is sent to stdout along with the PROFILE command that was issued.

An allocation specification can be either a list of cataloged data set names separated by colons or a data set allocation request. If a list of data set names is used, lowercase letters are treated as uppercase and the data set names must be fully qualified.

Specify a request for data set allocation by beginning the specification with the keyword *alloc* followed by keywords or keyword-value pairs in a format similar to the TSO/E ALLOCATE command. Keys are separated by blanks. A complete listing of keys can be found in *z/OS Using REXX and z/OS UNIX System Services*. You can also refer to the list of keys in the **tso** command description in tso.

Exit values

0 The TSO/E command was successful.

1-254 The TSO/E command ended in an error with the listed return code.

255 The TSO/E command ended with an unexpected error, the TSO/E command return code is outside the range 0-254, no command was entered, an error occurred when processing an environment variable, or the command was not found.

Localization

The **tsocmd** command is not sensitive to a user's locale. It is up to the user to provide input that is acceptable to TSO/E.

Usage notes

Related information

tso

tsort — Sort files topologically

Format

tsort [*file*]

Description

tsort reads input from files (or from the standard input if you do not specify a file) and produces an ordered list of items consistent with a partial ordering of items provided by the input.

Input to **tsort** takes the form of pairs of items (nonempty strings) separated by blanks. A pair of two different items indicates ordering. A pair of identical items indicates presence, but not ordering.

Examples

The command:

```
tsort <<EOF
a b c c d e
g g
f g e f
h h
EOF
```

produces the output:

```
a
b
c
d
e
f
g
h
```

Localization

tsort uses the following localization environment variables:

- **lang**
- **lc_all**
- **lc_messages**
- **nlspath**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

>0 An error occurred

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide.

tty — Return the user's terminal name

Format

tty [**–s**]

Description

tty displays the file name of the terminal device associated with the standard input.

Options

–s Does not display the name; the exit status of **tty** indicates whether the standard input is a terminal.

Localization

tty uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Standard input is a terminal

1 Standard input is not a terminal

2 Failure because of an unknown command-line option, or too many arguments

Messages

Possible error messages include:

Not a tty
The standard input is not associated with a terminal.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The POSIX standard considers the **-s** option to be obsolete.

type — Tell how the shell interprets a name

Format

type *name ...*

Description

type identifies the nature of one or more names. Names can be shell reserved words, aliases, shell functions, built-in commands, or executable files. For executable files, the full path name is given.

Usage notes

type is a built-in shell command.

Localization

type uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion
2 Failure because of an incorrect command-line argument

Messages

Possible error messages include:

name **is not found**
type could not locate the specified name. Check that the *name* was specified properly and that you have the appropriate permissions.

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems.

Related information

alias, **command**, **sh**, **whence**

typeset — Assign attributes and values to variables

Format

typeset ±f [**tux**] *name ...*

typeset [**±lprtuxH**] [**±iLRZ**[*number*]] [*variable*[**=***value*] ....]

Description

Invoking **typeset** with no options displays a list of all variables and their attributes. This list is sorted by variable name and includes quoting so that it can be reinput to the shell with the built-in command **eval**. When only arguments of the form **+***option* are specified, **typeset** displays a list of the variables that have all

specified attributes set. When only arguments of the form –*option* are present, **typeset** displays a list of all the variables having all the specified attributes set, and also displays their values.

When the **f** option is used, **typeset** applies to functions; otherwise, it applies to variables. For functions, the only other applicable options are **–t**, **–u** and **–x**.

If the command line contains at least one variable, the attributes of each variable are changed. In this case, parameters of the form –*option* turn on the associated attributes. Parameters of the form +*option* turn off the associated attributes. (Notice that, contrary to what you might expect, - means *on*, and + means *off*.) Parameters of the form *variable*=*value* turn on the associated attributes and also assign *value* to *variable*.

When **typeset** is invoked inside a function, a new instance of each variable is created. After the function ends, each variable is restored to the value and attributes it had before the function was called.

Options

–f Specifies attributes of functions.

–H Performs file mapping from POSIX to the host name.

–i[*number***]**
Marks each variable as having an integer value, thus making arithmetic faster. If *number* is given and is nonzero, the output base of each *variable* is *number*. The default is decimal.

–l Converts uppercase characters to lowercase in any value assigned to a variable. If the **–u** option is currently turned on, this option turns it off.

–p Writes output to the coprocess. This option is not currently implemented.

–r Makes each variable read-only. See **readonly**.

–t Tags each variable. Tags are user-defined, and have no meaning to the shell. For functions with the **–f** option, this turns on the `xtrace` option. See **set** for a discussion of the `xtrace` option.

–u Converts lowercase characters to uppercase in any value assigned to a variable. If the **–l** option is currently turned on, this option turns it off.

When used with **–f**, the **–u** option indicates that the functions named in the command line are not yet defined. The attributes specified by the **typeset** command are applied to the functions once they are defined.

–x Sets each variable for automatic export. See **export**.

The last three options that follow justify, within a field, the values assigned to each variable. The width of the field is *number* if it is defined and is nonzero; otherwise, the width is that of the first assignment made to variable.

–L[*number***]**
Left-justifies the values assigned to each variable by first removing any leading blanks. Leading zeros are also removed if the **–Z** option has been turned on. Then blanks are added on the end or the end of the value is truncated as necessary. If the **–R** flag is currently turned on, this option turns it off.

–R[*number***]**
Right-justifies the values assigned to each variable by adding leading

blanks or by truncating the start of the value as necessary. If the **–L** flag is currently turned on, this option turns it off.

–Z[*number***]**
Right-justifies values assigned to each variable. If the first nonblank character of value is a digit, leading zeros are used. See also the **–L** option.

Usage notes

typeset is a built-in shell command as well as a separate utility.

An autoloaded function is defined (loaded) by the /bin/sh shell when invoked as a command name, it's not already defined to the shell, and the function definition file is found in a directory specified in the **FPATH** variable. (For more information see Command execution under the **sh** command.) To replace an autoloaded function, use the **unset -f name** command. The next time the function name is invoked, the **FPATH** search will find the new version.

Localization

typeset uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

2 Failure due to an incorrect command-line argument

If the command is used to display the values of variables, the exit status value is the number of names that are incorrect.

Messages

Possible error messages include:

Base number not in [2,36]
You used the **–i** option to specify a base for an integer, but the base was not in the range 2 through 36. All bases must be in this range.

name **not a function**
You tried to declare the given name as a function, but the name already referred to something that was not a function (for example, a variable).

Portability

POSIX.2. It is an extension to the POSIX.2 and XPG standards.

Related information

export, **readonly**, **sh**

uconvdef — Create binary conversion tables

Format

uconvdef [–f SrcFile] [–v] uconvTable

Description

uconvdef reads **SrcFile** and creates **uconvTable**, a binary conversion table. **SrcFile** is the input source file that defines a mapping between UCS-2 and multibyte code sets. UCS-2 is the Universal Character Set, coded in 2 octets, as defined by ISO/IEC 10646-1:1993(EE), while multibyte code sets consists of one or more bytes per character.

uconvTable is in a format that can be opened and read by **iconv** conversion functions.

Options

–f SrcFile
: **SrcFile** is the input source file that defines a mapping between UCS-2 and another single or multibyte code set. If this option is not used, standard input is read. For information about the format of the input source table, refer to the **ucmap** description in *z/OS XL C/C++ Programming Guide*.

–v Specifies that the **SrcFile** file statements be displayed.

uconvTable
: Specifies the path name of the compiled table created by the **uconvdef** command. This file defines conversions into and out of UCS-2.

Examples

To create the compiled **uconvTable** that defines the conversion table between IBM-1047 and UCS-2, issue:

```
uconvdef –f IBM-1047.ucmap /usr/lib/nls/locale/uconvTable/IBM-1047
```

The \ (backslash) is a line continuation character that is needed if the command is broken into multiple lines.

Exit values

0 Successful completion.
>0 An error occurred.

Related information

iconv

The **iconv** subroutine, **iconv_close** subroutine, **iconv_open** subroutine (refer to *z/OS XL C/C++ Programming Guide*).

ulimit — Set process limits

Format

ulimit [**–SHaAcdfMnst**] [*num*]

Description

ulimit sets or displays the resource limits on processes created by the user.

Options

–S Set or display the soft limits. The soft limit may be modified to any value that is less than or equal to the hard limit. For certain *resource* values, the soft limit cannot be set lower than the existing usage.

–H Set or display the hard limits. The hard limit may be lowered to any value that is greater than or equal to the soft limit. The hard limit can be raised only by a process which has superuser authority.

–a Display all resource limits that are available.

-A Set or display the maximum address space size for the process, in units of 1024 bytes. If the limit is exceeded, storage allocation requests and automatic stack growth will fail. An attempt to set the address space size limit lower than the current usage or to set the soft limit higher than the existing hard limit will fail.

–c Set or display the core file limit. The core file limit is the maximum size of a dump of memory (in 512–byte blocks) allowed for the process. A value of 0 (zero) prevents file creation. Dump file creation will stop at this limit.

–d Set or display the data size limit. The data size limit is the maximum size of the break value for the process, in units of 1024 bytes. This resource always has unlimited hard and soft limits.

–f Set or display the file size limit. The file size limit is the maximum file size (in 512-byte blocks) allowed for the process. A value of 0 (zero) prevents file creation. If the size is exceeded, a SIGXFSZ signal is sent to the process. If the process is blocking, catching, or ignoring SIGXFSZ, continued attempts to increase the size of a file beyond the limit will fail.

–M Set or display the amount of storage above the 2 gigabyte bar that a process is allowed to have allocated and unhidden, in megabyte increments. An attempt to set the storage size limit lower than the current usage or to set the soft limit higher than the existing hard limit will fail.

Tip: The amount of storage that **ulimit -M** displays does not necessarily reflect the MEMLIMIT setting found in the user's RACF OMVS segment. The value displayed will depend on how the user entered the OMVS shell and whether a change of identity was performed.

–n Set or display the file descriptors limit. The file descriptors limit is the maximum number of open file descriptors allowed for the process. This number is one greater than the maximum value that may be assigned to a newly created descriptor. Any function that attempts to create a new file descriptor beyond the limit will fail. An attempt to set the open file descriptors limit lower than that already used will fail.

–s Set or display the stack size limit. The stack size limit is the maximum size of the stack for a process, in units of 1024 bytes. The stack is a per-thread resource that has unlimited hard and soft limits.

–t Set or display the cpu time limit. The cpu time limit is the maximum amount of CPU time (in seconds) allowed for the process. If the limit is exceeded, a SIGXCPU signal is sent to the process and the process is granted a small CPU time extension to allow for signal generation and

delivery. If the extension is used up, the process is terminated with a SIGKILL signal. An attempt to set the CPU limit lower than that already used will fail.

num The new limit. *num* can be specified as "unlimited".

Usage notes

1. **ulimit** is a built-in shell command. It cannot be used with the tcsh shell.
2. If the command fails because of an attempt to set a resource limit lower than the current amount in use or higher than the existing hard limit, the resulting error message may indicate an invalid argument.

Localization

ulimit uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Related information

setrlimit in *z/OS XL C/C++ Runtime Library Reference*.

umask — Set or return the file mode creation mask

Format

umask [**–S**] [*mode*]

tcsh shell: **umask** [*value*]

Description

umask sets the file-creation permission-code mask of the invoking process to the given *mode*. You can specify the *mode* in any of the formats recognized by **chmod**; see **chmod** for more information.

The *mode* may be specified in symbolic (rwx) or octal format. The symbolic form specifies what permissions are allowed. The octal form specifies what permissions are disallowed.

The file-creation permission-code mask (often called the *umask*) modifies the default (initial) permissions for any file created by the process. The umask specifies the permissions which are not to be allowed.

If the bit is turned off in the umask, a process can set it on when it creates a file. If you specify:

```
umask a=rx
```

you have allowed files to be created with read and execute access for all users. If you were to look at the mask, it would be 0222. The write bit is set, because write

is not allowed. If you want to permit created files to have read, write, and execute access, then set umask to 0000. If you call **umask** without a *mode* argument, **umask** displays the current umask.

To calculate the permissions that will result from specific umask values, subtract the umask from 666 for files, and from 777 for directories For example, a umask of 022 results in permissions of 644.

In the tcsh shell, **umask** sets the file creation mask to *value*, which is given in octal. Common values for the mask are `002`, giving all access to the group and read and execute access to others, and `022`, giving read and execute access to the group and others. Without *value*, **umask** prints the current file creation mask. For more information, see "tcsh — Invoke a C shell" on page 689.

Options

–S Displays the umask in a symbolic form:

```
u=perms,g=perms,o=perms
```

giving owner, group and other permissions. Permissions are specified as combinations of the letters **r** (read), **w** (write), and **x** (execute).

Localization

umask uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to an incorrect command-line argument, or incorrect *mode*

Portability

POSIX.2, X/Open Portability GuideX/Open Portability Guide, UNIX systemsUNIX systems.

Related information

chmod, **tcsh**

unalias — Remove alias definitions

Format

unalias *name ...*

unalias –a

tcsh shell: **unalias** *pattern*

Description

unalias removes each alias *name* from the current shell execution environment.

In the tcsh shell, **unalias** removes all aliases whose names match *pattern*. For example,

```
unalias *
```

removes all aliases. It is not an error for nothing to be unaliased. For more information, see "tcsh — Invoke a C shell" on page 689.

Options

–a Removes all aliases in the current shell execution environment.

Localization

unalias uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Usage notes

unalias is a built-in shell command.

Exit values

0 Successful completion

1 There was an alias that could not be removed

2 Failure due to an incorrect command-line option or there were two aliases that could not be removed

>2 Tells the number of aliases that could not be removed

Portability

POSIX.2 User Portability Extension, X/Open Portability GuideX/Open Portability Guide.

Related information

alias, **sh**, **tcsh**

uname — Display the name of the current operating system

Format

uname [**–aImnrsv**]

Note: Option **–I** is an uppercase i, not a lowercase L.

Description

The **uname** command lets shell scripts and other programs determine configuration information about the machine upon which the shell is running.

Options

The following options select the information to be displayed:

–a All fields (equivalent to **–mnrsv**).

–I The IBM current product name information. This option affects the value of the system name, release, and version fields. This option might affect the output of the **–a, –r, –s** and **–v** options. When **–I** is not specified (the default), the OS/390 product name information is returned.

–m The processor or machine type.

–n The node name of this particular machine. The node name is set by the SYSNAME sysparm (specified at IPL), and it usually differentiates machines running at a single location.

–r The release (minor version) number of the operating system.

–s The name of the operating system. This is the default output, when no options are given.

–v The version (major version) number of the operating system.

uname displays the selected information in the following order:

<system name> <nodename> <release> <version> <machine>

Examples

1. The following shell command changes the prompt to identify the node name of the system:

   ```
   export PS1="`uname –n ` $ "
   ```

2. The following indicates what is returned when you specify the **–I** option and when you do not (not specifying **–I** is the default):

   ```
   If running on z/OS 1.2:
   issuing >uname -rsv gives you
   OS/390 12.00 03

   issuing >uname -rsvI gives you
   z/OS 02.00 01
   ```

Localization

uname uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to inability to find the desired information

2 Failure due to an incorrect command-line option

Portability

POSIX.2, X/Open Portability Guide, UNIX System V.

Related information

sh

---

uncompress — Undo Lempel-Ziv compression of a file

Format

uncompress [**cDfVv** [*file*]]

Description

uncompress expands compressed data written by the Lempel-Ziv compression program **compress**. Data is read from *file* or the standard input. On UNIX systems, the name of the file to be uncompressed must end with **.Z**. If it doesn't, **uncompress** adds one before looking for the file. It places the uncompressed output in a file with the same name but without the **.Z** extension. If this file already exists, **uncompress** asks if you want to overwrite it, unless you specify the **–f** option.

Since the number of bits of compression is encoded in the compressed data, **uncompress** automatically uses the correct number of bits. This includes the 9–14 bit compression range specified by POSIX.

Options

–c Writes uncompressed output to the standard output (like **zcat**).

–D Must be used to uncompress a sorted dictionary file compressed using the **–D** option of **compress**.

–f Forces file to be uncompressed, regardless of whether a file with the same base name already exists.

–V Prints version number information for **uncompress**.

–v Displays name of each file when it is uncompressed.

Localization

uncompress uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion
1 Failure due to any of the following:

- Unknown command-line option
- Inability to obtain information about an argument file
- File has more than one link
- File is not a regular file
- File is not in compressed format
- File was compressed using more than 16 bits
- There is no space for decompress tables
- A compressed file is corrupt

Portability

uncompress is found on many UNIX systems.

The **–D** option is an extension to traditional implementations of **uncompress**; the **–D** and **–V** options are extensions to the POSIX standard.

Related information

compress, **cpio**, **pack**, **unpack**, **zcat**

unexpand — Compress spaces into tabs

Format

unexpand [**–Ba**] [**–t** *tablist*] [**-W** *option*[,*option*]...] [*file ...*]

Description

unexpand replaces blank characters in the data from each *file* argument with the most efficient use of tabs and spaces. If you do not specify any files, **unexpand** reads the standard input. The result is sent to standard output.

Backspace characters are preserved. By default, **unexpand** compresses only leading spaces into tabs; tab stops are set every eight spaces.

Options

unexpand supports the following options:

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–a Compresses spaces into tabs wherever the resulting output is shorter, regardless of where the spaces occur in the line.

–t *tablist*
Specifies tab stops. The numbers in *tablist* are delimited by blanks or commas. If *tablist* is a single number, then **unexpand** places tab stops every *tablist* positions. If *tablist* contains multiple numbers, **unexpand** places tab stops at those specific positions. Multiple numbers in *tablist* must be in ascending order. This option, like the **–a** option, compresses spaces to tabs at any appropriate point in the line. If you specify **–t**, **unexpand** ignores the presence or absence of **–a**.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

Examples

1. To compress spaces in a text file into tabs every 3 positions:
   ```
   unexpand -t 3 myTextFile
   ```
2. To compress spaces in a text file containing ASCII characters into tabs, assuming that
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and

- You cannot alter the tag (for example, you are displaying an untagged public text file or a read-only text file)

then issue:

```
unexpand -a -W filecodeset=ISO8859-1,pgmcodeset=IBM-1047 myAsciiFile
```

3. To compress spaces in a text file containing EBCDIC characters into tabs, assuming that automatic conversion has been enabled but the text file is incorrectly tagged as UTF-8:

```
unexpand -a -B myMisTaggedFile
```

Localization

unexpand uses the following localization variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

unexpand uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 Successful completion

1 Failure due to any of the following:
- An incorrect command-line argument
- An inability to open the input files
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, 4.2BSD.

The **–B** and **-W** options are extensions of the POSIX standard.

Related information

expand, **pr**

uniq — Report or filter out repeated lines in a file

Format

uniq [**–c**|**–d**|**–u**] [**–B**] [**–f** *number1*] [**–s** *number2*] [**-W** *option*[,*option*]...] [*input_file* [*output_file*]]

uniq [**–c**|**–d**|**–u**] [*–number*] [*-+number*] [**–B**] [**-W** *option*[*,option*]...] [*input_file* [*output_file*]]

Description

uniq manipulates lines that occur more than once in a file. The file must be sorted, since **uniq** only compares adjacent lines. When you invoke this command with no options, it writes only one copy of each line in *input_file* to *output_file.* If you do not specify *input_file* or you specify **–**, **uniq** reads the standard input.

If you do not specify *output_file*, **uniq** uses the standard output. The specified *output_file* cannot be a FIFO.

Options

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–c Precedes each output line with the number of times that line occurred in the input.

–d Displays only lines that are repeated (one copy of each line).

–f *number1*
Ignores the first *number1* fields when comparing lines. Blanks separate fields in the input.

–s *number2*
Ignores the first *number2* characters when comparing lines. If you specify both **–s** and **–f**, **uniq** ignores the first *number2* characters after the first *number1* fields.

–u Displays only those lines that are not repeated.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

You can choose only one of the **–c**, **–d**, or **–u** options.

–number
Equivalent to **–f** *number* (obsolescent).

+number
Equivalent to **–s** *number* (obsolescent).

Examples

1. The command:
   ```
   uniq
   ```
   is a filter which prints one copy of each different line in its sorted input.
2. The command:
   ```
   uniq -f 2 -s 1
   ```
   compares lines starting with the second character of the third field.
3. The command:
   ```
   uniq -d
   ```
   prints one instance of each repeated line in the input (and omits all unique lines).
4. To print one copy of each different line in a text file containing UTF-8 characters, assuming that
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are displaying an untagged public text file or a read-only text file)

then issue:

```
uniq -W filecodeset=UTF-8,pgmcodeset=IBM-1047 myUtf8File
```

5. To print only those lines that are not repeated in a text file containing EBCDIC characters, assuming that automatic conversion has been enabled but the text file is incorrectly tagged as ASCII:

```
uniq -u -B myMisTaggedFile
```

Localization

uniq uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

uniq uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Incorrect command-line option
- Missing *number* after **–f**
- Missing or incorrect *number* after **–s**
- Inability to open the input or output file
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

3 Failure while reading the input file:
- Error during system call
- Input line too long
- Incorrect character in input

Messages

Possible error messages include:

Missing character skip count
You specified **–s** but did not supply a number after the **–s**.

Missing number of fields to skip
You specified **–f** but did not supply a number after the **–f**.

Field skip not a number in *string*
In a *–number* or *+number* construct, *number* was not a valid number. This could happen because of a typographical error in entering a **–** option.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–B** and **-W** options are extensions of the POSIX standard. The *–number* and *+number* options are considered obsolete.

Related information

comm, **sort**

unlink — Removes a directory entry

Format

unlink *file*

Description

unlink removes a directory entry.

Following the format, *file* specifies the entry to be removed, which can refer to a path name, a hard link, or a symbolic link. If *file* refers to a symbolic link, **unlink** removes the symbolic link but not any file or directory named by the contents of the symbolic link. If the entry that is unlinked is the last one associated with a file, then the file itself is deleted.

unlink is implemented as a shell built-in.

Localization

unlink uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following reasons:
- No write permission for the directory that contains the link to be removed
- Attempting to unlink a file that does not exist
- Path name specified is a directory

2 Failure due to incorrect number of arguments specified

Related information

mv, **rm**, **rmdir**

---

unmount — Remove a file system from the file hierarchy

Format

unmount [**–R** | **f**] [**–v**] [**–o normal** | **drain** | **immediate** | **force** | **reset**] [**-m**] *name...*

Description

The **unmount** shell command, located in **/usr/sbin**, unmounts file systems.

Rule: You must have mount authority before you can issue the **unmount** command. See the section on mount authority in *z/OS UNIX System Services Planning*.

Options

–f The list of names to unmount are file system names instead of path names.

This option is mutually exclusive with **-R**.

–m Specifies that the *name...* parameter can be any file or directory within the file system to be unmounted.

–R Unmounts the specified file system and all the file systems below it in the file system hierarchy.

This option is mutually exclusive with **-f**.

–o normal | **drain** | **immediate** | **force** | **reset**

normal
Specifies that if no user is accessing any of the files in the specified file system, the system processes the **unmount** request. Otherwise, the system rejects the **unmount** request. This is the default

drain Specifies that an unmount drain request is to be made. The system will wait for all use of the file system to be ended normally before the unmount request is processed or until another UNMOUNT command is issued.

Currently, **unmount –o drain** is not supported in a sysplex. If an **unmount –o drain** is issued in a sysplex, the following behavior is exhibited:

- If there is no activity in the file system, **unmount -o drain** will perform the unmount, but it will behave like an **unmount normal**.
- If there is activity in the file system, **unmount -o drain** will return a Return_value of -1 with Return_code EINVAL and Reason_code JrNotSupInSysplex.

immediate
The system immediately unmounts the file system. Any users accessing files in the specified file system will receive failing return codes. All data changes to files in the specified file system are saved. If the data changes cannot be saved, the **unmount** request fails.

force Also specifies that the system will unmount the file system immediately. Any users accessing files in the specified file system will receive failing return codes. If possible, all data changes to files in the specified file system are saved. If the data changes to the files cannot be saved, the unmount request continues and the data is lost.

Rule: An **unmount –o immediate** request must be issued before you can request an **unmount –o force** of a file system. Otherwise, **unmount –o force** will fail.

reset A **reset** request stops a previous **unmount –o drain** request.

Restriction: unmount –o reset is not supported in a sysplex.

–v Lists all file systems that are unmounted.

name... specifies the path name of the mount point directory to use when locating the file system to be unmounted or the name of the file system to be unmounted. If the **-m** option is used, the name can be for any file or directory within that file system.

Examples

1. To unmount a file system that is mounted on **/u/wjs**, issue:
   ```
   unmount /u/wjs
   ```
2. The output of **mount –q** can be used for the input of **unmount**. For example:
   ```
   mount -q /ict/hfsfir
   ```
   can be used as input:
   ```
   unmount $(mount -q /ict/hfsdir)
   ```
3. To unmount a file system that contains the file or directory **/u/wjs**, using the **-m** option to specify the directory:
   ```
   unmount -m /u/wjs
   ```
4. To unmount a file system that contains the file or directory **/u** along with all other file systems mounted over or below that file system, using the **-m** option to specify the directory:
   ```
   unmount -R -m /u
   ```

Usage notes

1. Because the path name for **unmount** is a node, symbolic links cannot be followed unless a trailing slash is added to the symbolic link name. For example, if **/etc** has been converted into a symbolic link, **/etc -> $SYSNAME/etc**, issuing **unmount -R /etc** without the trailing slash will result in trying to **unmount -R /etc -> $SYSNAME/etc**. Depending on the security access for the symbolic link, RACF errors might occur. However, if you specify **unmount -R /etc/** with the trailing slash, the symbolic link will be followed and RACF will determine the access from the file being linked to.
2. When the **-m** option is specified, the **unmount** shell command operates on the path name and its associated file system. If the path name does not have a file system mounted on it, the associated file system is the one that contains the path. For example:
   ```
   mkdir /mega
   mount -f 'posix.hfs.mega' /mega
   mkdir /mega/wellie0
   mount -f 'posix.hfs.wellie0' /mega/wellie0
   ```

then:

```
unmount -R /mega
```

will unmount the file system mounted at `/mega/wellie0` and `/mega`. If you enter the same command again:

```
unmount -R /mega
```

The unmount will fail because there is no file system mounted at `/mega`.

If you then issue the command with the **-m** options;

```
unmount -R -m /mega
```

the unmount will attempt to unmount the file system containing the `/mega` directory (in this case, the root) and any other file systems that are mounted on the root.

Exit values

0 Successful completion

Related information

chmount, **mount**

---

unpack — Decode Huffman packed files

Format

unpack *file...*

Note: The **unpack** utility is fully supported for compatibility with older UNIX systems. However, it is recommended that the **uncompress** utility be used instead because it may provide greater functionality and is considered the standard for portable UNIX applications as defined by POSIX.2 IEEE standard 1003.2-1992.

Description

unpack uncompresses files compressed by **pack**, using a Huffman minimal redundancy code. By default, **unpack** looks for *file* with a **.z** extension. It places the decompressed output in a file with the same name, but without the extension. The owner, permissions, and times of last access and last modification are also preserved. Packed files can be identified by *file*. You can use **pcat** to view packed text files without unpacking them in place.

unpack does not unpack a file if:
- The file name is too long after the **.z** is removed
- The input file cannot be opened
- An existing file has the same name as the output file
- The output file can't be created
- The input file doesn't appear to have been created by **pack**

Localization

unpack uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLATE**
- **LC_CTYPE**
- **LC_MESSAGES**

- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Files

unpack uses the following file:

pk$* Temporary copy of input file. (You may see this in the current directory if **unpack** is interrupted.) The file is in the same directory as the file being unpacked.

Exit values

0 Successful completion

n Indicates that files could not be unpacked properly. For example, if three out of six files could not be unpacked properly, the exit status is 3.

Possible reasons for failure include:
- Unknown command-line option
- Error creating a name for a temporary file
- Error opening an input file or a temporary file
- Error writing to a temporary file
- Inability to rename a temporary file
- Inability to restore the modification time on a packed file
- Input file was not packed
- A packed file is corrupted

Messages

Possible error messages include:

file: **Not a packed file**
pack did not process the file. In this case, the file is not changed.

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

file, **pack**, **pcat**

unset — Unset values and attributes of variables and functions

Format

unset *name ...*

unset –fv *name ...*

tcsh shell: **unset** *pattern*

Description

Calling **unset** with no options removes the value and attributes of each variable or function name.

In the tcsh shell, unset removes all variables whose names match pattern, unless they are read-only. For example:

```
unset *
```

which we **strongly** recommend you do not do, will remove all variables unless they are read-only. It is not an error for nothing to be **unset**. For more information, see "tcsh — Invoke a C shell" on page 689.

Options

–f Removes the value and attributes of each function *name*.

–v Removes the attribute and value of the variable *name*. This is the default if no options are specified.

unset cannot remove names that have been set read-only.

Usage notes

unset is a special built-in shell command.

Localization

unset uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to an incorrect command-line option

2 Failure due to an incorrect command-line argument

Otherwise, **unset** returns the number of specified *names* that are incorrect, not currently set, or read-only.

Messages

Possible error messages include:

name **readonly variable**
: The given *name* cannot be deleted because it has been marked read-only.

Portability

POSIX.2, X/Open Portability Guide.

Related information

readonly, **sh**, **tcsh**

uptime — Report how long the system has been running

Format

uptime

Description

uptime gives a one-line display of the following information:

- The current time
- How long the system has been running
- Number of users who are currently logged into z/OS UNIX and the system load averages for the past 1, 5, and 15 minutes. Load averages are not supported on z/OS UNIX, and are displayed as 0.00

Files

uptime uses the following file:

/etc/utmpx
The current login status file.

Localization

uptime uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion.
1 Invalid **/etc/utmpx** file
Command syntax error.

uucc — Compile UUCP configuration files

Format

uucc

Description

uucc reads the contents of the **uucp** configuration files and compiles them into a single configuration file called **/usr/lib/uucp/config**. The configuration files are:

- Systems
- Devices
- Dialers
- Dialcodes
- Permissions

Because **uucc** expects these text files to be in the current working directory, you need to change the directory (with the **cd** command) to **/usr/lib/uucp** before

issuing **uucc**. See the section on creating or editing UUCP configuration files in *z/OS UNIX System Services Planning* for more information.

Files

uucc uses the following files:

/usr/lib/uucp/Systems
Contains a list of remote systems and the methods for connecting with them.

/usr/lib/uucp/Devices
Describes the physical and logical connections listed in the Systems file.

/usr/lib/uucp/Dialers
Contains dialing information for the modems and dialers listed in the Devices file.

/usr/lib/uucp/Dialcodes
Contains abbreviations that can be used in the phone numbers specified in Systems.

/usr/lib/uucp/Permissions
Defines the commands and areas of the file system that remote sites can access on your system.

/usr/lib/uucp/config
Contains the previous information compiled into one file for use by the uucp utilities.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to open file
- Insufficient memory
- Ctrl-C interrupt

Related information

uucp

---

uucico daemon — Process UUCP file transfer requests

Format

uucico [**–f**] [**–g** *grade*] [**–r0**|**–r1**] [**–s** *system*] [**–x** *type*]

Description

The **uucico** daemon processes file transfer requests that were queued by **uucp** and **uux**. It establishes the connection with remote sites and manages the transfer of data between the local and remote sites as specified by the queued **uucp** or **uux** job.

uucico is automatically invoked after the **uucp** or **uux** command completes (unless the **–r** option was specified on the **uucp** or **uux** command). To process requests that cannot be successfully completed at the time the **uucp** or **uux** command was executed and to initiate transfers from remote sites, the traditional approach is to

use **cron** to start **uucico** at regular intervals. (See *z/OS UNIX System Services Planning* for more information about using **cron** to start **uucico**. It contains information about creating crontab entries.)

uucico has two modes: slave mode and master mode.

- In slave mode, **uucico** receives requests from the remote site. The **–r0** option (the default option) starts **uucico** in slave mode. **uucico** is typically started in slave mode by either the **uucpd** daemon (for remote connections via TCP/IP) or as the login shell for special UUCP user IDs that can be logged onto via serial connections. See **uucpd** and **uucp** for more information.
- In master mode, **uucico** processes requests from the local site; the **–r1** and **–s** options start **uucico** in master mode. **uucico** is typically started in master mode via **cron**. **uucp** and **uux** also invoke **uucico** in master mode by default.

If **uucico** cannot contact a remote system, it does not allow itself to run again until a specified amount of time has passed. You can specify how long the daemon should wait before trying to call each system again by setting a parameter in the Permissions file. For information about the permissions file, see *z/OS UNIX System Services Planning*.

If **uucico** receives a SIGQUIT, SIGTERM or SIGPIPE signal, it ends any current conversation with a remote site and exits.

Options

–f Ignores the required wait period for all remote systems and makes calls as requested.

–g *grade*
Processes outgoing work only if it is designated priority *grade* or better. *grade* is a number (`0–9`) or letter (`A–Z`, `a–z`), where `0` is the highest priority and `z` is the lowest.

r0 | –r1
Specifies the mode for **uucico** to use. **r0** (the default) specifies slave mode; **r1** specifies master mode. If you want **uucico** to call a remote system (master mode), specify **–r1**.

–s *system*
Calls the remote system. By default, **uucico** calls all defined systems.

–x *type*
Turns on debugging. *type* is a number indicating the level of detail. `0` is the least detail and `9` is the most detail. The debugging output is written to **stderr** if **uucico** is run in the foreground, or to **/usr/spool/uucp/LOGFILE** if **uucico** is run in the background by **uucpd** or by a remote **uucico** logging into a UUCP user ID.

The LOGFILE must be monitored so that it does not fill up your file system.

Examples

To call the remote site `west`, with debugging output sent to **stdout**:

```
uucico –r1 –x 9 –s west
```

Files

uucico uses the following files:

/usr/lib/uucp/config
UUCP configuration file. See **uucc**.

/usr/spool/uucp/LOGFILE
UUCP debug file

/usr/spool/locks
The directory containing the lock files created by **uucico**.

/usr/spool/uucp/.Status
UUCP status file

Exit values

0 Successful completion

1 Failure due to any of the following:
- Unknown command-line option
- Not running setuid **uucp**
- Argument list too long
- Unable to open log file
- CTRL-C interrupt

Portability

X/Open Portability Guide.

Related information

uucc, **uucp**, **uulog**, **uux**, **uuxqt**

---

uucp — Copy files between remote UUCP systems

Format

uucp [**–Ccdfjmr**] [**–g** *grade*] [**–n** *user*] [**–x** *debug_level*] [*site1*!] *file1* [*site2!*] *file2*

uucp [**–Ccdfjmr**] [**–g** *grade*] [**–n** *user*] [**–x** *debug_level*] *file...* [*site2!*] *directory*

Description

uucp copies a source file or files from one site to a target on another site. The source can be a file or group of files specified by metacharacters. The source cannot be a directory. The target can be a corresponding file name or directory.

File names given to **uucp** have the form:
`[site!] pathname`

or
`[site1![site2!]... pathname`

where *site* names the remote site. If a site is not specified, *pathname* is a path name on your machine. *site* must be on the list of site names that **uucp** knows about. Use **uuname** to list sites that are known to **uucp**.

You can also specify multiple site names as a way of sending files to a site that your system does not have a direct connection to. File names that contain multiple site names are called *multinode* or *multihop* names. When processing a **uucp** request involving multihop names, only the destination name can be a multihop name. The source file name cannot be a multihop name.

The path names can have one of these forms:

- A full path name.
- A path name preceded by ~*name*/, where ~*name* is replaced on the specified site by the login directory of user *name*.
- A path name preceded by ~/, where ~/is replaced on the specified site with the name of the public UUCP directory.
- A file name or prefix name containing the current directory on your machine as a prefix.

Destination path names cannot begin with exactly two slashes, which indicate an MVS file name.

If the target is a directory, you must append / to the end of the path name to ensure that it is not treated as a file. If the / is not appended to a directory name, then the name is treated as a file name and multiple copies to that command will behave like the **cp** command. That is, each subsequent copy will overlay the previous one.

Path names can contain the shell metacharacters ?, *, and [ ]. The character ~ also has a special meaning, as previously described. The appropriate site expands these characters after encountering them.If the destination file is a multihop name, then the source file cannot contain shell metacharacters because **uucp** uses **uux** to handle multihop requests, and **uux** does not allow shell metacharacters in names. Be careful when using metacharacters, because expansions on other sites may occur in unforeseen ways. For more information about metacharacters and their expansion by the shell, see **sh**.

Options

–C Copies named files to the spool directory for transfer. If both this option and the **–c** option are given, this option takes precedence. This option is useful if you will be changing the file after running the **uucp** command and want to send the version of the file before you changed it.

–c Does not copy files to the spool directory for transfer. This is the default.

–d Makes all necessary intermediate directories to complete file transfer. This is the default.

–f Does not make intermediate directories. If **–f** is specified with the **–d** option, **–f** takes precedence.

–g *grade*
Sets the priority of this job to *grade*. It is a number (0–9) or letter (A–Z, a–z), where 0 is the highest priority and z is the lowest.

–j Passes the UUCP job ID number to standard output; this job ID can be used with **uustat** to determine the job's status or to terminate it. If **uucp** generates several job requests and several job IDs, only the last one appears.

–m Sends mail notifying you when the copy finishes. The default is to send mail only if an error occurs that prevents the copy from being made.

–n *user*
Notifies the user at the destination site when a file you sent to the destination site arrives. This option has no effect when you use **uucp** to get files from the remote system.

–r Queues the job to be processed later. Do not start **uucico** to begin transferring the file.

–x *debug_level*
Sets the verbosity of the debugging information to the specified debug level, which is a number, 0 or greater. Level 0 provides tersed messages while level 9 provides verbose messages. Values greater than 9 give no additional information. The default level is 0.

Options are not passed on to remote sites when the destination of your **uucp** command is a multihop name. For this **uucp** command:

```
uucp –mf file1 site1!site2!/file1
```

the **–m** and **–f** options are ignored. For multihop, **uucp** creates a **uux** request to run a **uucp** command at the next site (*site1* in our example). But because *site1* can be any system that supports **uucp**, it is possible that this particular system might not support the same options that are supported by **uucp**. For that reason, options are not passed to the **uucp** command to be run at *site1*.

To summarize the restrictions when using multihop destination names:
- Options are not passed.
- Shell metacharacters cannot be used in source file names.

Examples

1. To copy the file **/notes/memo** from your site to a file named **minutes** in the public UUCP directory on a site named `south`:

   ```
   uucp /notes/memo south! ~/minutes
   ```

2. You can also copy files locally. To copy the file **resume.txt** on your site to the file **/business/resumes/november** on your site:

   ```
   uucp resume.txt /business/resumes/november
   ```

   You must have read permission on the current directory. If the directories **business/resumes** do not exist, they are created if you have write permission in **/**.

3. To copy the file **index** from the public UUCP directory on `north` to the current directory on the local site:

   ```
   uucp north! ~/index
   ```

   You must have write permission on the current directory.

4. To copy the file **index** from the public UUCP directory on `south` to the subdirectory **south/records** in the public UUCP directory on the current site:

   ```
   uucp -f -m south! ~/index ' ~/south/records/'
   ```

   You must protect the tilde so the shell does not expand them to the user's home directory. If the subdirectory **south/records** does not exist, the file copy fails. Mail is sent to you when the transfer is completed successfully.

5. You want to copy a file from your system to the site named `east`. Your system does not have a connection to `east`, but you do have a connection to `north`, and `north` has a connection to `east`:

```
uucp memo north!east! ~/memo
```

6. You want to use shell metacharacters to specify the files to be transferred to a remote site.

   In this command, the source path name is expanded by the shell. The **uucp** command succeeds if there is at least one file that matches the name specification:

   ```
   uucp /mystuff/file?.[ab&]* remote!/tmp/
   ```

   In this command, the source path name is not expanded by the shell, because it cannot find any matching file. The '!' is not allowed, because **uucp** interprets all '!' characters as delimiting system names.

   ```
   uucp remote!/tmp/file?.[!b]* /mystuff/
   ```

Environment variables

uucp uses the following environment variable:

TZ Sets the time zone used with date and time messages

Localization

uucp uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_COLLECT**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**

See Appendix F, “Localization,” on page 997 for more information.

Files

uucp uses the following files:

/usr/lib/uucp/config
UUCP configuration file generated by **uucc**.

/usr/spool/uucp/LOGFILE
Log file for **uucp** and other UUCP utilities.

/usr/spool/uucppublic
Public UUCP directory.

/usr/spool/uucp/.Sequence/*sitename*
Sequence files, one for each remote site.

Usage notes

uucp does not convert files to or from EBCDIC. If a text file is sent from an ASCII system to an MVS system, it must be converted to EBCDIC after its arrival. Similarly, if an EBCDIC text file is sent to an ASCII system, the file is not automatically converted to ASCII. The receiving user must convert the file to ASCII.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to open log file
- Insufficient memory
- Ctrl-C interrupt

2 Unknown command-line option

uucp can also have partial failures, where a file is inaccessible or a host could not be determined. **uucp** returns the 1 exit value and logs the partial failure in the log file **/usr/spool/uucp/LOGFILE**. Files that were accessible or had a known host are still queued for transfer.

Portability

X/Open Portability Guide, UNIX systems.

The **–g** option is an extension to the POSIX standard.

Related information

uucc, **uucico**, **uulog**, **uux**

uucpd daemon — Invoke uucico for TCP/IP connections from remote UUCP systems

Format

uucpd [–l seconds] [–x debug_level]

Description

The **uucpd** program allows remote **uucico** programs to communicate with local **uucico** in order to perform file transfers via TCP/IP connections. **inetd** starts **uucpd** when the remote **uucico** connects to the UUCP port. **uucpd** manages the login sequence with the remote **uucico**. After successful login, it then starts **uucico** to complete the transfer.

In order for **inetd** to start **uucpd**, the **inetd** configuration file (for example, **inetd.conf**) must contain a **uucp** entry such as the following:

```
uucp  stream  tcp  nowait  OMVSKERN  /usr/sbin/uucpd  uucpd -l0
```

Options

–l *seconds*
: Sets the login timeout value in seconds. When *seconds* are specified as zero, the login will wait without timing out.

–x *debug_level*
: Invoke **uucpd** and **uucico** with the **–x** option. *debug_level* indicates the level of detail (**0** has the least detail and **9** has the most detail). The **uucpd** login sequence debug output is written to a file in **TMPDIR** with a filename beginning with *uucpd* and followed by randomly generated characters. The **uucico** debug output is written to the **uucp** logfile.

  Guideline: When using the **–x** option, the UUCP logfile should be monitored so that it does not become too large and fill up the file system.

The Permissions file provides an alternative method for setting debug for connections on a system-by-system basis. See the section on Permission file in *z/OS UNIX System Services Planning* for more information.

Usage notes

uucpd is not affected by the locale information specified in locale-related environment variables.

Exit values

0 Successful completion

1 Failure to establish a connection with the remote system

>1 **uucico** failure

Portability

X/Open Portability GuideX/Open Portability Guide.

Related information

inetd, **uucico**, **uucp**, **uux**

uudecode — Decode a transmitted binary file

Format

uudecode [**-o** *outfile*] [*infile...*]

Description

uudecode decodes data that was encoded by **uuencode**. If an *infile* is specified on the command line, **uudecode** decodes that file; if no *infile* is specified on the command line, input is read from the standard input. Output is written to the file name that was specified when the file was encoded. When the **-o** option is specified, the file name that was specified when the file was encoded is overridden by the *outfile* operand. See **uuencode** for more information.

uudecode automatically strips off any leading and trailing lines added by mailers.

For a summary of the UNIX03 changes to this command, see Appendix N, “Shell commands changed for UNIX03,” on page 1039.

Options

-o *outfile*

A path name of a file is used instead of any path name contained in the input data. Specifying an *outfile* option-argument of **/dev/stdout** indicates standard output is used.

Localization

uudecode uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**

- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Usage notes

If the path name of the file to be produced exists and is writable, the file is overwritten. If it exists, but is not writable by the user, **uudecode** will end with an error.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to open the input file
- Missing `begin` line in the input file
- Inability to create the output file
- Missing `end` line in the input file
- A file that is too short

2 Failure because of an incorrect command-line option

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide. Generally found on most UNIX systems.

Related information

uuencode

---

uuencode — Encode a file for safe transmission

Format

uuencode [**-m**] [*infile*] *remotefile*

Description

When files are transmitted over a network or over phone lines, nonprintable characters (for example, control characters) may be interpreted as commands, telling the network to do something. In general, therefore, it is not safe to transmit a file if it contains nonprintable characters.

uuencode translates a binary file into a special code that consists entirely of printable characters from the POSIX portable character set. A file encoded in this way is generally safe for transmission over networks and phone lines. **uuencode** is often used to send binary files through electronic mail.

If an *infile* is specified on the **uuencode** command line, **uuencode** reads that file as input. Otherwise, it reads the standard input. **uuencode** always writes the encoded result to the standard output. The encoded version of the data is about 35% larger than the original. If the size is a problem, you can shrink the file with **compress** before encoding it. The recipient must decode it and then uncompress it.

The *remotefile* command-line argument is the name that the file should be given after it has been transmitted to its destination. Specifying a *remotefile* operand of **/dev/stdout** indicates that **uudecode** is to use standard output. When the file reaches its destination, **uudecode** can be used to translate the encoded data into its original form. The first line of the encoded file records the file's access permission bits and the *remotefile* argument.

Because the encoded file consists entirely of printable characters, you may use a text editor to edit the file. Of course, the only things you are likely to edit are the name of the original file or the name of the remote file.

For a summary of the UNIX03 changes to this command, see Appendix N, "Shell commands changed for UNIX03," on page 1039.

Options

-m Encode the output using the MIME Base64 algorithm. If **-m** is not specified, the historical algorithm is used.

Examples

This command encodes the file **long_name.tar.Z** so it decodes with the name **arc.trz** and redirects the output to **arc.uue**:

```
uuencode long_name.tar.Z arc.trz > arc.uue
```

Localization

uuencode uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion

1 Failure because of an incorrect command-line option, or a missing command-line argument

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide. Generally found on most UNIX systems.

Related information

uudecode

uulog — Display log information about UUCP events

Format

uulog [**–s** *site*]

Note: The **uulog** utility is fully supported for compatibility with older UNIX systems. However, because it is no longer supported by POSIX.2 IEEE standard 1003.2-1992, this utility should be avoided for applications intended to be portable to other UNIX-branded systems.

Description

uulog displays information about UUCP events, such as file transfers and remote command execution. It also displays the most recent debug output to the log. In order to use **uulog**, you must have permission to read the file `/usr/spool/uucp/LOGFILE`.

The format of the display is:

```
user ID    local_site   date/time   messagetext
```

where:

user ID
: Login ID of the user who requested the file transfer or requested the command be run. Entries created by **uuxqt** or by programs spawned by **uuxqt** have the ID `uucp`.

local_site
: Name of the local site.

date/time
: Date and time of the event in the form (*mm*/*dd*-*hh*:*mm*).

messagetext
: Text of the log entry. The message text depends on the event being recorded; most entries are self-explanatory.

Options

If you do not specify an option, **uulog** displays the debug information for the last conversation that failed.

–s *site* Displays information about UUCP events for this site.

Environment variables

uulog uses the following environment variable:

TZ Sets the time zone used with date and time messages.

Localization

uulog uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_LCTIME**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Files

uulog uses the following files:

/usr/lib/uucp/config
UUCP configuration file. (See **uucc**.)

/usr/spool/uucp
UUCP spool directory.

/usr/spool/uucp/LOGFILE
Log file for **uulog** and other UUCP utilities.

Exit values

0 Successful completion

1 Failure due to any of the following:
- **LOGFILE** could not be opened
- Could not lock **LOGFILE**

2 Unknown command-line option

Portability

X/Open Portability Guide, UNIX systems.

Related information

uucc, **uucp**, **uux**

---

uuname — Display list of remote UUCP systems

Format

uuname [–l]

Note: The **uuname** utility is fully supported for compatibility with older UNIX systems. However, because it is no longer supported by POSIX.2 IEEE standard 1003.2-1992, do not use this utility for applications intended to be portable to other UNIX-branded systems.

Description

uuname displays a list of all remote systems known to UUCP. Systems are listed in the order they are entered in **/usr/lib/uucp/Systems**. To display only the local system name, use the **–l** option.

Options

–l Displays the local system name.

Localization

uuname uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**

- **LC_LCTIME**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Files

uuname uses the following file:

/usr/lib/uucp/config
UUCP configuration file. See **uucc**.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Argument list too long
- Inability to open log file
- Insufficient memory
- Ctrl-C interrupt

2 Unknown command-line option

Portability

X/Open Portability Guide, UNIX systems.

Related information

uucc, **uucp**, **uux**

---

uupick — Manage files sent by uuto and uucp

Format

uupick [**–s** *system*]

The **uupick** utility is fully supported for compatibility with older UNIX systems. However, because it is no longer supported by POSIX.2 IEEE standard 1003.2-1992, this utility should be avoided for applications intended to be portable to other UNIX- branded systems.

Note:

Description

uupick is an interactive shell script used to manage files in the UUCP public receive directory that were sent to you using the **uuto** command. Only those files in the receive directory are managed.

For each file or directory entry found, **uupick** prompts you with one of the following messages, depending on the type of the entry:

```
from system:  file name ?
from system:  dir name ?
```

where *system* is the name of the system that sent the file or directory, and *name* is the name of the file or directory.

To tell **uupick** how to handle an entry, issue one of the following commands:

ENTER
Skips this entry and go to the next one.

***** Display the **uupick** command summary.

d Deletes the specified entry.

m [*target*]
Moves the entry to the named target directory or file. If the target does not specify an absolute path name or no directory, the path name is assumed to be relative to the current directory. If no directory is given, **uupick** assumes the current directory.

a [*dir*] Moves all files from *system* to the target directory *dir*.

p Prints the contents of the entry to standard output. If the entry is a directory, **p** lists the files in the directory.

q Quits **uupick**.

CTRL-D
Quits **uupick**.

!*command*
Escapes to the shell in order to perform *command*.

The tilde (~) does not stand for the public UUCP directory in path names specified inside **uupick**. It is interpreted by the command shell being used.

Options

–s *system*
Displays only files from the system *system*.

Localization

uupick uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_LCTIME**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Files

uupick uses the following files:

/usr/lib/uucp/config
The UUCP configuration file, which contains the list of known systems as well as the location of the public UUCP library. See **uucc**.

/usr/spool/uucppublic
The default value for the public UUCP directory. The public UUCP directory is always the home directory of the user *uucp* as defined in the user database.

/usr/spool/uucppublic/receive/*user***/system**
When files are sent to your system using **uuto**, they are placed into **/usr/spool/uucppublic/receive/user/system**, where *user* is your login name and *system* is the name of the system that sent the files.

Usage notes

1. **uupick** does not convert files from EBCDIC. If you receive a file from an ASCII system, you will need to convert it to EBCDIC.
2. When moving files, **uupick** does not check for files of the same name in the destination directory. These files are overwritten.
3. **uupick** is a shell script.

Portability

X/Open Portability Guide.

Related information

uuto

---

uustat — Display status of pending UUCP transfers

Format

uustat [**–j** *jobid* | **–k** *jobid* | **–r** *jobid*]

uustat [**–m**]

uustat [**–q**]

uustat [**–s** *site*] [**–u** *user*]

uustat [**–a** [**–o** *number*] [**–y** *number*]]

Description

uustat displays reports on the progress of pending UUCP transfers. You can display the status of transfers for a particular job ID or user ID. **uustat** can also stop or restart jobs in the queue.

If you do not specify any options, it displays the status of all UUCP requests for all sites made by the current user.

Options

–a Displays the jobs queued for all users instead of only the jobs for the user issuing the command.

–j *jobid*
Displays the status of the specified job.

–k *jobid*
Stops the UUCP job identified by *jobid*. **uustat** can display the job ID of a job in the queue, when used with one of the other options. You cannot use this option with the **–q** or **–r** options.

–o *number*
Displays the jobs that are older than *number* hours.

–q Displays the latest conversation status and times tried for all sites that recently had errors, as well as a count of the jobs queued. You cannot use this option with the **–k** or **–r** options.

–m Displays the latest conversation status and times tried for all sites, as well as a count of the jobs queued. You cannot use this option with the **–k** or **–r** options.

–r *jobid*
Restarts the UUCP request specified by *jobid*. This option updates the timestamp on the file, making the request appear recent. It cannot restart jobs that have been stopped with the **–k** option. You cannot use this option with the **–k** or **–q** options.

–s *site* Displays the status of all UUCP transfers requested for *site*.

–u *user*
Displays the status of all UUCP transfers requested by *user*.

–y *number*
Displays the jobs that are younger than *number* hours.

Output

uustat uses a variety of output formats, depending on the options specified.

If you do not specify an option, or if you specify the **–s** and **–u** options, the output is in this format, one line to every request within a work file:

```
job ID mo/dy–hh:mm  rtype  site  user  information
```

The following list explains the fields:

job ID Identifies the job. If a job contains more than one request, subsequent requests are displayed below the first, without a job ID.

mo/dy–hh:mm
Time of the request.

rtype The request type, either `S` (for send) or `R` (for receive).

site The name of the remote site.

user The name of the user who requested the job.

information
Describes the request. The format depends on the type of request.

For a send request, `information` has the format:

```
size  filename
```

where *size* is the size in bytes of the file to be sent and *filename* is either the absolute path name on your site, or the UNIX-style filename relative to your spool directory for the remote site.

For a receive request, *information* has the format:

```
filename
```

For a remote execution request (such as a request produced by **mailx**, the command to be run is displayed after any data files associated with it.

For the **–q** and **–m** options, the output is in this format:

```
site  transfersC (age)   commandsX(age)   status retry
```

where:

site Remote site name.

transfersC(age)
Number of file transfer jobs pending; if any are over one day old, the age in days of the oldest job is given in parentheses.

commandsX(age)
Number of pending command requests that have been received; if any are over one day old, the age in days of the oldest job is given in parentheses.

status Time and result of the last attempt to call this site. The `status` field shows the status of attempts made by this system to connect to other systems. When other systems call this system, this field is not updated.

retry Time to the next connection attempt in *hours:minutes* and the current retry count. The `retry` field is displayed only between retry attempts.

For the **–k** and **–r** options, **uustat** displays a message telling you if the attempt to stop or restart a job was successful.

Examples

1. To display all waiting UUCP requests:
   ```
   uustat
   ```
2. To display all jobs waiting for remote site `east`:
   ```
   uustat –s east
   ```
3. To stop the UUCP job associated with job ID westn0003:
   ```
   uustat –k westn0003
   ```

Environment variables

uustat uses the following environment variable:

TZ Sets the time zone used with date and time information.

Appendix I, “Format of the TZ environment variable,” on page 1021 explains how to set the local time zone with the TZ environment variable.

Localization

uustat uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Files

uustat uses the following files:

/usr/lib/uucp/config
UUCP configuration file.

/usr/spool/uucp
UUCP spool directory, containing site-specific subdirectories and information files.

/usr/spool/uucp/*site*
Subdirectory containing queued job requests, work files, data files, and execution files for the UUCP host site.

/usr/spool/uucp/.Status/*site*
Status file for the remote UUCP host site. **uustat** queries the status file with the **–q** option.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Argument list too long
- Unable to open log file
- Log files
- Insufficient memory
- CTRL-C interrupt

2 Unknown command-line option.

Portability

X/Open Portability Guide, UNIX systems.

Related information

uucp, **uulog**, **uuxqt**

uuto — Copy files to users on remote UUCP systems

Format

uuto [**–mp**] *file ... destination*

The **uuto** utility is fully supported for compatibility with older UNIX systems. However, because it is no longer supported by POSIX.2 IEEE standard 1003.2-1992, do not use this utility for applications intended to be portable to other UNIX systems.

Description

uuto is a simplified method of using **uucp** to copy a file, or files, to a user on another system. *file* is a file, or files, on your system. The **destination** has the following form:

```
system!user
```

where *system* is a system known to **uucp** and **user** is the login name of a user on the remote system. You can use **uuname** to list the names of the remote system known to **uucp**. Make sure to enter the user name in the correct case. Otherwise, the recipient will not be able to use **uuto** to receive the files that you sent.

uuto sends files to the UUCP public directory on the remote system. In particular, the files are sent to the directory:

pubdir/receive/*user*/*sendsystem*

where *pubdir* is the UUCP public directory, *user* is the user's name specified in the destination, and *sendsystem* is the name of the sending system.

The recipient is notified by mail when the files arrive. If several files are sent, the recipient is notified when the last file arrives. Depending on the nature of the remote system, the recipient can move files from this directory using the **uupick** utility or by using the system copy commands.

Options

–m Sends the user a note when the copy is completed.

–p Places files in spool directory before transfer to remote system.

Localization

uuto uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_LCTIME**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Files

uuto uses the following files:

/usr/lib/uucp/config
The configuration file for UUCP contains the list of systems that **uucp** knows about. This configuration file is compiled from a number of text configurations using the **uucc** utility. (See **uucc** for more information.)

/usr/spool/uucppublic
The public UUCP directory.

Usage notes

1. **uuto** is a shell script.
2. **uuto** does not convert files to ASCII. If you use **uuto** to send a file to an ASCII system, it must be converted to ASCII after it has been sent.

Portability

X/Open Portability Guide, UNIX systems.

Related information

uucc, **uulog**, **uupick**, **uustat**, **uux**

uux — Request command execution on remote UUCP systems

Format

uux [**–bCcjnprz**] [**–g** *grade*] [**–x** *debug_*level] [*site!*] *commandstring*

Description

uux specifies that *commandstring* be run on another site. If files required to run the command are on different sites, **uux** generates the UUCP requests to gather the files together on one site, runs the command, and sends the standard output of the command to a file on a specified site.

commandstring is any valid command for the remote site, with arguments, except that the command and any filenames can specify a site in the UUCP manner:

site1!*command site2*!*file1*

where *site1* is the name of the site where the command is to be run, and *site2* is the name of the site where *file1* is.

- If you do not specify any site names, then the command and any files are assumed to reside at your site.
- If you specify a site for the command, but not for the files, then the files are assumed to reside on the same site named for the command.
- If you specify a site for some of the files, then those files without a site name are assumed to reside on the site named.

site must be a valid site name, as listed by the **uuname** command. Specifying multiple site names, such as *site1!site2!command* or *site1!site2!file* is not allowed for **uux**

Pipes of commands are valid, but only the first command in a pipeline can have a site name. All other commands in the pipeline take place on the site specified for the first command.

File names can have one of these forms:

- A full path name.
- A path name preceded by *~name/*, where *~name* is replaced on the specified site by the login directory of user *name*.
- A path name preceded by ~/, where ~/ is replaced on the specified site with the name of the public UUCP directory.
- A file name or prefix name containing the current directory on your machine as a prefix.

Unlike arguments to **uucp**, path names cannot contain the shell metacharacters ?, *, and [ ].

Nonlocal file names must be unique within the command, or the command fails. This is because nonlocal files are copied to a working directory on the remote site; if the filenames are not unique, one overwrites another.

If the command fails, you are notified by electronic mail.

Options

–b Mails input back to the user. The contents of stdin are sent back to the user if the command fails.

–C Copies named files to the spool directory for transfer. If both this option and the **–c** option are given, this option takes precedence. This option is useful if you will be making changes to the file after running the **uux** command and want to send the version of the file before you changed it.

–c Does not copy files to the spool directory for transfer. This is the default.

–g *grade*
Sets the priority of the job to **grade**. It is a number (0–9) or a letter (A–Z, a–z), where 0 is the highest priority and z is the lowest.

–j Passes the UUCP job ID number to standard output. This job ID can be used with **uustat** to determine the job's status or to terminate it. If the **uux** request generates several job IDs, only the last is shown.

–n Does not send mail if the command fails.

–p Uses standard input of **uux** as the standard input for the specified command. The input is stored in a temporary file that is passed to the command when it runs.

–r Queues the job to be processed later. Do not start **uucico** to begin transferring the file.

–x *debug_level*
Sets the verbosity of the debugging information to *debug_level*, which is a number that is 0 or greater. Level 0 provides terse messages while level 9 provides verbose messages. Values greater than 9 give no additional information. The default level is 0.

–z Returns notification of success to the user who issued the **uux** command.

Commands on remote sites are actually run by **uuxqt** in its own directory, **/usr/spool/uucp/.Xqtdir**.

Special characters

The command string passed to **uux** can use the shell metacharacters <, >, **;**, and |. If any of these characters are not valid for the command interpreter on the destination system, the command fails.

More complex redirection, such as 2>, is not handled by **uux** because the 2 is interpreted as a parameter to the preceding command). Only the simple metacharacters listed are allowed.

To escape a file name or quoted string, use parentheses. Parentheses pass the file name to the command on the remote site without special interpretation by **uux**. For example, the following command will not do what you expect because "hello" is treated as a file unless enclosed in parentheses.

```
uux "Remote!echo hello >test.out"
```

The correct way to enter that command is:

```
uux "Remote!echo (hello) >test.out"
```

Examples

1. Suppose that a neighboring site, south, has a program called **laser** for printing and formatting documents. You have execute permission for **laser**. To print the file **inventor.y** in south's public UUCP directory using south's **laser** program:

   ```
   uux south!laser ' ~/inventor.y'
   ```

   The tilde needs protection from shell expansion.

   To print the file **report.001** in your public UUCP directory:

   ```
   uux south!laser ! ~/report.001
   ```

2. Suppose you have execute permission for **uucp** on south. To request that south use **uucp** to copy the file **index** from its public UUCP directory to west, a neighbor of south:

   ```
   uux south!uucp \(~/index\) \(west! ~/\)
   ```

   The arguments ~/index and west! ~/ are not interpreted by **uux** because of the parentheses. The backslashes are necessary to escape the parentheses on the z/OS shell.

Security

uux is potentially a security risk to your system. UUCP minimizes the risk by allowing you to specify the commands that can be run by each remote site. See the section on permission files in *z/OS UNIX System Services Planning* for more information.

For electronic mail, each remote site must be able to execute a mail routing agent on your site. Further permissions can be granted at your discretion.

Localization

uux uses the following localization environment variables:

- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**

See Appendix F, "Localization," on page 997 for more information.

Files

uux uses the following files:

/usr/lib/uucp/config
: UUCP configuration file

/usr/spool/uucp/*site*
: Subdirectory containing queued job requests, work files, data files, and execution files for the UUCP host site.

/usr/spool/uucp/LOGFILE
: Log file for **uux** and other UUCP utilities.

/usr/spool/uucp/.Sequence/*sitename*
: Sequence file containing the 4-digit sequence number of the last job queued. If **uux** requires a sequence number, it is based on the value in this

file. If this file does not exist, **uux** creates it with the sequence number `0000`. *sitename* is the name of a remote site; each remote site has its own sequence number.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Argument list too long
- Inability to open log file
- Insufficient memory

2 Unknown command-line option

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–g**, **–p**, **–r**, and **–x** options are extensions to the POSIX standard. They are retained for compatibility with other UNIX UUCP implementations.

Related information

uucc, **uucico**

uuxqt daemon — Carry out command requests from remote UUCP systems

Format

uuxqt [**–c** *command_name*] [**–s** *site*] [**–x** *debug_level*]

Description

The **uuxqt** daemon carries out the command requests made on other sites by mail programs, news programs, or by the **uux** command.

uuxqt is automatically started after **uucico** completes. Additionally, **cron** can be used to start **uuxqt** at predetermined times.

Options

–c *command_name*
Processes only requests to run *command_name*.

–s *site* Runs only commands requested by *site*.

–x *debug_level*
Sets the verbosity of the debugging information to *debug_level*, which is a number, 0 or greater. Level 0 provides terse messages while level 9 provides verbose messages. Values greater than 9 give no additional information. The default level is 0.

Examples

To run all of the commands requested by the remote site `north`:

```
uuxqt –s north
```

Usage notes

1. The **uuxqt** command is a security risk on all sites, because it allows outside access to your computer. UUCP limits the danger by setting execute permissions for every site in the configuration file..
2. **uuxqt** checks the command requests from each site against the list of allowed commands and either runs them or sends a mail message that says:

   ```
   Permission denied
   ```

Localization

uuxqt does not use localization environment variables.

Files

uuxqt uses the following files:

/usr/lib/uucp/config
: UUCP configuration file

/usr/spool/uucp/.Xqtdir
: This file contains permissions for UUCP sites.

/usr/spool/uucp/.Sequence/*sitename*
: Sequence file containing the four-digit sequence number of the last job queued. If **uuxqt** requires a sequence number (for example, to mail a message), it is based on the value in this file. If this file does not exist, **uuxqt** creates it with the sequence number `0000`. *sitename* is the name of a remote site; each remote site has its own sequence file.

/usr/spool/uucp/*site*
: Subdirectory containing commands from the UUCP host site (as well as all work files and data files associated with *site*). The format of the execute files is described in **uucp**.

/usr/spool/uucp/.Xqtdir
: Working directory for **uuxqt**. All required files are copied here before **uuxqt** runs a command.

Exit values

0 Successful completion

1 Failure because of any of the following:
- Argument list too long
- Unable to open log file
- Insufficient memory
- Ctrl-C interrupt

2 Unknown command-line option

Portability

X/Open Portability Guide

Some UUCP systems produce execute files with command lines that are not supported by **uuxqt**.

Related information

uucc, **uucp**, **uux**

vi — Use the display-oriented interactive text editor

Format

vi [**–BelRrsv**] [*+command*] [**–c** *command*] [**–t** *tag*] [**–w** *size*] [**-W** *option*[,*option*]...] [*file ...*]

These symbols are used throughout this command description:

Table 35. Symbols used in the vi command description

Symbol	Indicates the ...
Ctrl-L followed by a single letter	Control character that is transmitted by holding down the Ctrl key and the letter key at the same time.
BACKSPACE	The real backspace key. This might differ from the Ctrl-H key.
ENTER	The ENTER key, which is labeled RETURN on some keyboards.
ESCAPE	The Escape key.
INTERRUPT	The break key; often Ctrl-C.
→	The right arrow key.
←	The left arrow key.
↓	The down arrow key.
↑	The up arrow key.

Description

vi has two components: a screen editor (**vi**) and a line editor (**ex**). Each has a different set of commands. You can invoke the line editor from within the screen editor. Conversely, you can invoke the screen editor from within the line editor.

In the screen editor, you are in either *command mode* or *insert mode*. In command mode, every character you type is immediately interpreted as a command. In insert mode, every character you type is added to the text that you are editing.

There are two ways to start your session in **ex** mode:
- Invoke the command under the name **ex**.
- Invoke it under the name **vi** but specify the **–e** option.

Similarly, there are two ways to start your session in **vi** mode:
- Invoke it under the name **ex** but specify the **–v** option.
- Invoke the command under the name **vi** (without specifying **–e**).

vi and **ex** work on files containing text data. If a file contains the null character (value `.0` or `\0`), it is turned into the value `0x7F`. The newline character is interpreted as a line delimiter. Each line is limited to a maximum length of {LINE_MAX} bytes, including the newline. Any lines exceeding that length are truncated at that length. If the last line in the file does not end in a newline, a newline is added. In all those cases, **vi** marks the file as modified and displays a message.

vi is available if you login to the shell with the **rlogin** command or via telnet. It is not available if you login with the OMVS command.

The current position marker

The *current position marker* indicates a position in the text that is currently being edited (or has just been edited). In **ex** mode, the current position pointer is just the line number of the line being edited. In **vi** mode, the pointer gives this line number plus the position of the cursor within the line. The line indicated by the current position pointer is always on the screen.

vi display conventions

vi displays the input for search commands (/ and ?), **ex** commands (:), and system commands (!) on the bottom line of the screen. Error and informational messages also appear on this line. If the last line in the file is above the bottom of the screen, then screen lines beyond the end of the file are displayed with a single ~character in column one. In certain infrequent circumstances (typically involving lines longer than the width of the screen), **vi** is unable to fill the display with complete lines. In this case, one or more screen lines are shown with a single @ character in column one. These lines are not part of the file content and should be ignored.

Options

+*command*
: Begins the editing session by running the specified editor *command*. To specify multiple commands, separate them with a vertical bar (|).

–B
: Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–c *command*
: Runs *command* before displaying any text on the screen. *command* is any **ex** command. You can specify multiple **ex** commands by separating them with an or-bar (|) and enclosing them in quotation marks. The quotation marks ensure that the shell does not interpret the | as a pipe character. For example:

```
–c 'set all | ver'
```

–e
: Invokes **ex**.

–l
: Sets LISP mode. The (and) commands use blocks of LISP code as their context rather than sentences.

–R
: Sets the **readonly** variable, preventing the accidental overwriting of files. Any command that writes to a file requires the ! suffix.

–r
: Tries to recover all files specified on the command line after a system or editor crash. If you do not specify any files, **vi** displays a list of all recoverable files.

  When using **vi -r** to recover a file that was being edited with automatic conversion, it must also be recovered with automatic conversion enabled when writing the data back to the original tagged text file. Likewise, if explicit conversion was being used when editing the file (by using the **-W filecodeset** or **-W pgmcodeset** options), the same options must be specified when writing the recovered data back to the original file. Failure to do either of these might result in incorrectly coded character data being written to the file when you save the recovered version.

–s Turns on *quiet mode.* The editor does not print file information messages, thus allowing **ex** to be used as a filter. Because the file is not displayed, the editor does not read the value of the TERM environment variable. This option also keeps **ex** from reading any startup files (**.exrc** or the file specified by EXINIT).

–t *tag* Searches for a tag in the same way that you use with the **ex tag** command.

–v Puts the editor into **vi** mode.

–w *size*
Sets the option variable `window` to *size*. See Setting the vi options for more information.

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

Examples

1. To edit or browse a file containing ASCII characters using the **vi** editor, assuming that:
   - The file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are browsing an untagged public file or a read-only file)

   issue:

   ```
   vi -W filecodeset=ISO8859-1,pgmcodeset=IBM-1047 myAsciiFile
   ```
2. To edit or browse a file containing EBCDIC characters using the **vi** editor, assuming that automatic conversion has been enabled but the file is incorrectly tagged as UTF-8, issue:

   ```
   vi -B myMisTaggedFile
   ```

vi command summary

The **vi** command is divided into categories: scrolling commands, movement commands, object manipulation commands, text insertion commands, and miscellaneous commands.

Scrolling commands

Scrolling commands adjust the position of text on the screen. The current position pointer only changes if the current line is scrolled off the screen. For example, **Ctrl-E** scrolls the text on the screen up one line. The cursor remains pointing to the same text that it was pointing to, unless that text is moved off the screen. See Scrolling commands.

vi scrolling and movement commands can be preceded by a decimal integer that serves as a *count*, as in:

```
[count] command
```

count means different things with different commands. If you type *count*, it is not displayed anywhere on the screen.

Ctrl-B Scrolls text back by a page, (that is, a screen), less two lines. The cursor is placed on the bottom line of the screen. *count* specifies a number of pages to scroll. The default value for *count* is 1.

Ctrl-D Scrolls text onto the bottom of the screen. The current position pointer moves forward the same amount in the text, which means that the cursor stays in the same relative position on the screen. If *count* is given, the screen scrolls forward by the given number of lines; this number is used for all future **Ctrl-D** and **Ctrl-U** commands (until a new *count* is given). The default scrolling amount is half the screen.

Ctrl-E Scrolls a new line onto the bottom of the screen. The current position pointer is not changed unless the current line scrolls off the top of the

screen; then the pointer is set to the top line. If *count* is given, the screen scrolls forward the given number of lines. The default value for *count* is 1.

Ctrl-F Scrolls text forward a page (that is, a screen), less two lines. The cursor is placed on the top line of the screen. *count* specifies the number of pages to scroll. The default value for *count* is 1.

Ctrl-U Scrolls text onto the top of the screen. The current position pointer moves backward the same amount in the text, which means that the cursor stays in the same relative position on the screen. *count* operates as for **Ctrl-D**. The default scrolling amount is half the screen.

Ctrl-Y Scrolls a new line onto the top of the screen. The current position pointer is not changed unless the current line scrolls off the bottom of the screen; then the pointer is set to the bottom line. If *count* is given, the screen scrolls backward the given number of lines. The default value for *count* is 1.

[*n***] z [***m***]** *type*
Redraws the screen in a window of *m* lines. *type* determines the position of the current line. If *type* is the newline character, the current line is placed at the top of the window. If *type* is a period (**.**), the current line is placed in the middle of the window. If *type* is a minus sign (–), the current line is placed at the bottom of the window. If *n* is given, the current position pointer is first set to that absolute line number; then the screen is positioned according to *type*. If you omit *n*, it defaults to the current line. If you omit *m*, it defaults to `window`. (See Setting the vi options.)

Movement commands

Movement commands move the cursor in the file. For example, the character **j** moves the cursor down one line and the screen is scrolled only if necessary. There are two types of movement commands: absolute movement commands and context-dependent movement commands.

Absolute movement commands

Absolute movement commands move the cursor, regardless of the nature of the surrounding text. For example, **j** always moves the cursor down one line.

All the following movement commands except **m**, **0**, **^**, **`**, and **´** can be preceded by *count* to repeat the movement that many times.

G Moves to the absolute line number specified as *count*. As a special case, if *count* is zero or is not specified, the cursor is moved to the last line of the file.

h Moves the cursor one position to the left.

BACKSPACE
Moves the cursor one position to the left.

← Moves the cursor one position to the left.

Ctrl-H Moves the cursor one position to the left.

↓ Moves the cursor to the next line at the same column on the screen. Scroll the screen one line if needed.

j Moves the cursor to the next line at the same column on the screen. Scroll the screen one line if needed.

Ctrl-J Moves the cursor to the next line at the same column on the screen. Scroll the screen one line if needed.

Ctrl-N Moves the cursor to the next line at the same column on the screen. Scroll the screen one line if needed.

k Moves the cursor to the previous line at the same column on the screen. Scrolls the screen up one line if needed.

↑ Moves the cursor to the previous line at the same column on the screen. Scrolls the screen up one line if needed.

Ctrl-P Moves the cursor to the previous line at the same column on the screen. Scrolls the screen up one line if needed.

l Moves the cursor one position to the right.

→ Moves the cursor one position to the right.

SPACE
Moves the cursor one position to the right.

m Records the current position pointer under a mark name. A *mark name* is a single lowercase letter, given immediately after the **m**. For example, the command **ma** records the current location of the current position pointer under the name **a**.

0 (Zero) Moves the cursor to the first character of the current line.

+ Moves the cursor to the first nonblank character on the next line. Scroll the screen one line if needed.

Ctrl-M
Moves the cursor to the first nonblank character on the next line. Scroll the screen one line if needed.

– Moves the cursor to the first nonblank character on the previous line. Scrolls the screen up one line if needed.

| Moves the cursor to the column number specified as *count*. This is a screen column number, not a character offset. If a double-byte character occupies column positions 5 and 6, the command **6|** moves the cursor to the character that includes column 6.

If *count* is greater than the length of the current line, **vi** moves the cursor to the last character on the line. If the column indicated is spanned by a tab, **vi** moves the cursor to the first character after the tab.

^ Moves the cursor to the first nonblank character of the current line.

$ Moves cursor forward to the end of a line. *count* specifies the number of lines, including the current line, to move forward.

` When followed by a mark name, moves the cursor to the position that has been associated with that name. The position is set by the **m** command. A grave character followed by another grave character moves the cursor to the previous context. The previous context is typically the last place where you made a change. More precisely, the previous context is set whenever you move the cursor in a nonrelative manner.

´ Similar to the grave (`) character, except that the cursor is set to the first nonblank character on the marked line.

Context-dependent movement commands

Context-dependent movement commands move the cursor based on the nature of the text; for example, **w** moves the cursor to the beginning of the next word, so it must look at the text to determine where the next word begins.

vi defines a *word* as:

- A sequence of letters, digits, and underscores delimited at both ends by characters that are not letters, digits, or underscores; the beginning or end of a line; or the end of the editing buffer.
- A sequence of characters other than letters, digits, underscores, or white space delimited at both ends by a letter, digit, underscore, white space, the beginning or end of a line, or the end of the editing buffer.

vi defines a *fullword* as a sequence of nonblank characters delimited at both ends by blank characters (space, tab, newline) or by the beginning or end of a line or file.

B Moves the cursor back to the first character of the current fullword. If the cursor is already at the beginning of a fullword, **vi** moves it to the first character of the preceding fullword.

b Moves the cursor back to the first character of the current word. If the cursor is already at the beginning of a word, **vi** moves it to the first character of the preceding word.

E Moves the cursor forward to the end of a fullword. If the cursor is already at the end of a word, **vi** moves it to the last character of the next fullword.

e Moves the cursor forward to the end of a word. If the cursor is already at the end of a word, **vi** moves it to the last character of the next word.

F*c* Searches backward in the line for the single character *c* and positions the cursor on top of it. When *count* is given, the editor searches back for the *count* the such character.

f*c* Searches forward in the line for the single character *c* and positions the cursor on top of it. When *count* is given, the editor searches for the *count* the such character.

H Places the cursor on the first nonblank character of the top line of the screen. *count* specifies the number of lines from the top of the screen.

L Places the cursor on the first nonblank character of the bottom line of the screen. *count* specifies the number of lines from the bottom of the screen.

M Places the cursor on the first nonblank character of the middle line of the screen.

N Repeats previous **/** or **?**, but in the opposite direction.

n Repeats previous **/** or **?**.

T*c* Searches backward in the line for the character *c* and position the cursor after the character being sought. *count* searches backward for the *count* the matching character and then positions the cursor after the character being sought.

t*c* Searches forward in the line for the character *c* and position the cursor on the preceding character. *count* searches forward for the *count* the matching character and then positions the cursor on the preceding character.

W Moves forward to the start of the next fullword.

w Moves forward to the start of the next word.

(Moves back to the beginning of the previous sentence. A sentence is bounded by a period (.), exclamation mark (!), or question mark (?); followed by any number of closing double quotation marks, ("), closing single quotation marks ('), closing parentheses ()), or closing square brackets (]); followed by two spaces or the end of the line. Paragraph and section boundaries are also sentence boundaries; see **[[** and **{**.

If you specified the *lisp* option, a *lisp* s-expression is considered a sentence for this command.

) Moves forward to the beginning of the next sentence. See **(** for the definition of a sentence.

If you specified the *lisp* option, a *lisp* s-expression is considered a sentence for this command.

{ Moves back to the beginning of a paragraph. A paragraph begins on a blank line, a section boundary, or a text formatter macro in the `paragraphs` variable.

} Moves forward to the beginning of the next paragraph. See { for the definition of a paragraph.

[[Moves back to the beginning of a section. A section begins on lines starting with a form feed (**Ctrl-L**), starting with an open brace {, a text formatter macro in the `sections` variable, or begin or end of file.

If you specified the *lisp* option, a section boundary is also identified by a line with a leading (.

]] Moves forward to the beginning of the next section. See **[[** for the definition of a section.

If you specified the *lisp* option, a section boundary is also identified by a line with a leading (.

% Finds the balancing character to that under the cursor. The character should be one of the following characters:

[{(< >)}].

; Repeats the previous **F**, **f**, **T**, or **t** command.

, Repeats the previous **F**, **f**, **T**, or **t** command in the opposite direction.

/regexp **,**
Search forward in the file for a line matching the regular expression *regexp* and position the cursor at the first character of the matching string. When used with an operator to define a text range, the range begins with the character at the current cursor position and ends with the first character of the matching string. You can specify whole lines by following *regexp* with **/+***n* or **/–***n*, where *n* is the offset from the matched line.

?*regexp*
Is similar to **/**, but searches backwards in the file.

Ctrl-] Uses the word after the cursor as a tag. (For information about tag, see **ex**.)

Object manipulation commands

Object manipulation commands change the text that is already in the file. An *object manipulator command* works on a block of text. The command character is followed immediately by any movement command. The object that is manipulated by the object manipulator command is the text from the current position pointer to wherever the movement command would leave the cursor.

For example, in **dL**, **d** is the object manipulator command to delete an object. It is followed by the movement command **L** which means move to the bottom line of the screen. The object manipulated by the command thus extends from the current line to the bottom line on the screen; these lines are deleted.

Typically, an object extends up to, but not including, the position of the cursor after the move command. However, some movements work in a *line* mode. For example, **L** puts the cursor on the first nonblank character of the last line on the screen. If it is used in an object manipulation command, it includes the entire starting line and the entire ending line. Some other objects include the cursor position. For example, **d$** deletes up to and including the last character on a line; by itself the **$** would have placed the cursor on the final character. Repeating the command letter implies working on a line basis; thus **5dd** deletes five lines.

Use of buffers

Objects that are deleted or otherwise manipulated have their original values placed in a *buffer*, an area of computer memory that can hold text. There are several ways this can be done:

1. You can use a named buffer. Buffers are named with single lowercase letters. To place an object in a buffer, type a double quotation mark **"** followed by the buffer name, followed by the object manipulator command, as in:

   ```
   "adL
   ```

   This deletes text from the current line to the bottom line on the screen and puts the deleted text in buffer **a**. Typically, this sort of operation overwrites the current contents of the buffer. However, if you use the same form but specify the buffer name in uppercase, the object is appended to the current contents of the buffer. For example:

   ```
   "AdL
   ```

   deletes from the current line to the bottom line on the screen, and adds the deleted text to buffer **a**.
2. If you are deleting material and delete at least one full line, **vi** uses buffers numbered **1** through **9**. The first time a full line or more is deleted, the text is placed in buffer **1**. The next time, the previous contents of **1** are copied to **2**, and the newly deleted text is put into **1**. In the same way, deleted text continues to be rippled through the nine numbered buffers. When text is rippled out of buffer **9**, it is gone for good.
3. In all other cases, the object manipulated goes to the unnamed buffer. For example, the unnamed buffer is used if you delete less than a line of text. The unnamed buffer is like the other buffers, but does not have a name.

Examples of buffers

Following are some examples of the use of buffers:

1. To delete text from the current cursor position through to the bottom of the screen and place it into buffer 1 (this will also ripple numbered buffers), enter:
   ```
   dL
   ```
2. To delete from the current cursor position through to the next position containing (but not including) the string *fred*, and place the deleted text into buffer *a*, enter:
   ```
   "ad/fred/+0
   ```
3. To delete the current word and place it into an unnamed buffer, enter:
   ```
   dw
   ```

List of object manipulator commands

The following section lists the object manipulator commands.

c Deletes the object and enters insert mode for text insertion after the current cursor position. If less than one line is changed, a dollar sign ($) is placed on the final character of the object and typing goes directly over top of the current object until the dollar sign ($) is reached. Additional text is inserted, with the existing text shifting to make room for the new text.

d Deletes the object.

y Moves the object to the appropriate buffer; the source is not changed. This can be used to duplicate or copy objects.

< Shifts the object left by the value of the variable `shiftwidth`. This operator always works on a line basis. This command replaces all leading blanks and tabs required for the new indent amount. *count* shifts *count* lines.

> Shifts the object right by the value of the variable `shiftwidth`. This operator always works on a line basis. This command replaces all leading blanks and tabs required for the new indent amount. *count* shifts *count* lines.

! Filters the object through an external command. After typing the object, the command line opens up for a system command which is parsed in the same manner as the **ex** system command (**:!**). This operator then invokes the given command and sends the entire object on a line basis to that command. The object is then deleted and the output from the command replaces it. For example, **1G!Gsort** moves to the first line of the file; then takes all the text from the first line to the last line and runs it through the **sort** command. The output of **sort** then replaces the original text.

The following shorthand commands are equivalent to the shown object manipulations. Each command can be preceded by *count* or by a buffer name to save the manipulated text.

C Changes to the end of the current line. This is equivalent to the **c$** command.

D Deletes to the end of the current line. This is equivalent to the **d$** command.

s Substitute the character. This is equivalent to the **cl** command.

S Substitute the line. This is equivalent to the **cc** command.

x Deletes the current character. This is equivalent to the **dl** command.

X Deletes the previous character. This is equivalent to the **dh** command.

Y Yanks the current line. This is equivalent to the **yy** command.

Text insertion commands

Text insertion commands add new text to the existing text.

A Enters insert mode at end of line. This is equivalent to the **$a** command.

a Enters insert mode after the current cursor position.

I Enters insert mode before first nonblank character on line. This is equivalent to the **^i** command.

i Enters insert mode before the current cursor position.

O Opens up a new line before the current line and enters insert mode on it.

o Opens up a new line after the current line and enters insert mode on it.

R Replaces characters on the screen with characters typed up to the next ESC. Each character typed overlays a character on the screen. The newline character is an exception; it is simply inserted and no other character is replaced. While you are doing this, the screen may not correspond exactly to the contents of the file, because of such things as tabs. The screen is updated when you leave insert mode.

r Replaces the character under the cursor with the next character typed. When *count* is given, *count* characters following the cursor to the new character are changed. If *count* is given and the newline character is the replacement character, *count* characters are deleted (as usual) and replaced with a single newline character, not *count* newlines.

Miscellaneous commands

This section lists miscellaneous commands.

J Joins *count* lines together. If you do not specify *count*, or *count* is less than 2, **vi** uses a *count* of 2, joining the current line and the next line. This command supplies appropriate spacing: one space between words, two spaces after a period, and no spaces at all when the first character of the line is a). When a line ends with white space, **vi** retains the white space, does not add any further spaces, and then appends the next line.

p Same as **p** except that text is pasted before the cursor instead of after it.

P Put buffer contents before the cursor. Also called a *paste* operation. If preceded by quote *buffername* (for example, **"b**), the contents of that buffer are used; otherwise the contents of the unnamed buffer are used. If the buffer was created in **ex** mode, the contents of the buffer are inserted before the current line. If the buffer was created in **vi** mode, the contents are inserted before the cursor. As a special case, if a paste operation is repeated with the period (**.**) command and it used a numbered buffer, the number of the buffer is incremented. Thus, **"1p ...**, pastes in the contents of buffer 1 through buffer 6; in other words the last six things that were deleted are put back.

Q Switches to **ex** mode. You leave **vi** mode and the **ex** prompt is shown on the bottom line of the screen.

U Undoes all changes to current line. As soon as you move off a line or invoke an **ex** command on the line, the original contents of the line are forgotten and **U** is not successful.

u Undoes last change. If repeated, you undo the undo (that is, go back to what the text was before the undo). Some operations are treated as single changes; for example, everything done by a global **G** is undone with undo.

ZZ Writes the file out, if changed, and then exits.

. Repeats the last command. Any command that changes the contents of the file can be repeated by this command. If you do not specify *count* with the **.** command, **vi** uses the *count* that was specified for the command being repeated.

~ Toggles the case of the character under the cursor and moves the cursor right by one. This command can be preceded by *count* to change the case of *count* characters.

& Repeats the previous **ex** substitute command, using the current line as the target. Flags set by the previous command are ignored. Equivalent to the **ex** command **&**.

: Invokes a single **ex** command. The editor places the cursor on the bottom line of the screen and displays a colon (**:**) to prompt for input. You can then type one or more **ex** commands; when you press ESC or a RETURN, the line you have entered is passed to **ex** and executed there.

@ Invokes a macro. When the next character is a letter from **a** through **z**, **vi** treats it as the name of a buffer. The contents of that buffer are treated as input typed to **vi**. The text of a macro may contain an **@** calling another macro. A macro may call itself, provided it is invoked at the end of the macro (tail recursion). Such a macro executes forever or until an error occurs or the INTERRUPT key is pressed. A macro that invokes itself at the beginning (head recursion) loops until it runs out of memory. A **vi** error terminates all currently executing macros. All changes made during a macro call are treated as a unit and may be undone with a single **u** command.

= Reindents the specified line as though they were set via lisp and autoindent-set, if the *lisp* option was specified.

Ctrl-G Displays the current path name, current line number, total number of lines in the file, and the percentage of the way through the file. This is equivalent to the **ex** command **file**.

Ctrl-L Redraws the screen assuming another process has written on it. This should never happen unless a filter **!** command writes to the screen rather than the standard output.

Ctrl-R Redraws the screen, removing any deleted lines flagged with the **@** convention.

Ctrl-Z Stops the editor and returns you to system level. You can return to the editor with the **fg** command; however, when you resume a **vi** session in this way, all of the session's buffers are empty. The **jobs** command lists all the stopped **vi** jobs. The amount of available memory limits the number of **vi** sessions that may be stopped at one time (see **fg** and **jobs**).

Ctrl-^ Switches to editing the alternate file (see **ex** for an explanation of **write**). If you attempt this and you have not written out the file since you made the most recent change, **vi** does not switch to the alternate file.

Insert mode commands

The object manipulation command **c**, and the text insertion commands [**AaIiOoRr**] put **vi** into INSERT mode. In this mode, most characters typed are inserted in the file. The following characters have special meaning.

Ctrl-D Decrements the *autoindent* for the current line by one level. This is only relevant if the variable **autoindent** is on.

Ctrl-H Deletes the last typed character. The character is not removed from the screen; however it is no longer in your file. When you backspace over characters, new text overwrites the old ones. You are permitted to backspace to the start of the current line regardless of where you started to insert text. (This is not true of some other versions of **vi**.)

BACKSPACE
Deletes the last typed character. The character is not removed from the screen; however it is no longer in your file. When you backspace over characters, new text overwrites the old ones. You are permitted to backspace to the start of the current line regardless of where you started to insert text. (This is not true of some other versions of **vi**.)

Ctrl-J Ends the current line and starts a new one.

Ctrl-M
Ends the current line and starts a new one.

RETURN
Ends the current line and starts a new one.

Ctrl-Q Inserts the following character literally, instead of using its special meaning. You could use this to escape, say, the ESC character itself. It is impossible to insert a Ctrl-J or the null character in your line.

Ctrl-V Inserts the following character literally, instead of using its special meaning. You could use this to escape, say, the ESC character itself. It is impossible to insert a Ctrl-J or the null character in your line.

Ctrl-T Increments the autoindent for the current line by one level. This is only relevant if the variable `autoindent` is on.

Ctrl-W
Deletes the word preceding the cursor and blanks. Although the characters are not removed from the screen, they are no longer in your file.

Ctrl-@ If this is the first character typed after entering insert mode, the previously typed insert mode contents are repeated. After this, you exit insert mode. Only up to 256 characters from the previous insertion are inserted.

ESC Leaves insert mode.

INTERRUPT
Leaves insert mode.

ex command mode

vi enters **ex** command mode if the program is invoked with the **–e** option or if the **Q** command is issued from **vi**. You can issue a single **ex** command from **vi** using the **:** command.

An **ex** command takes the general form:

[*address-list*] [[**command**] [**!**] [*parameters*]]

Each part is optional and may be invalid for some commands. You can specify multiple commands on a line by separating them with an or-bar |.

address-list
Commands can take zero, one, or two addresses. The address % is a short form to indicate the entire file. You can omit any or all of the addresses. In the command descriptions to follow, the addresses shown are the addresses that the commands use by default. Possible default addresses are:

[.,.] Indicates a two-address line range defaulting to the current line.

[1,$] Indicates a two-address line range defaulting to the entire file.

[.+1] Indicates a single address defaulting to the next line.

address An address refers to a line in the text being edited. An address can be an expression involving the following forms:

. The value of dot; that is, the current line.

n A line number indicating an absolute line in the file; the first line has absolute line number 1.

$ The last line in the file.

+[*n***]** *n* lines forward in the file. If you omit *n*, it defaults to 1.

–[*n***]** *n* lines backward in the file. If you omit *n*, it defaults to 1.

'*x* The value of the mark *x*.

/*pat***/** Search for regular expression *pat* forward from the current line.

?*pat***?** Search for regular expression *pat* backwards from the current line.

Thus:

```
/pattern/+3
++
100
```

are three addresses: the first searches for a pattern and then goes three lines further; the second indicates two lines after dot; and the third indicates the 100th line in the file.

command
The **command** is a word, which can be abbreviated. Characters shown in square brackets are optional. For example:

a[**ppend**]

indicates that the **append** command can be abbreviated to **a**.

! Some commands have a variant; this is typically toggled with an exclamation mark (!) immediately after the command.

parameters
Many **ex** commands use parameters to allow you to specify more information about commands. Common parameters include:

buffer Specifies one of the named areas for saving text.

count Is a positive integer, specifying the number of lines to be affected by the command. If you do not specify *count*, it defaults to 1.

file Is the path name for a file. If *file* includes the **%** character, **vi**

replaces that character with the path name of the current file. If *file* includes the **#** character, **vi** replaces that character with the path name of the alternate file. If you do not specify a file, the default is the current file.

flags Indicate actions to be taken after the command is run. It can consist of leading plus (+) and minus (–) signs to adjust the value of the current line indicator, followed by **p**, **l**, or **#** to print, list, or number a line. Thus:

```
.+5 delete 6 ++#
```

deletes starting five lines down from dot; six lines are deleted; the current line indicator is set to the following line, then incremented by two; and that line is printed with its line number.

ex commands

You can enter these commands as shown in **ex** mode. In **vi** mode, they must be preceded by the colon (**:**) character.

ab[breviate] *lhs rhs*
Indicates that the word *lhs* should be interpreted as abbreviation for *rhs*. (See "Context-dependent movement commands" on page 834 for the definition of *word*.) If you enter *lhs* surrounded by white space in **vi** INSERT mode, it is automatically changed into *rhs*. If you do not specify any arguments for the **ab** command, it displays the abbreviations that are already defined. Abbreviated names cannot contain **#** or any other form of punctuation.

[.] a[ppend][!]
Enters **ex** INSERT mode. Text is read and placed after the specified line. An input line consisting of one period (**.**) leaves INSERT mode. If you specify an address of zero, text is inserted before the first line of the file. The current line indicator points to the last line typed.

If an exclamation mark (**!**) is specified, the `autoindent` option is toggled during input. This command cannot be invoked from **vi** mode.

ar[gs] Displays the current list of files being edited. The current file is shown enclosed by square brackets.

cd[!] *path*
Changes the current directory to *path*. If you omit *path*, **cd** sets the current working directory to the directory identified by the **HOME** variable. If *path* is a relative path name, **cd** searches for it using the directories specified in the **CDPATH** variable. If path is –, then **cd** changes to the previous working directory. If you modified the buffer since the last write, **vi** displays a warning message. You can override this behavior by including the exclamation mark (!).

[.,.] c[hange][!] [*count***]**
Deletes the line range given and then enters INSERT mode. If an exclamation mark (**!**) is specified, `autoindent` is toggled during input. You cannot invoke this command from **vi** mode.

chd[ir][!] [*path***]**
Same as **cd**.

[.,.] co[py] *addr* **[***flags***]**
Copies the line range given after *addr*. If *addr* is zero, the lines are inserted before the first line of the file. The current line indicator points to the last line of the inserted copied text.

[.,.] d[elete] [*buffer***] [***count***] [***flags***]**
Deletes the specified line range. After the line range is deleted, the current line indicator points to the line after the deleted range. A *buffer* can be specified as a letter **a**–**z**. If so, deleted lines are saved in the buffer with that name. If an uppercase letter is specified for *buffer*, the lines are appended to the buffer of the corresponding lowercase name. If no buffer name is given, deleted lines go to the unnamed buffer.

e[dit][!] [+*line***] [***file***]**
Begins a new editing session on a new file; the new file replaces the old file on the screen. The text conversion that is specified on the **vi** or **ex** command (for example, the **-B** or **-W** option) is used. This command is usually invalid if you have modified the contents of the current file without writing it back to the file. Specifying an exclamation mark (**!**) goes on to start a new session even you have not saved the changes of the current session.

You can specify *line* as either a line number or as a string of the form */regexp* or *?regexp* where *regexp* is a regular expression. When *line* is a line number, the current line indicator is set to the specified position. When it has the form */regexp*, **vi** searches forward through the file for the first occurrence of *regexp* and sets the current line indicator to that line. *?regexp* is similar to */regexp* except that **vi** searches through the file backwards. If you omit *line* and do not specify a file, the value of the current line indicator does not change. Otherwise, if a file is specified, the current line indicator is set to either the first or last line of the buffer, depending on whether the command was issued in **vi** or **ex** mode.

ex[!] [+*line***] [***file***]**
Begins a new editing session on a new file; the new file replaces the old file on the screen. The text conversion that is specified on the **vi** or **ex** command (for example, the **-B** or **-W** option) is used. This command is typically invalid if you have modified the contents of the current file without writing it back to the file. Specifying an exclamation mark (**!**) goes on to start a new session even you have not saved the changes of the current session.

You can specify *line* as either a line number or as a string of the form */regexp* or *?regexp* where *regexp* is a regular expression. When *line* is a line number, the current line indicator is set to the specified position. When it has the form */regexp*, **vi** searches forward through the file for the first occurrence of *regexp* and sets the current line indicator to that line. *?regexp* is similar to */regexp* except that **vi** searches through the file backwards. If you omit *line* and do not specify a file, the value of the current line indicator does not change. Otherwise, if a file is specified, the current line indicator is set to either the first or last line of the buffer, depending on whether the command was issued in **vi** or **ex** mode.

f[ile] [*file***]**
Changes the current file name to *file* and marks it **[Not edited]**. If this file exists, it cannot be overwritten without using the exclamation mark (**!**) variant of the **write** command.

[1,$] g[lobal][!] */pat/* **[***commands***]**
Matches *pat* against every line in the given range. On lines that match, the *commands* are run. If the exclamation mark (!) variant is set, the *commands* are run on lines that do not match. This is the same as using the *vi* command.

The **global** command and the **undo** command cannot occur in the list of *commands*. A subsequent **undo** command undoes the effect of the entire **global** command. In **ex** mode, multiple command lines can be entered by ending all but the last with a backslash (\). Commands that will take input are permitted; the input is included in the command list, and the trailing period (.) can be omitted at the end of the list. For example, `g/rhino/a\ hippo` appends the single line `hippo` to each line containing `rhino`. *delim* is an arbitrary, nonalphabetic character. The total length of a global command list is limited (see "Limits" on page 859).

[.] i[nsert][!]
Enter **ex** INSERT mode, reads text and places it before the specified line. Otherwise, this is identical to the **append** command. This command cannot be entered from **vi** mode.

[.,.+1] j[oin][!] [*count***] [***flags***]**
Joins together the lines of text within the range. Unless an exclamation mark (!) is specified, all white space between adjacent joined lines is deleted. Two spaces are provided if the previous line ended in a period, no spaces if the joined line begins with a opening parenthesis, and one space otherwise.

[.] k *x* Synonymous with the **mark** command.

[.,.] l[ist] [*count***] [***flags***]**
Displays the line range in a visually unambiguous manner. This command displays tabs as **^I**, and the end of lines as **$**. The only useful flag is **#**, for line numbering. The current line indicator points to the last line displayed.

map[!] *lhs rhs*
This defines macros for use in **vi**. The *lhs* is a string of characters; whenever that string is typed exactly, **vi** behaves as if the string *rhs* had been typed. If *lhs* is more than one character long, none of the characters are echoed or acted on until either a character is typed that isn't in the *lhs* (in which case all the characters up to that point in the *lhs* are run) or the last character of *lhs* is typed. If the variable `remap` is set, *rhs* itself can contain macros. If the flag ! is specified, the map applies within **vi** INSERT mode; otherwise it applies to command mode. A **map** command with no arguments lists all macros currently defined.

[.] ma[rk] *x*
Records the specified line as being marked with the single lowercase letter *x*. The line can then be addressed at any point as **'***x*.

[.,.] m[ove] [*addr***] [***flags***]**
Moves the specified line range after the *addr* given. If *addr* is zero, the text is moved to the start of the file. The current line indicator is set to the last line moved.

n[ext][!] [+*command***] [***file ...***]**
Begins editing the next file in the file list (where the file list was either specified on the command line or in a previous **next** command). The text conversion that is specified on the **vi** or **ex** command (for example, the **-B** or **-W** option) is used. If the current file has been modified since the last

write, **ex** typically prevents you from leaving the current file. You can get around this by specifying an exclamation mark (!). If the `autowrite` is set, the current file is written automatically and you go to the next file. If a list of files is specified, they become the new file list. If necessary, expressions in this list are expanded. Thus:

```
next *.c
```

sets the file list to all the files in the current directory with names ending in `.c` (typically C source files).

[.,.] nu[mber] [*count***] [***flags***]** *[.,.] # [count] [flags]*
Displays the specified line range with leading line numbers. The current line indicator points to the last line displayed.

[.] o[pen] [*pat***] [***flags***]**
Enters open mode, which is simply **vi** mode with a oneline window. If a match is found for the regular expression *pat* in the specified line, then the cursor is placed at the start of the matching pattern.

pre[serve]
Saves the current buffer in a form that can later be recovered using the **–r** option on the **recover** command. **vi** sends you mail telling you that you can recover this file and explains how to do so.

[.,.] p[rint] [*count***] [***flags***]**
Displays the specified line range. The current line indicator points to the last line displayed.

[.] pu[t] [*buffer***]**
Pastes deleted or yanked lines back into the file after the given line. If no buffer name is given, the most recently changed buffer is used.

Because the **edit** command does not destroy buffers, you can send that command in conjunction with **put** and **yank** to move text between files.

q[uit][!]
Exit from **vi** or **ex**. If the current file has been modified, an exclamation mark (!) must be used or you cannot exit until you write the file.

[.] r[ead][!] [*file***]**
Reads the contents of *file* and inserts them into the current file after the given line number. The text conversion that is specified on the **vi** or **ex** command (for example, the **-B** or **-W** option) is used. If the line number is 0, the contents of the given file are inserted at the beginning of the file being edited. If the current file name is not set, a *file* must be given, and it becomes the current file name; otherwise, if a *file* is given, it becomes the alternate file name. If the *file* begins with an exclamation mark (!), then it is taken as a system command. Pipes are used to read in the output from the command after the given line number.

rec[over] [*file***]**
Attempts to recover *file* if it was saved as the result of a **preserve** command or a system or editor crash. If you do not specify *file*, this command displays a list of all recoverable files.

rew[ind][!]
Rewinds the file argument list back to the beginning and starts editing the first file in the list. The text conversion that is specified on the **vi** or **ex** command (for example, the **-B** or **-W** option) is used. If the current file has been modified, an exclamation mark (!) must be specified; otherwise, you

cannot leave the current file until you have written it out. If `autowrite` is set, the current file is written out automatically if it needs to be.

se[t] [*parameter-list***]**
Assigns or displays the values of option variables, If you do not specify a parameter list, **set** displays all the variables with values that have changed since the editing session started. If the parameter **all** is specified, **ex** displays all variables and their values. You can use the parameter list to set or display each of many variable values. Each argument in the list is a variable name; if it is a Boolean variable, the value is set on or off depending on whether the name is prefixed by `no`. Non-Boolean variables alone in an argument are a request to display their values. A Boolean variable's value can be displayed by following the name by a question mark (?). You can set numeric or string variables with: *name=value* In a string variable, spaces must be preceded by a backslash. For example:

```
set readonly? noautowrite shell=/bin/sh
```

shows the value of the **readonly** flag, sets **noautowrite**, and sets the **shell** to `/bin/sh`.

```
set report report=5
```

shows the value of the `report` variable, and then set the value to 5. for more details. See Setting the vi options for more details.

sh[ell] Invokes a child shell. The environment variable **SHELL** is used to find the name of the shell to run.

so[urce] *file*
Runs editor commands from *file*. A file being executed with **source** can contain **source** commands of its own.

st[op] Suspends the editor session and returns to system level. For more information, see the description of the **vi** command **Ctrl-Z**.

[.,.] s[ubstitute] [*/pat/repl/***] [***options***] [***count***] [***flags***]**
Searches each line in the line range for the regular expression *pat* and replaces matching strings with *repl*.

Normally, **ex** only replaces the first matching string in each line. If *options* contains **g** [global], all matching strings are changed.

If *options* contains **c** [confirm], **ex** first prints the line with caret (^) characters marking the *pat* matching location; you can then type `y` if you want **ex** to go ahead with the substitution. *pat* cannot match over a line boundary; however in **ex** mode, *repl* can contain a newline, escaped by a preceding backslash (\). See Appendix C, “Regular expressions (regexp),” on page 971 for full information about both *pat* and *repl*. If there is no *pat* or *repl*, **ex** uses the most recently specified regular expression or replacement string. You can use any nonalphabetic character in place of the slash (/) to delimit *pat* and *repl*.

su[spend]
This is synonymous with the **stop** command.

[.,.] t *addr* **[***flags***]**
This is synonymous with the **copy** command.

ta[g][!] *tagname*
Looks up *tagname* in the files listed in the variable `tags`. If the tag name is found in a tags file, that file also contains the name of the file that contains the tag and a regular expression required within that file to locate that tag.

If the given file is different from the one you are currently editing, **ex** normally begins editing the new file. The text conversion that is specified on the **vi** or **ex** command (for example, the **-B** or **-W** option) is used. However, if you have modified the current file since the last time it was written out, **ex** does not start editing a new file unless the **tag** command contains an exclamation mark (!). If `autowrite` is on, the current file is automatically written out and the new file read in. When the new file is read in, the regular expression from the tags file is invoked with the `magic` variable off.

Tag names are typically used to locate C function definitions in C source files. The first step is to create a `tags` file using the **ctags** command. After you do this, you can use the **ex tag** command to look up a particular function definition and go directly to that definition in the file that contains it.

All characters in tag names are significant unless the variable `taglength` is nonzero; in this case, only the given number of characters are used in the comparison.

una[bbreviate] *lhs*
The abbreviation *lhs* previously created by **abbreviate** is deleted.

u[ndo]
Undoes the last change or set of changes that modified the buffer. Globals and **vi** macros are both considered as single changes that can be undone. A second **undo** undoes the **undo** restoring the previous state. The **edit** command cannot be undone, because it cleans up the temporary file which is used to maintain undo information. You cannot undo operating system commands and commands that write output to the file system.

unm[ap][!] *lhs*
Deletes the *lhs* map. If the flag `!` is used, this applies to the insert mode maps; otherwise it applies to the command mode maps.

[1,$] v /*pat***/** *commands*
This is a synonym for the **global** command with the `!` flag; that is, a global for all nonmatching lines. You can use any nonalphabetic character to delimit *pat* instead of the slash (/).

ve[rsion]
Displays the current version information for **vi** or **ex**.

[.] vi[sual] [*type***] [***count***] [***flags***]**
Enters **vi** mode. If no *type* is specified, the current line is at the top of the screen. If *type* is caret (^), the bottom line of the screen is one window before the current line. If *type* is a minus sign, (–), the current line is at the bottom of the screen. If *type* is a period (`.`), the current line is in the middle of the screen.

You can use the **undo** command to undo all the changes that occurred during the **vi** command.

[1,$] w[rite][!] [>>] [*file***]**
Writes the given range of lines to *file*. The text conversion that is specified on the **vi** or **ex** command (for example, the **-B** or **-W** option) is used. If two right angle brackets (>>) are included, the lines are appended to the current contents of the file. If the current file name is not set, a *file* must be given. This becomes the current file name. Otherwise, *file* becomes the alternate

file name if it is specified. If the *file* begins with an exclamation mark (!), then it is taken as a system command. **vi** writes the given range to the command through a pipe.

If a *file* is given, it must not already exist. The variable **readonly** must not be set. If a *file* is not given, the file must be edited; that is, it must be the same file as that read in. All these conditions can be overridden by using the flag !.

[1,$] wn[!] [>>] [*file***]**
Similar to **write**, except that it begins editing the next file in the file list immediately afterward (if the write is successful).

[1,$] wq[!] [>>] [*file***]**
Similar to **write**, except that it exits the editor immediately afterward (if the write is successful).

x[it] If you have modified the current file since the last write, performs a **write** command using the specified range and file name and then terminates.

[.,.] y[ank] [*buffer***] [***count***]**
Copies the given line range to the specified *buffer* (a letter from **a** through **z**). If a buffer is not specified, the unnamed buffer is used. Buffers are not destroyed by an **edit** command, so **yank** and **put** can be used to move text between files.

Because the **edit** command does not destroy buffers, you can use that command in conjunction with **put** and **yank** to move text between files.

[.+1]z [*type***] [***count***] [***flags***]**
Displays *count* lines. If no count is specified, **ex** uses the current value of the `scroll` variable. The lines are displayed with the given line located according to the *type*. If *type* is a plus sign (+), the editor displays the given line and a screen after that. If *type* is a period (.), the editor displays a screen with the given line in the middle. If *type* is a minus sign (-), the editor displays a screen with the given line at the end. If *type* is a caret (^), the editor displays the screen before that. If *type* is an equal sign (=), the current line is centered on the screen with a line of hyphens printed immediately before and after it. The current line indicator points to the last line displayed.

[.,.] <[<...] [*count***] [***flags***]**
Shifts the line range by the value of the `shiftwidth` variable. If there are multiple left angle brackets (<), each one causes another shift. The current line indicator points to the last line displayed. If a *count* is specified, that many lines are shifted.

[.,.] >[>...] [*count***] [***flags***]**
Shifts the line range right by the value of the `shiftwidth` variable. If there are multiple right angle brackets (>), each one causes another shift. The current line indicator points to the last line displayed. If a *count* is specified, that many lines are shifted.

[*range***] !** *command*
Submits *command* to be run by the command interpreter named by the **SHELL** variable. If *range* is given, the *command* is invoked with the contents of that line range as input. The output from the *command* then replaces that line range. Thus: 1,$!sort sorts the entire contents of the file.

Substitutions are made in *command* before it is run. Any occurrences of an exclamation mark (!) are replaced by the previous *command* line, while

occurrences of percentage (%) and hash mark (#) characters are replaced with the path names of the current and alternate files, respectively. If any such substitutions actually take place, the new command line is displayed before it is executed. (See the **read** and **write** sections in "ex command mode" on page 840 for more information about the current and alternative files.)

If the file has been modified and the variable `autowrite` is on, the file is written before calling the command. If **autowrite** is off, a warning message is given.

[$] = Displays the given line number. The default line number is the last line of the file. The current line indicator is not changed.

" *a line of text*
This is a comment.

[.,.] & [*options***] [***count***] [***flags***]**
Repeats the last **substitute** command. If any *options*, *count*, or *flags* are specified, they replace the corresponding items in the previous **substitute** command.

[.,.] ~ [*options***] [***count***] [***flags***]**
Repeats the last **substitute** command. However, the regular expression that is used is the last regular expression; that is, if there has been a search, the search's regular expression is used. The simple **substitute** with no arguments, or the **&** command, uses the regular expression from the previous substitute. **substitute** with an empty regular expression uses the last regular expression, like **~**. If any *options*, *count*, or *flags* are specified, they replace the corresponding items in the previous **substitute** command.

@ *buffer*
Executes each line in *buffer* as an **ex** command. If you do not specify *buffer* or if you specify a buffer named @, the last buffer executed is used.

Ctrl-D Displays the number of lines of text given by the `scroll` variable. The current line indicator points to the last line displayed.

Special characters in ex commands

When an **ex** command contains the percentage character (%), the character is replaced by the name of the current file. For example, if you are about to try out a macro and you are worried that the macro may damage the file, you could issue:

```
!cp % /tmp
```

to copy the current file to a safe holding place. As another example, a macro could use the percentage character (%) to refer to the current file.

When an **ex** command contains the hash mark (#), the character is replaced by the name of the alternate file. The name of the alternate file can be set with the **read** command as described previously. Thus a command like:

```
e #
```

tells **ex** to edit the alternate file. Using an alternate file can be convenient when you have two files that you want to edit simultaneously. The command just given lets you flip back and forth between the two files.

Setting the vi options

Options are set with the **set** command. For example:

```
set autowrite
```

sets the **autowrite** option. For options which are flags (that is, are not numeric), the variables can be turned off by putting **no** in front of the name in the **set** command, as in:

```
set noautowrite
```

In the following list, variables that are off by default are preceded by `no`. The minimal abbreviation of each option is shown after the comma. Default values are shown after the equal sign (=).

autoflush, af
: When this option is set, it holds the maximum number of seconds of data a user would lose if a system crash occurs. **vi** flushes memory out to its temporary files approximately this many seconds, unless no changes have been made to the current edit buffer, or the user is sitting idle. It allows you to eventually recover a more current representation of your edit buffer (after the **exrecover** daemon and **vi** —r is run) because it intermittently updates **vi**'s temporary files which are used by the **exrecover** daemon.

  Note the following:

  - The default is set to 120 seconds (2 minutes).
  - To turn off this option, set `autoflush` to 0.
  - This option does not affect on read-only files.
  - This option is different from the previous `preserve` option because it works with **vi**'s temporary files (whose location is specified by the environment variables: TMP_VI, TMPDIR or TMP) as opposed to recovered files found in **/etc/recover/$LOGNAME**.

autoindent, ai
: When **autoindent** is on and you are entering text, the indentation of the current line is used for the new line. In **vi** mode, you can change this default indentation by using the control keys **Ctrl-D** (to shift left) or **Ctrl-T** to shift right. In **ex** mode, a tab or spaces can be typed at the start of a line to increase the indent, or **Ctrl-D** can be typed at the start of the line to remove a level. **^Ctrl-D** temporarily removes the identation for the current line. **0Ctrl-D** places the current line at a zero indent level, and the next line has this indent level as well.

  The size of indent levels is defined by the variable `shiftwidth`.. Based on this value and the value of `tabstop`, the editor generates the number of tabs and spaces needed to produce the required indent level.

  The default is `noautoident`.

autoprint, ap
: When this option is set in **ex** mode, the current line is printed after the following commands: **copy**, **delete**, **join**, **move**, **substitute**, **undo**, **&**, **~**, **<**, and **>**. Automatic displaying of lines does not take place inside global commands.

  The default is `autoprint`.

autowrite, aw
: When this option is on, the current file is automatically written out if it has been changed since it was last written and you have run any of the

following commands: **next**, **rewind**, **tag**, **Ctrl-^** (**vi**), and **Ctrl-]** (**vi**). Using an exclamation mark (`!`) with any of these commands stops the automatic write.

The default is `noautowrite`.

beautify, bf
When this option is on, the editor discards all nonprinting characters from text read in from files.

The default is `nobeautify`.

cdpath Used by **cd** to find relative path names when changing the directory. You must delimit entries with a colon (:). If the current directory is to be included in the search, it must be indicated by a dot (`.`). `cdpath` defaults to the contents of the **CDPATH** environment variable if it exists, or to dot (`.`) if it does not.

directory, dir
The editor uses temporary files with unique names under the given directory. Any error on the temporary files is fatal.

The default is `directory=tmp`.

edcompatible
When this option is on, the editor attempts to make substitution commands behave in a way that is compatible with the **ed** editor. The **g** and **c** options on the substitute commands are remembered and toggled by their occurrence. The **r** option uses the last regular expression rather than the last substitute regular expression. Percentage mark (`%`) as the entire pattern is equivalent to the previous pattern.

The default is `nocompatible`.

errorbells, eb
When this option is on, **vi** precedes error messages with the alert character. When it is off, the editor warns you of an error by displaying a message using a standout mode of your terminal (such as reverse video).

The default is `noerrorbells`.

exrc When this option is on, **ex** and **vi** access any **.exrc** files in the current directory during initialization. If it is off, **ex** and **vi** ignore such files unless the current directory is the **HOME** directory.

home Used as the destination directory by **cd**. If no path is specified, `home` defaults to the contents of the **HOME** environment variable if it exists, or to the **vi** startup directory if it does not.

ignorecase, ic
When this option is on, the case of letters is ignored when matching strings and regular expressions.

The default is `noignorecase`.

linedelete
vi sets the line delete character automatically to the current terminal line delete character, as specified by the user. Within **vi**, you can set the line delete character with the `linedelete` variable. The value you specify is the numeric value of the line delete character. The default is `0x15`, the ASCII value for **Ctrl-U**. Another value is `0x18` for **Ctrl-X**.

list When this option is on, tabs are displayed as a caret mark (^) rather than expanded with blanks, and the ends of lines are indicated with a dollar sign ($).

The default is `nolist`.

magic When this option is off (`nomagic`), regular expression characters ^ \ and $ become the only ones with special meanings. All other regular expression metacharacters must be preceded by a backslash (\) to have their special meaning.

The default is `magic`.

maxbuffers
The number of K units (1024 bytes) of memory to be used for the editor buffers. These are allocated in units of 16K.

The default is `maxbuffers=512`, but if that is not available upon entry, this is set to the number actually obtained. At least 32K is needed. This is in addition to the code and data space required by **vi**; this may be as much as 128K. Changing **maxbuffers** has no effect.

mesg When this option is on, **ex** allows others to use the **write** or **talk** commands to write to your terminal while you are in visual mode. The command

```
mesg n
```

overrides this variable (see **mesg**). This option does not affect systems that do not support **mesg**.

number, nu
When this option is on, line numbers are displayed to the left of the text being edited.

The default is `nonumber`.

paragraphs
This list of character pairs controls the movement between paragraphs in **vi** mode. Lines beginning with a period (`.`) followed by any pair of characters in the list are paragraph boundaries (for example, `.IP`). Such lines are typically commands to text formatters like **nroff** or **troff**.

The default is `paragraphs="IPLPPPQPP LIpplpipbp""`

prompt When this option is on, **ex** command mode prompts with a colon (`:`). No prompts are given if input is not being read from a terminal.

The default is `prompt`.

pwd This is a read-only variable. The value always refers to the current working directory, and can only be changed by the **cd** command.

quiet When this option is on, **vi** does not display file information messages.

The default is set by the **–s** option.

readonly
When this option is on, **vi** does not let you write to the current file.

The default is based on the permissions of the current file. If you do not have write permission on this file, the default is **readonly**. Otherwise, the default is set by the **–R** option.

remap If this option is on and a `map` macro is expanded, the expansion is reexamined to see if it also contains `map` macros.

The default is remap.

report The editor displays a message whenever you issue a command that affects more than this number of lines.

The default is report=5.

restrict
All filenames are restricted to the current directory. Subcommands cannot be called. This variable is automatically set if you invoke the editor with a command that starts with the letter **r**, as in **rvi**. When the option is turned on, it cannot be turned off.

The default is norestrict.

scroll This sets the number of lines to scroll for the **z** **ex** and **Ctrl-D** (**ex**) commands.

The default is the value of the variable window, divided by two.

sections
This list of character pairs controls the movement between sections in **vi** mode. Lines beginning with a period (**.**) followed by any pair of characters in the list are section boundaries (for example, **.**SH). Such lines are typically commands to text formatters like **nroff** or **troff**.

The default is sections="SHNHH HU"

shell, sh
This is the name of the command interpreter to be used for **!** commands and the shell command. The default value is taken from the SHELL environment variable.

shiftwidth, sw
This sets the width of indent used by shift commands and autoindent.

The default is shiftwidth=8.

showmatch, sm
If this option is on and you type a closing parenthesis or closing brace in input mode, the cursor moves to the matching open parenthesis or brace. It stays there for about one second and then moves back to where you were. This lets you note the relationship between opening and closing parentheses/braces.

The default is noshowmatch.

showmode
When this option is on, **vi** displays an indicator in the bottom right corner of the screen if you are in Insert/Open/Change/Replace mode. If no indicator is displayed, you are in Command mode.

The default is noshowmode.

tabstop
Tab stops for screen display in **vi** mode are set to multiples of this number.

The default is tabstop=8.

taglength, tl
If this variable is nonzero, tags are only compared for this number of characters.

The default is taglength=0.

tags The value of this variable should be a list of file names separated by a

backslash (\) followed by a space. If there is no backslash before the space, **vi** treats the second and subsequent tags as part of an `option=value` combination. For example:

```
set tags=file1\ file2\ file3\
```

These are used by the **tag ex** command and the **Ctrl-] vi** command. The files are typically created with the **ctags** program.

The default is `tags=tags`.

term The value of this variable is the terminal type. The TERM environment variable specifies this variable's default value.

terse If this option is on, messages are displayed in an abbreviated form. The default is `noterse`.

warn When this option is on, commands with an exclamation mark (`!`) print a warning message if the current file has been modified. No message is printed if this option is off.

The default is `warn`.

window This variable gives the number of text lines available in **vi** mode or the default number of lines to display for the command.

The default is given by the **–w** option. If it is not specified with the **–w** option, its value defaults to the environment variable LINES or the value found in the terminfo database for **TERM**.

wrapmargin wm
If this variable is nonzero in **vi** insert mode, when a line reaches this number of characters from the right of the screen, the current word moves down to the next line automatically; you do not have to press ENTER.

The default is `wramargin=0`.

wrapscan, ws
If this option is off, forward searches stop at the end of the file and backward searches stop at the beginning.

The default is `wrapscan`

writeany, wa
If this option is off, the editor does not let a file marked `[Not edited]` overwrite an existing file.

The default is `nowriteany`.

Regular expressions

Many **ex** commands use regular expressions when searching and replacing text. A *regular expression* (indicated by *pat* in the command descriptions) is used to match a set of characters.

A regular expression consists of a string of normal characters that exactly match characters in a line. These can be intermixed with special characters (known as *metacharacters*), which allow matching in some special manner. Metacharacters can themselves be matched directly by preceding them with the backslash (\) character. If the variable **magic** is turned off, all but two of the metacharacters are disabled; in this case, the backslash character must precede them to allow their use as metacharacters. See Appendix C, “Regular expressions (regexp),” on page 971 for examples.

^ Matches the start of a line. This is only a metacharacter if it is the first character in the expression.

$ Matches the end of a line. This is only a metacharacter if it is the last character in the expression.

. Matches any single character.

***** Matches zero or more occurrences of the previous expression.

\< Matches the empty string preceding the start of a word. A word is a series of alphanumeric or underscore characters preceded by and followed by characters that are not alphanumeric or underscore.

\> Matches the empty string following the end of a word. A word is a series of alphanumeric or underscore characters preceded by and followed by characters that are not alphanumeric or underscore.

[*string***]**
Matches any of the characters in the class defined by *string*. For example, **[aeiouy]** matches any of the vowels. You can put a range of characters in a class by specifying the first and last characters of the range, with a hyphen (**-**) between them. For example, in ASCII **[A–Za–z]** matches any upper or lowercase letter. If the first character of a class is the caret (^), the class matches any character not specified inside the square brackets. Thus, in ASCII **[a–z_][^0–9]** matches a single alphabetic character or the underscore, followed by any nonnumeric character.

\(...\) A set of characters in the pattern can be surrounded by escaped parentheses. See the description of *\n* in Replacement patterns. This is not affected by the setting of **magic**.

~ Matches the replacement part of the last substitute command.

Replacement patterns

A *replacement pattern* (indicated by *repl* in the command descriptions) describes what to put back in a line for the set of characters matched by the regular expression.

& Is replaced by the entire string of matched characters.

~ Is replaced by the entire replacement pattern from the last substitute.

\n Is replaced by the string that matched the *n*th occurrence of a **\(...\)** in the regular expression. For example, consider:

```
s/\([a-zA-Z]*\)our/\lor/
```

The **\l** represents the string that matched the regular expression **\([a-zA-Z]*\)**. Thus, the previous command might change the word **colour** to **color**.

\u Changes the next character in the replacement to uppercase.

\l Changes the next character in the replacement to lowercase.

\U Changes the following characters in the replacement to uppercase.

\L Changes the following characters in the replacement to lowercase.

\E, \e Turns off the effects of **\U** or **\L**.

Initializing the editor

Initialization code consists of one or more **ex** commands that run when the editor starts up. Initialization code can be obtained in several ways:

1. If there is an environment variable named **EXINIT** with a nonnull value, it is assumed to hold initialization code. **vi** executes this code using an **ex source** command.
2. If **EXINIT** does not exist or has a null value, the editor tries to find a file named **.exrc.** If you have an environment variable named **HOME**, the value of this variable is assumed to be the name of your home directory. **vi** runs the **.exrc** file using an **ex source** command.
3. If **EXINIT** variable or the **$HOME/.exrc** file sets the option variable `exrc` and if there is a file named **.exrc** under the current directory, it is assumed to hold initialization code. **vi** runs this code using an **ex source** command.

All **.exrc** files must be owned by the same user ID that invoked the **vi** command, and must only be writable by that user ID. Typical permissions for a **.exrc** file would be 744.

The **.exrc** file is read as if it were a sequence of keystrokes typed at the beginning of an **ex** session. As a result, the contents of **.exrc** must be the same as the characters you would type if you were in **vi** or **ex**. In particular, if the input contains an unusual character (for example, a carriage return) that you would typically precede with Ctrl-V, there must be a Ctrl-V in the **.exrc** file. If you are creating an **.exrc** file with **vi**, you must type Ctrl-V Ctrl-V to put a Ctrl-V character into your initialization file, then Ctrl-V followed by the special character to put the special character into your initialization file. The **.exrc** file must show both Ctrl-V and the special character. A command specified in the **.exrc** file can be ignored (treated as a comment) by beginning that line with a double quotation mark (").

Files

vi uses the following files:

/tmp Directory used for temporary files if **TMP_VI**, **TMPDIR** and **TMP** are not defined.

/tmp/VI*nnnnn.mmm*
Temporary files.

.exrc Startup file.

Localization

vi uses the following localization environment variables:
- **LANG**
- **LC_COLLATE**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Environment variables

vi uses the following environment variables:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

CDPATH
Contains a list of directories to be searched.

COLUMNS
Contains the number of columns between the left and right margins (see option variable **wrapmargin**). This is also used as the horizontal screen size.

ENV Contains the path name of a file containing KornShell commands. When you invoke **sh**, it executes this file before doing anything else.

EXINIT
Contains a list of **vi** commands to be run when the editor is started up.

HOME
Contains the directory to be searched for the editor startup file.

LINES
Contains the number of lines in a screen (see option variable **windows**). This is also used as the vertical screen size.

PATH Contains a list of directories to be searched for the shell command specified in the **ex** commands **read**, **write**, and **shell**.

SHELL
Contains the name of the command interpreter for use in **!**, **shell**, **read**, **write**, and other **ex** commands with an operand of the form **!***string*. The default is the **sh** utility.

TERM Contains the name of the terminal type.

TERMINFO
Contains the path name of the terminfo database.

TMPDIR
Contains the path name that the shell uses as the directory for temporary files.

TMP_VI
Contains a directory path name that can be specified by an administrator as a location for **vi**'s temporary files. This is useful if the current default directory for these files (typically **/tmp**) is implemented as a TFS. In this case, all **vi**'s temporary files that the **exrecover** daemon uses for recovery would be gone after a system crash.

This environment variable should be set by a system administrator as opposed to a user setting it for their environment. If the latter occurs, and the user sets the TMP_VI directory to something different from what **exrecover** recognizes as TMP_VI, the user will need to run the **exrecover** daemon manually to allow the temporary files to be converted to the recoverable files used by **vi** (located in /etc/recover/$LOGNAME).

Restrictions: When setting TMP_VI, follow these restrictions:

1. Do not set TMP_VI to **/etc/recover/$LOGNAME**
2. Do not set TMP_VI to any directory where a path name component is an environment variable with a user's value different from the initialization process's value (for example $HOME). The temporary files that are connected with **vi** are converted into a form recoverable by **vi** when **exrecover** is run during IPL. Because **exrecover** is issued during IPL, it is owned by the initialization process and will contain different values for certain environment variables, if those environment variables are set. Throughout the file system, there might exist some temporary files that can only be converted by **exrecover**. This conversion can be done manually by a system administrator (to recover files owned by all users) or by a single user (to recover only their own files).

Exit values

0 Successful completion

1 Failure due to any of the following:
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion
- Unknown option
- No such command from open/visual
- Missing *lhs*
- Missing file name
- System does not support job control
- Write forms are **w** and **w>>**
- Internal error: bad seek pointer
- Internal error: Line out of range
- Internal error: line too long
- Nonzero address required on this command
- No lines in the buffer
- Nothing to undo
- Cannot escape a newline in global from visual
- Global command too long
- Argument list too long
- File is read-only
- No previous command to substitute for **!**
- Command too long
- No previous regular expression
- Buffers are 1–9, a–z
- Line too long
- System does not support job control
- Digits required after **=**
- Nothing in buffer
- Missing *rhs*
- Too many macros
- Recursive map expansion
- Nothing to repeat
- Last repeatable command overflowed the repeat buffer
- Bad tag
- No tags file
- No such tag in tags file
- Negative address—first buffer line is 1
- Not an editor command

- Unimplemented **ex** command
- Wrong number of addresses for command
- Mark requires following letter
- Undefined mark referenced
- Global within global not allowed
- First address exceeds second
- Cannot use open/visual unless open option is set
- Regular expression \ must be followed by / or ?
- No address allowed on this command
- No more files to edit
- No current file name
- Extra characters at end of command
- Not that many lines in buffer
- Insufficient memory
- Restricted environment
- Command too long
- Trailing address required
- Destination cannot straddle source in **m** and **t**
- No file name to substitute for **%**
- No alternate file name to substitute for **#**
- file name too long
- Too many file names
- Argument buffer overflow
- Incomplete shell escape command
- Regular expressions cannot be delimited by letters or digits
- No previous scanning regular expression
- No previous substitute to repeat
- Cannot escape newlines into regular expressions
- Missing **[**
- Badly constructed regular expression
- No remembered regular expression
- Line overflow in substitute
- Replacement pattern contains **\d**—cannot use in regular expression
- Replacement pattern too long
- Regular expression too complicated
- Cannot escape newline in visual
- No such set option
- String too long in option assignment

2

- Unknown command-line option
- Missing or incorrect *num* in an **-n** option

Limits

- Maximum number of lines: 65 279 (64K - 256 - 1).
- Length of longest line: {LINE_MAX}bytes, including the newline.
- Longest command line: 256 bytes.
- Length of filenames: 128 bytes.
- Length of string options: 64 bytes.
- Length of remembered regular expressions: 256 bytes.
- Number of **map**, **map!,** and **abbreviate** entries: 64 each.
- Number of saved keystrokes for **.** in **vi**: 128.
- Length of the *lhs* of **map**, **map!,** or **abbreviate**: 10 bytes.
- Maximum number of characters in a tag name: 30.

- Number of characters in a **:** escape from **vi**: 128.
- Requires 128K of memory plus the set option `maxbuffers` K of auxiliary memory. During startup, `maxbuffers` is changed to reflect available memory; at least 32K is required.
- Number of nested source files is 3.

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

The **-B**, **-e**, **-s**, **-v**, and **-W** options are extensions of the POSIX standard.

Related information

ed, **ex**, **fg**, **jobs**, **mesg**, **sed**, **talk**, **tee**, **write**

See Appendix C, "Regular expressions (regexp)," on page 971 for more information about **regexp**.

wait — Wait for a child process to end

Format

wait [*pid* | *job-id* ...]

tcsh shell: **wait**

Description

wait waits for one or more jobs or child processes to complete in the background. If you specify one or more *job-id* arguments, **wait** waits for all processes in each job to end. If you specify *pid*, **wait** waits for the child process with that process ID (PID) to end. If no child process has that process ID, **wait** returns immediately.

If you specify neither a *pid* nor a *job-id*, **wait** waits for the process IDs known to the invoking shell to complete.

In the tcsh shell, the shell waits for all background jobs. If the shell is interactive, an interrupt disrupts the **wait** and cause the shell to print the names and job numbers of all outstanding jobs. See "tcsh — Invoke a C shell" on page 689.

Localization

wait uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Usage notes

wait is a built-in shell command.

Exit values

If one or more arguments (pid or job-id) are specified, the exit status of **wait** is the exit status of the last argument.

If you specified a *job-id* that has terminated or is unknown by the invoking shell, an error message and a return code of 127 is returned. If you specified a *pid* that has terminated or is unknown to the shell, a return code of 127 is returned. If a signal ended the process abnormally, the exit status is a value greater than 128 unique to that signal. Otherwise, possible exit status values are:

0 Successful completion or **wait** was invoked with no arguments, and all child processes known to the invoking shell have completed.

1–126 An error occurred

127 A specified *pid* or *job-id* has terminated or is unknown by the invoking shell

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

Related information

sleep, **tcsh**

wall — Broadcast a message to logged-in users

Format

wall [*message*]

Description

wall sends a message to all logged-in users. The **wall** command reads from the standard input (stdin). Type each line, pressing Enter after each. After you finish typing the message, enter End-of-File or an interrupt (typically, <EscChar-D> for End-of-File or <EscChar-C> for an interrupt, where EscChar is normally the cent sign; if you use rlogin or telnet to enter the shell, hold down the Ctrl key while pressing either D or C).

You must be a superuser to ensure permission to write to all the ttys that are logged in. If you are not a superuser, then writes to all ttys will fail (except your own) and those users will not receive the message. Superusers can also get failures if the **/etc/utmpx** file does not correctly represent the users currently logged in.

Recipients of the message receive a beep announcing the message. The message is displayed in this form:

```
Broadcast Message from SWEHR@AQFT (ttyp0006) at 10:43:54 (EDT5EST)...

This is the text of the message line1.
This is line2.
```

Exit values

0 **wall** successfully sent the message to all users.

1 Failure due to any of the following:

- No message was entered in response to the prompt.
- You do not have permission to write to a user's terminal.

wc — Count newlines, words, and bytes

Format

wc [**–Blw**] [**–c**|**–m**] [**-W** *option*[,*option*]...] [*file ...file ...*]

Description

wc tells you how large a text document is. It counts the number of newlines, words, characters, and bytes in text files. If you specify multiple files, **wc** produces counts for each file, plus totals for all files. If you do not specify any files, **wc** reads from the standard input (stdin).

Options

–B Disables the automatic conversion of tagged files. This option is ignored if the **filecodeset** or **pgmcodeset** options (**-W** option) are specified.

–c Prints a byte count. You cannot specify this option with **–m**.

–l Prints a <newline> count

–m Prints a character count. You cannot specify this option with **–c**.

–w Prints a word count

-W *option*[**,***option*]**...**
Specifies z/OS-specific options. The option keywords are case-sensitive. Possible options are:

filecodeset=*codeset*
Performs text conversion from one code set to another when reading from the file. The coded character set of the file is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **pgmcodeset** is specified but **filecodeset** is omitted, then the default file code set is ISO8859-1 even if the file is tagged with a different code set. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, “Controlling text conversion for z/OS UNIX shell commands,” on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

When specifying values for **filecodeset**, use the values that Unicode Service supports. For more information about supported code sets, see *z/OS Unicode Services User's Guide and Reference*.

pgmcodeset=*codeset*

Performs text conversion from one code set to another when reading from the file. The coded character set of the program (command) is *codeset*. *codeset* can be a code set name known to the system or a numeric coded character set identifier (CCSID). Note that the command `iconv -l` lists existing CCSIDs along with their corresponding code set names. The **filecodeset** and **pgmcodeset** options can be used on files with any file tag.

If **filecodeset** is specified but **pgmcodeset** is omitted, then the default program code set is IBM-1047. If neither **filecodeset** nor **pgmcodeset** is specified, text conversion will not occur unless automatic conversion is enabled or the _TEXT_CONV environment variable indicates text conversion. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

If **filecodeset** or **pgmcodeset** is specified, then automatic conversion is disabled for this command invocation and the **-B** option is ignored if it is also specified. See *z/OS UNIX System Services Planning* for more information about automatic conversion.

Restriction: The only supported values for **pgmcodeset** are IBM-1047 and 1047.

The order of options can dictate the order in which **wc** displays counts. For example, **wc –cwl** displays the number of bytes, then the number of words, then the number of <newline>s. If you do not specify any options, the default is **wc –lwc** (<newline> count, then words, then bytes).

A word is considered to be a character or characters delimited by white space.

Note: If you have a file containing double-byte characters, the byte count is higher than the character count.

Examples

1. To display the <newline> count, followed by the word count, followed by the byte count of a text file to the standard output (stdout):

   ```
   wc myTextFile
   ```

2. To display a byte count followed by a word count of a text file containing ASCII characters to the standard output (stdout), assuming that:
   - The text file is untagged and you do not want to tag it or enable automatic conversion, and
   - You cannot alter the tag (for example, you are displaying an untagged public text file or a read-only text file):

   ```
   wc -cw -W filecodeset=ISO8859-1,pgmcodeset=IBM-1047 myAsciiFile
   ```

3. To display the <newline> count of a text file containing EBCDIC characters, assuming that automatic conversion has been enabled but the text file is incorrectly tagged as UTF-8:

   ```
   wc -lB myMisTaggedFile
   ```

Localization

wc uses the following localization environment variables:

- **LANG**
- **LC_ALL**

- **LC_CTYPE**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Environment variables

wc uses the following environment variable:

_TEXT_CONV
Contains text conversion information for the command. The text conversion information is not used when either the **-B** option or the **filecodeset** or **pgmcodeset** option (**-W** option) is specified. For more information about text conversion, see Appendix L, "Controlling text conversion for z/OS UNIX shell commands," on page 1027.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Inability to open the input file
- The code set is not valid
- Could not turn off automatic conversion
- Could not perform requested text conversion

2 Failure because of an incorrect command-line option

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The way the order of options **–c**, **–l** and **–w** affects the order of display is an extension to traditional implementations of **wc**. The **-B** and **-W** options are extensions of the POSIX standard.

Related information

awk, **ed**, **vi**

whence — Tell how the shell interprets a command name

Format

whence [**–v**] *name ...*

Description

whence tells how the shell would interpret each *name* if used as a command name. Shell keywords, aliases, functions, built-in commands, and executable files are distinguished. For executable files, the full path name is given. If the executable file is a tracked alias, the string identifies it as *cached*.

Options

–v Gives a more verbose report.

Usage notes

whence is a built-in shell command.

Localization

whence uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, "Localization," on page 997 for more information.

Exit values

0 Successful completion
1 Command *name* could not be found
2 Failure due to an incorrect command-line argument

Portability

POSIX.2.

Related information

command, **sh**

---

who — Display information about current users

Format

who[**–AabdHilmprsTtuw**] [*file*]
who –q[*file*]
who am I | **i**

Description

who displays information about users who are logged into the system. By default, the output contains the user's login name, terminal name, and the time that the user logged in. Normally, **who** consults the file **/etc/utmpx** for information, but you can use the *file* argument to specify another accounting file.

When called as:

```
who am i
```

or

```
who am I
```

who displays your login name, terminal, and login time. This command works only in the POSIX locale.

Options

–A Displays all accounting entries.

–a Displays all types of entries. This is equivalent to specifying **–AbdHilprTtuw**.

–b Displays all entries written at system boot time.

–d Displays entries produced after the death of a process spawned from **/usr/sbin/init**.

–H Displays column headings above the output.

–i Displays idle time for users. The idle time is the *hours:minutes* since the last activity; a dot (.) means that the terminal has been used in the last minute, and the string *old* means that the terminal has not been used in more than 24 hours, or hasn't been used since boot time.

–l Displays logged-out user entries.

–m Displays information about current terminal only.

–p Displays entries for processes spawned from **/usr/sbin/init**.

–q Displays a quick list with the number of users and their names; other options are ignored.

–r Displays all run-level change entries.

–s Displays only the three fields *user name*, *terminal*, and *time of entry*.

–T Displays the state of each terminal as a plus sign (+) if the terminal allows write access to other users, and a minus sign (–) if write access is denied. **who** displays a question mark (?) if the write access cannot be determined.

–t Displays all time change entries (both old and new time).

–u Displays only entries associated with logged-in users. **who** enables this option when you do not provide any options on the command line.

–w Displays the terminal state; this indicates whether the terminal can be written to.

Files

who uses the following files:

/etc/utmpx
Displays the current status file.

Localization

who uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_TIME**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

2 Failure because of an incorrect command-line option, or because of too many command-line arguments.

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide.

The **utmpx** file format, the options, and the output of **who** are totally compatible with UNIX System V.

The **–A**, **–a**, **–b**, **–d** **–i**, **–l**, **–p**, **–r**, **–s**, **–t**, **–w**, and **am I** options are extensions to the POSIX standard.

Related information

See the **utmpx** file format description in Appendix H, "File formats," on page 1003 for more information.

whoami — Display your effective user name

Format

whoami

Description

whoami displays a user name associated with the effective user ID. To display your login name, use `who am i`.

For example, if you login as *user1*, then use the **su** command to change to *user2*:

Command
    Returned
who am I
    user1
whoami
    user2

Exit values

0 Successful completion
1 Incorrect command line argument
2 Error getting effective username; displays effective UID

Related information

who, **id**

write — Write to another user

Format

write *user_name* [*terminal*]

Description

write lets you send a message directly to the terminal of someone else logged in to the system. It reads from the standard input (stdin) and writes to the terminal of another user.

Options

user_name
Specifies the user to whom you want to send your message.

terminal
Is an optional identifier for use when the other user is logged in on more than one terminal. The format of the terminal name is the same as returned by **who**.

Usage notes

1. When you issue a **write** command to send a message to another user, the other user receives a message of the form:

   ```
   Message from your_name (terminal) [date] ...
   ```

   After the system establishes the connection to the other user, it sends two alert characters (typically beeps) to your terminal to tell you that it is ready to send your message. You can then type your message, which will appear on the other user's terminal. To end your message, enter end-of-file or an interrupt (typically, <EscChar-D> for end-of-file or <EscChar-C> for an interrupt, where EscChar is normally the cent sign; if you use rlogin or telnet to enter the shell, you hold down the Ctrl key while you press either D or C). When **write** receives an indication for end-of-message, it tells the other user that the message is over and breaks the connection.

   The other user can reply to your message with:

   ```
   write your_user_name
   ```

   However, if both of you are trying to write on each other's terminal at the same time, the messages may get interleaved on your screens, making them difficult to read. For two-way conversations, use **talk** instead of **write**.
2. You can add the output of a command to the material that you write. To do this, start a line with an exclamation mark (!) and put a standard system command on the rest of that line. **write** calls your shell to execute the command, and sends the standard output (**stdout**) from the command to the other user. The other user does not see the command itself or any input to the command. For example, you might write:

   ```
   Here is what my file contains:
   !cat file
   ```
3. The **mesg** command lets you refuse **write** messages. With:

   ```
   mesg n
   ```

   you can tell the system that you don't want to be interrupted by **write** messages. If people try to **write** to you, they are denied immediately; the system does not inform you about such attempts. For further details, see **mesg**.

Localization

write uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 **write** successfully wrote a message, or the intended recipient used **mesg** to refuse messages (either before you start sending a message or as you are sending the message).

1 Failure due to any of the following:
- *user_name* is not signed on
- You do not have permission to write on that user's terminal
- **write** cannot open the target terminal for writing
- The command line had an incorrect number of options

Portability

POSIX.2 User Portability Extension, X/Open Portability Guide, UNIX systems.

Related information

mailx, **mesg**, **talk**, **who**

writedown — Set or display user's write-down mode

Format

writedown –a | –d | –i [–p]
writedown –p

Description

writedown sets or displays the user's write-down mode for the current address space. Setting or querying the write-down mode is only allowed if multilevel security is active and the user has "write-down" privilege. See *z/OS Planning for Multilevel Security and the Common Criteria* for more information about multilevel security.

Options

–a Activate write-down mode. This allows the user to write data to a resource protected by an multilevel security label of lower labeled classification than the user's seclabel.

–d Set the write-down mode from the default value in the user's security profile.

–i Inactivate write-down mode. This prevents the user from writing data to a resource protected by a multilevel security label of lower labeled classification than the user's security label.

–p Print the user's current write-down mode setting to stdout. The output is "active" or "inactive". If used with **–a**, **–d**, or **–i**, the new value is displayed.

Usage notes

1. This command is only supported when the user has at least READ access to the IRR.WRITEDOWN.BYUSER resource in the FACILITY class and SETR MLS is active.

2. Write-down mode affects the current process' address space. When the write-down mode is changed, all processes running in the same address space will get the new write-down setting, until the shell (where **writedown** was invoked) exits.
3. **writedown** is a built-in shell command in **sh** and **tcsh**. It affects the security setting for commands issued by the current shell, and by child processes, such as shell scripts.
4. See *z/OS Planning for Multilevel Security and the Common Criteria* for more information about write-down mode, multilevel security, and seclabels.

Exit values

The exit values for **/bin/sh** are as follows:

0 Successful completion

1 Failure due to any of the following:
- SETR MLS is not active
- User does not have at least READ access to IRR.WRITEDOWN.BYUSER resource in the FACILITY class

2 Command syntax error

The exit values for **/bin/tcsh** are as follows:

0 Successful completion

1 Failure due to any of the following:
- SETR MLS is not active
- User does not have at least READ access to IRR.WRITEDOWN.BYUSER resource in the FACILITY class
- Command syntax error

Examples

1. To display your current write-down mode:

```
> writedown -p
inactive
```

2. To activate and display your current write-down mode:

```
> writedown -ap
active
```

Related information

id, **sh**, **tcsh**

---

xlc — Compiler invocation using a customizable configuration file

Invocation commands

The xlc utility provides two basic compiler invocation commands, **xlc** and **xlC** (**xlc++**), along with several other compiler invocation commands to support various C/C++ language levels and compilation environments. In most cases, you would use the **xlc** command to compile C source files and **xlC** (**xlc++**) command to compile C++ source files.

You can however, use other forms of the command if your particular environment requires it. The various compiler invocation commands for C are:

- **xlc**
- **cc**
- **c89**
- **c99**
- **xlc_x**
- **cc_x**
- **c89_x**
- **c99_x**
- **xlc_64**
- **cc_64**
- **c89_64**
- **c99_64**

The various compiler invocation commands for C++ are:

- **xlC** (**xlc++**)
- **cxx**
- **c++**
- **xlC_x** (**xlc++_x**)
- **c++_x**
- **cxx_x**
- **xlC_64** (**xlc++_64**)
- **c++_64**
- **cxx_64**

The two basic compiler invocation commands appear as the first entry of each of these list items. Select an invocation command using the following criteria:

xlc Invokes the compiler for C source files with a default language level of ANSI, the compiler option **-qansialias** to allow type-based aliasing, and the compiler option **-qcpluscmt** to allow C++ style comments (//).

xlC (xlc++)
Invokes the compiler so that source files are compiled as C++ language source code.

Files with .c suffixes, assuming you have not used the **-+** compiler option, are compiled as C language source code with a default language level of ANSI, and compiler option **-qansialias** to allow type-based aliasing.

If any of your source files are C++, you must use this invocation to link with the correct runtime libraries.

cc Invokes the compiler for C source files with a default language level of extended and compiler options **-qnoro** and **-qnoroconst** (to provide placement of string literals or constant values in read/write storage).

Use this invocation for legacy C code that does not require compliance with ANSI C. This invocation is intended to provide the same compiler behavior as when invoked by the **cc** command name of the c89 utility.

c89 Invokes the compiler for C source files, with a default language level of ANSI, and specifies compiler options **-qansialias** (to allow type-based

aliasing) and **-qnolonglong** (disabling use of long long). Use this invocation for strict conformance to the *ISO/IEC 9899:1990* standard. This invocation is intended to provide the same compiler behavior as when invoked by the **c89** command name of the c89 utility.

c99 Invokes the compiler for C source files, with a default language level of STDC99 and specifies compiler option **-qansialias** (to allow type-based aliasing). Use this invocation for strict conformance to the *ISO/IEC 9899:1999* standard.

cxx/c++
The **cxx** and **c++** commands invoke the compiler for C++ language source code. Both are intended to provide the same compiler behavior as when invoked using the **cxx** and **c++** command names of the c89 utility.

You can combine the previously described command names with the following suffixes:

_x Command invocations using command names with suffix _x are the same as invocations using names without suffixes, except the **-qxplink** option is also specified and appropriate XPLINK libraries are used in the link step. If you are building an XPLINK application, you no longer need to use command names with suffix _x to link with the correct runtime libraries. This can be achieved through the new configuration attributes that have been introduced to enable XPLINK behavior without the use of suffixes. See "Configuration file attributes" on page 878 for further information.

_64 Command invocations using command names with suffix _64 are the same as invocations using names without suffixes, except the **-q64** option is also specified and appropriate 64-bit libraries are used in the link step. If you are building a 64-bit application, you no longer need to use command names with suffix _64 to link with the correct runtime libraries. This can be achieved through the new configuration attributes that have been introduced to enable 64-bit behavior without the use of suffixes. See "Configuration file attributes" on page 878 for further information.

Notes:

1. Suffixes are used as a naming convention and do not enforce behavior. The content of the command line will take precedence over the suffixes.
2. When compiling and linking a C++ application using a single command line invocation, the application will be correctly link edited with any stanza if at least one C++ source file is specified on the command line. If only object files or a mix of C sources and C++ object files are specified on the command line, a C++ stanza must be used to correctly link edit the application.

Setting up the compilation environment

Before you compile your C and C++ programs, you must set up the environment variables and the configuration file for your application. For more information on the configuration file, see "Setting up a configuration file" on page 877.

Environment variables

You can use environment variables to specify necessary system information.

Before using the compiler, you must install the message catalogs and set the environment variables:

LANG
Specifies the national language for message and help files.

NLSPATH
Specifies the path name of the message and help files.

The LANG environment variable can be set to any of the locales provided on the system. See the description of locales in *z/OS XL C/C++ Programming Guide* for more information.

The national language code for United States English may be En_US or C. If the Japanese message catalog has been installed on your system, you can substitute Ja_JP for En_US.

To determine the current setting of the national language on your system, see the output from both of the following echo commands:

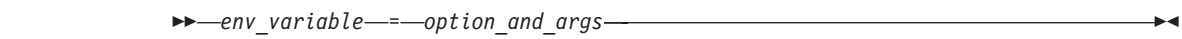
- **echo $LANG**
- **echo $NLSPATH**

The LANG and NLSPATH environment variables are initialized when the operating system is installed, and may differ from the ones you want to use.

Environment variables for OpenMP

If you use OpenMP constructs for parallelization, you can specify runtime options using the OMP environment variables.

OpenMP runtime options affecting parallel processing are set by specifying OMP environment variables. These environment variables use syntax of the form:



If an OMP environment variable is not explicitly set, its default setting is used.

For information about the OpenMP specification, see http://www.openmp.org.

OMP_DYNAMIC

The OMP_DYNAMIC environment variable enables or disables dynamic adjustment of the number of threads available for running parallel regions.

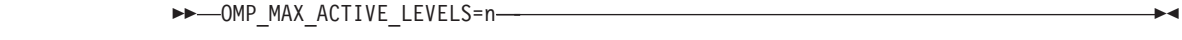
If it is set to TRUE, the number of threads available for executing parallel regions can be adjusted at run time to make the best use of system resources.

If it is set to FALSE, dynamic adjustment is disabled.

The default setting is TRUE.

OMP_MAX_ACTIVE_LEVELS

Use OMP_MAX_ACTIVE_LEVELS to set the *max-active-levels-var* internal control variable. This controls the maximum number of active nested parallel regions. The syntax is as follows:



where *n* is the maximum number of nested active parallel regions. It must be a positive scalar integer. The maximum number that you can specify is 5.

In programs where nested parallelism is disabled, the initial value is 1. In programs where nested parallelism is enabled, the initial value is greater than 1. The function **omp_get_max_active_levels** can be used to retrieve this value at run time.

OMP_NUM_THREADS

The OMP_NUM_THREADS environment variable specifies the number of threads to use for parallel regions.

The syntax of the environment variable is as follows:

num_list
A list of one or more positive integer values separated by commas.

If you do not set OMP_NUM_THREADS, the number of processors available is the default value to form a new team for the first encountered parallel construct. If nested parallelism is disabled, any nested parallel constructs are run by one thread by default.

If *num_list* contains a single value, dynamic adjustment of the number of threads is enabled (**OMP_DYNAMIC** is set to true), and a parallel construct without a **num_threads** clause is encountered, the value is the maximum number of threads that can be used to form a new team for the encountered parallel construct.

If *num_list* contains a single value, dynamic adjustment of the number of threads is not enabled (**OMP_DYNAMIC** is set to false), and a parallel construct without a **num_threads** clause is encountered, the value is the exact number of threads that can be used to form a new team for the encountered parallel construct.

If *num_list* contains multiple values, dynamic adjustment of the number of threads is enabled (**OMP_DYNAMIC** is set to true), and a parallel construct without a **num_threads** clause is encountered, the first value is the maximum number of threads that can be used to form a new team for the encountered parallel construct. After the encountered construct is entered, the first value is removed and the remaining values form a new *num_list*. The new *num_list* is in turn used in the same way for any closely nested parallel constructs inside the encountered parallel construct.

If *num_list* contains multiple values, dynamic adjustment of the number of threads is not enabled (**OMP_DYNAMIC** is set to false), and a parallel construct without a **num_threads** clause is encountered, the first value is the exact number of threads that can be used to form a new team for the encountered parallel construct. After the encountered construct is entered, the first value is removed and the remaining values form a new *num_list*. The new *num_list* is in turn used in the same way for any closely nested parallel constructs inside the encountered parallel construct.

Note: If the number of parallel regions is equal to or greater than the number of values in *num_list*, the **omp_get_max_threads** function returns the last value of *num_list* in the parallel region.

If the number of threads requested exceeds the system resources available, the program stops.

The **omp_set_num_threads** function sets the first value of *num_list*. The **omp_get_max_threads** function returns the first value of *num_list*.

If you specify the number of threads for a given parallel region more than once with different settings, the compiler uses the following precedence order to determine which setting takes effect:

1. The number of threads set using the **num_threads** clause takes precedence over that set using the **omp_set_num_threads** function.
2. The number of threads set using the **omp_set_num_threads** function takes precedence over that set using the OMP_NUM_THREADS environment variable.

See the following example:

```
export OMP_NUM_THREADS=3,4,5
export OMP_DYNAMIC=false

// omp_get_max_threads() returns 3

#pragma omp parallel
{
// Three threads running the parallel region
// omp_get_max_threads() returns 4

  #pragma omp parallel if(0)
  {
  // One thread running the parallel region
  // omp_get_max_threads() returns 5

    #pragma omp parallel
    {
    // Five threads running the parallel region
    // omp_get_max_threads() returns 5
    }
  }
}
```

OMP_PROC_BIND

The OMP_PROC_BIND environment variable controls whether OpenMP threads can be moved between processors. The syntax is as follows:

By default, the OMP_PROC_BIND environment variable is not set. If you set OMP_PROC_BIND to TRUE, the threads are bound to processors. If you set OMP_PROC_BIND to FALSE, the threads may be moved between processors.

Note: The OMP_PROC_BIND environment variable provides a portable way to control whether OpenMP threads can be migrated.

OMP_SCHEDULE

The OMP_SCHEDULE environment variable specifies the scheduling algorithm used for loops with the **omp schedule(runtime)** clause.

For example:

```
OMP_SCHEDULE="guided, 4"
```

Valid options for *algorithm* are:

- auto
- dynamic[, *n*]
- guided[, *n*]
- runtime
- static[, *n*]

If specifying a chunk size with *n*, the value of *n* must be a positive integer.

The default scheduling algorithm is **auto**.

OMP_STACKSIZE

The OMP_STACKSIZE environment variable indicates the stack size of threads created by the OpenMP run time. OMP_STACKSIZE sets the value of the *stacksize-var* internal control variable. OMP_STACKSIZE does not control the stack size of the master thread. The syntax is as follows:

By default, the size value is represented in Kilobytes. You can also use the suffixes B, K, M, or G if you want to indicate the size in Bytes, Kilobytes, Megabytes, or Gigabytes respectively. White space is allowed between and around the size value and the suffix. For example, the following examples both indicate a stack size of 10 Megabytes.

```
setenv OMP_STACKSIZE 10M
setenv OMP_STACKSIZE " 10 M "
```

If OMP_STACKSIZE is not set, the initial value of the *stacksize-var* internal control variable is set to the default value. The default value for 32-bit mode is 256M. For 64-bit mode, the default is up to the limit imposed by system resources.

If the compiler cannot use the stack size specified or if OMP_STACKSIZE does not conform to the correct format, the compiler sets the environment variable to the default value.

OMP_THREAD_LIMIT

The OMP_THREAD_LIMIT environment variable sets the number of OpenMP threads to use for the whole program. The syntax is as follows:

n The number of OpenMP threads to use for the whole program. It must be a positive scalar integer.

The value for OMP_THREAD_LIMIT is a positive integer. When nested parallelism is enabled, the value you specify for OMP_THREAD_LIMIT can affect the behavior of a parallel region. For example, if the value of OMP_THREAD_LIMIT is much

smaller than the number of threads required in the program, say OMP_THREAD_LIMIT=1, the parallel region is run sequentially rather than in parallel.

If the OMP_THREAD_LIMIT environment variable is not set and the OMP_NUM_THREADS environment variable is set to a single value, the default value for OMP_THREAD_LIMIT is the value of OMP_NUM_THREADS or the number of available processors, whichever is greater.

If the OMP_THREAD_LIMIT environment variable is not set and the OMP_NUM_THREADS environment variable is set to a list, the default value for OMP_THREAD_LIMIT is the multiplication of all the numbers in the list or the number of available processors, whichever is greater.

If the OMP_THREAD_LIMIT and OMP_NUM_THREADS environment variables are both not set, the default value for OMP_THREAD_LIMIT is the number of available processors.

OMP_WAIT_POLICY

The OMP_WAIT_POLICY environment variable gives hints to the compiler about the preferred behavior of waiting threads during program run time. The OMP_WAIT_POLICY environment variable sets the *wait-policy-var* internal control variable value.

The syntax is as follows:

The default value for OMP_WAIT_POLICY is PASSIVE.

Use ACTIVE if you want waiting threads to be mostly active. With ACTIVE, the thread consumes processor cycles while waiting, if possible.

Use PASSIVE if you want waiting threads to be mostly passive. That is, the preference is for the thread to not consume processor cycles while waiting. For example, you prefer waiting threads to sleep or to yield the processor to other threads.

Setting up a configuration file

The configuration file specifies information that the compiler uses when you invoke it. This file defines values used by the compiler to compile C or C++ programs. You can make entries to this file to support specific compilation requirements or to support other C or C++ compilation environments.

A configuration file is a UNIX file consisting of named sections called stanzas. Each stanza contains keywords called configuration file attributes, which are assigned values. The attributes are separated from their assigned value by an equal sign. A stanza can point to a default stanza by specifying the "use" keyword. This allows specifying common attributes in a default stanza and only the deltas in a specific stanza, referred to as the local stanza.

For any of the supported attributes not found in the configuration file, the xlc utility uses the built-in defaults. It uses the first occurrence in the configuration file of a stanza or attribute it is looking for. Unsupported attributes, and duplicate stanzas and attributes are not diagnosed.

Note:

1. The difference between specifying values in the stanza and relying on the defaults provided by the xlc utility is that the defaults provided by the xlc utility will not override pragmas.
2. Any entry in the configuration file must occur on a single line. You cannot continue an entry over multiple lines.

Configuration file attributes

A stanza in the configuration file can contain the following attributes:

acceptable_rc
Enables you to specify a number that represents a return code value for a program invoked by the xlc utility. The xlc utility does not place any restriction on the value assigned to the `acceptable_rc` attribute. `acceptable_rc` can appear as part of any stanza in the configuration file.

Note: If the `acceptable_rc` attribute is not specified in the configuration file, the xlc utility will assign the value from a c89 *prefix*_ACCEPTABLE_RC environment variable, if it is exported, to the `acceptable_rc`, otherwise it will default to 4. The command name used to invoke the xlc utility determines the prefix that the xlc utility will use when looking for a *prefix*_ACCEPTABLE_RC environment variable. For example, if the xlc utility is invoked using the **`xlC`** command name, the xlc utility will look for _CXX_ACCEPTABLE_RC and, if found, use it. If the `acceptable_rc` attribute is specified in the configuration file, the xlc utility will use the value specified in the configuration file and will ignore an exported *prefix*_ACCEPTABLE_RC environment variable.

as Path name to be used for the assembler. The default is /bin/c89.

asopt The list of options for the assembler and not for the compiler. These override all normal processing by the compiler and are directed to the assembler specified in the `as` attribute. Options are specified following the c89 utility syntax.

asuffix
The suffix for archive files. The default is `a`.

asuffix_host
The suffix for archive data sets. The default is LIB.

ccomp The C compiler. The default is usr/lpp/cbclib/xlc/exe/ccndrvr.

cinc A comma separated list of directories or data set wild cards used to search for C header files. The default for this attribute is: -I//'CEE.SCEEH.+'. For further information on the list of search places used by the compiler to search for system header files, see the note at the end of this list of configuration file attributes.

classversion
The USL class library version. The default matches the current release, as described in the TARGET compiler option description in *z/OS XL C/C++ User's Guide*.

cppcomp
The C++ compiler. The default is /usr/lpp/cbclib/xlc/exe/ccndrvr.

cppinc
A comma separated list of directories or data set wild cards used to search for C++ header files. The default for this attribute is: -I//'CEE.SCEEH.+',-I//'CBC.SCLBH.+'.For further information on the list of search places used by the compiler to search for system header files, see the note at the end of this list of configuration file attributes.

csuffix
The suffix for source programs. The default is `c` (lowercase c).

csuffix_host
The suffix for C source data sets. The default is `C` (uppercase C).

cversion
The compiler version. The default matches the current release, as described in the TARGET compiler option description in *z/OS XL C/C++ User's Guide*. The oldest release supported is z/OS V1R6.

cxxsuffix
The suffix for C++ source files. The default is `C` (uppercase C).

cxxsuffix_host
The suffix for C++ source data sets. The default is CXX.

exportlist
A colon separated list of data sets with member names indicating definition side-decks to be used to resolve symbols during the link-editing phase. This attribute is only used for compatibility with configuration files that are defined using the z/OS V1R6 release. Attributes with an appropriate suffix should be used instead (see descriptions for `exportlist` attributes with a suffix). The default for this attribute should match the type of stanza for which it is specified.

Suffix-less C stanzas do not have a default.

The default for suffix-less C++ stanzas is:

```
CEE.SCEELIB(C128N):CBC.SCLBSID(IOSTREAM,COMPLEX)
```

The default for C stanzas with an `_x` suffix is:

```
CEE.SCEELIB(CELHS003,CELHS001)
```

The default for C++ stanzas with an `_x` suffix is:

```
CEE.SCEELIB(CELHS003,CELHSCPP,CELHS001,C128):CBC.SCLBSID
(IOSTREAM,COMPLEX)
```

The default for C stanzas with a `_64` suffix is:

```
CEE.SCEELIB(CELQS003)
```

The default for C++ stanzas with a `_64` suffix is:

```
CEE.SCEELIB(CELQS003,CELQSCPP,C64):CBC.SCLBSID(IOSQ64)
```

exportlist_c
A colon separated list of data sets with member names indicating definition side-decks to be used to resolve symbols during the link-editing phase of non-XPLINK C applications. The default for this attribute is NONE.

exportlist_cpp
A colon separated list of data sets with member names indicating

definition side-decks to be used to resolve symbols during the link-editing phase of non-XPLINK C++ applications. The default for this attribute is:

```
CEE.SCEELIB(C128n):CBC.SCLBSID(IOSTREAM,COMPLEX)
```

exportlist_c_x
A colon separated list of data sets with member names indicating definition side-decks to be used to resolve symbols during the link-editing phase of XPLINK C applications. The default for this attribute is:

```
CEE.SCEELIB(CELHS003,CELHS001)
```

exportlist_cpp_x
A colon separated list of data sets with member names indicating definition side-decks to be used to resolve symbols during the link-editing phase of XPLINK C++ applications. The default for this attribute is:

```
CEE.SCEELIB(CELHS003,CELHSCPP,CELHS001,C128):CBC.SCLBSID
(IOSTREAM,COMPLEX)
```

exportlist_c_64
A colon separated list of data sets with member names indicating definition side-decks to be used to resolve symbols during the link-editing phase of 64-bit C applications. The default for this attribute is:

```
CEE.SCEELIB(CELQS003)
```

exportlist_cpp_64
A colon separated list of data sets with member names indicating definition side-decks to be used to resolve symbols during the link-editing phase of 64-bit C++ applications. The default for this attribute is:

```
CEE.SCEELIB(CELQS003,CELQSCPP,C64):CBC.SCLBSID(IOSQ64)
```

isuffix The suffix for C preprocessed files. The default is `i`.

isuffix_host
The suffix for C preprocessed data sets. The default is CEX.

ilsuffix
The suffix for IPA output files. The default is `I`.

ilsuffix_host
The suffix for IPA output data sets. The default is IPA.

ixxsuffix
The suffix for C++ preprocessed files. The default is `i`.

ixxsuffix_host
The suffix for C++ preprocessed data sets. The default is CEX.

ld The path name to be used for the binder. The default is /bin/c89.

ld_c The path name to be used for the binder when only C sources appear on the command line invoked with a C stanza. The default is: /bin/c89.

ld_cpp
The path name to be used for the binder when at least one C++ source appears on the command line, or when a C++ stanza is used. The default is: /bin/cxx.

libraries
`libraries` specifies the default libraries that the binder is to use at bind time. The libraries are specified using the **-l***libname* syntax, with multiple library specifications separated by commas. The default is empty.

libraries2
`libraries2` specifies additional libraries that the binder is to use at bind

time. The libraries are specified using the **-l***libname* syntax, with multiple library specifications separated by commas. The default is empty.

options
A string of option flags, separated by commas, to be processed by the compiler as if they had been entered on the command line.

osuffix
The suffix for object files. The default is `.o`.

osuffix_host
The suffix for object data sets. The default is OBJ.

psuffix
The suffix for prelinked files. The default is `p`.

psuffix_host
The suffix for prelinked data sets. The default is CPOBJ.

pversion
The runtime library version. The default matches the current release, as described in the TARGET compiler option description in *z/OS XL C/C++ User's Guide*.

ssuffix
The suffix for assembler files. The default is `.s`.

ssuffix_host
The suffix for assembler data sets. The default is ASM.

steplib
A colon separated list of data sets or keyword NONE used to set the STEPLIB environment variable. The default is NONE, which causes all programs to be loaded from LPA or linklist.

syslib A colon separated list of data sets used to resolve runtime library references. Data sets from this list are used to construct the SYSLIB DD for the IPA Link and the binder invocation for non-XPLINK applications. For compatibility with configuration files defined using the z/OS V1R6 release, this attribute is also used with XPLINK applications as a fallback when the `syslib_x` attribute is not specified. When the `syslib_x` attribute is not specified, the default for this attribute should match the type of stanza for which it is specified. When the `syslib_x` attribute is specified, the default for this attribute matches the default for suffix-less stanzas.

The default for suffix-less stanzas is:

```
CEE.SCEELKEX:CEE.SCEELKED:CBC.SCCNOBJ:SYS1.CSSLIB
```

The default for stanzas with `_x` and `_64` suffixes is:

```
CEE.SCEEBND2:CBC.SCCNOBJ:SYS1.CSSLIB
```

syslib_x
A colon separated list of data sets used to resolve runtime library references. Data sets from this list are used to construct the SYSLIB DD for the IPA Link and the binder invocation when building XPLINK applications (31-bit and 64-bit).

The default for this attribute is:

```
CEE.SCEEBND2:CBC.SCCNOBJ:SYS1.CSSLIB
```

sysobj A colon separated list of data sets containing object files used to resolve runtime library references. Data sets from this list are used to construct the

LIBRARY control statements and the SYSLIB DD for the IPA Link and the binder invocation. This attribute is ignored for XPLINK and 64-bit applications.

The default is:

```
CEE.SCEEOBJ:CEE.SCEECPP
```

use Values for attributes are taken from the named stanza and from the local stanza. For single-valued attributes, values in the use stanza apply if no value is provided in the local, or default stanza. For comma-separated lists, the values from the use stanza are added to the values from the local stanza.

usuffix
The suffix for make dependency file names. The default make dependency file name suffix is ".u", but it is overwritten by the value assigned to this attribute.

There is no host version of this attribute, because make dependency feature only applies to z/OS UNIX files.

xlC The path name of the C++ compiler invocation command. The default is /usr/lpp/cbclib/xlc/bin/xlc.

xlCcopt
A string of option flags, separated by commas, to be processed when the **xlc** command is used for compiling a C file.

xsuffix
The suffix for definition side-deck files. The default is x.

xsuffix_host
The suffix for definition side-deck data sets. The default is EXP.

Note: When using the xlc utility to invoke the compiler, the compiler uses the following list of search places to search for system header files:

- If the **-qnosearch** option is not specified on the command line or in the configuration file:
  1. search places defined in the customizable defaults module (CCNEDFLT)
  2. followed by those specified on the command line using the -I flag option
  3. followed by those specified in the configuration file
- If the **-qnosearch** is specified only in the configuration file:
  1. search places specified on the command line using the -I flag option
  2. followed by those specified in the configuration file
- If the **-qnosearch** option is specified on the command line:
  1. search places specified on the command line following the last specified **-qnosearch** option
  2. followed by those specified in the configuration file

Tailoring a configuration file

The default configuration file is installed in /usr/lpp/cbclib/xlc/etc/xlc.cfg.

You can copy this file and make changes to the copy to support specific compilation requirements or to support other C or C++ compilation environments. The -F option is used to specify a configuration file other than the default. For example, to make **-qnoro** the default for the **xlC** compiler invocation command, add **-qnoro** to the **xlC** stanza in your copied version of the configuration file.

You can link the compiler invocation command to several different names. The name you specify when you invoke the compiler determines which stanza of the configuration file the compiler uses. You can add other stanzas to your copy of the configuration file to customize your own compilation environment.

Only one stanza, in addition to the one referenced by the "use" attribute, is processed for any one invocation of the xlc utility. By default, the stanza that matches the command name used to invoke the xlc utility is used, but it can be overridden using the -F flag option as described in the example below.

Example: You can use the -F option with the compiler invocation command to make links to select additional stanzas or to specify a stanza or another configuration file:

```
xlC myfile.C -Fmyconfig:SPECIAL
```

would compile `myfile.C` using the `SPECIAL` stanza in a `myconfig` configuration file that you had created.

Default configuration file

The default configuration file, (/usr/lpp/cbclib/xlc/etc/xlc.cfg.), specifies information that the compiler uses when you invoke it. This file defines values used by the compiler to compile C or C++ programs. You can make entries to this file to support specific compilation requirements or to support other C or C++ compilation environments. Options specified in the configuration file override the default settings of the option. Similarly, options specified in the configuration file are in turn overridden by options set in the source file and on the command line. Options that do not follow this scheme are listed in “Specifying compiler options” on page 892.

Example: The following example shows a default configuration file:

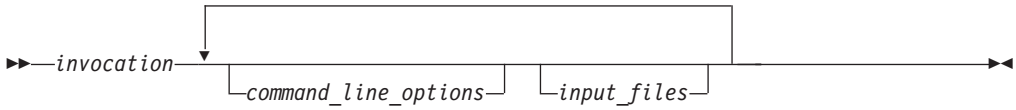
```
*
* FUNCTION: z/OS 2.1.1 XL C/C++ Compiler Configuration file
*
* Licensed Materials - Property of IBM
* 5650-ZOS Copyright IBM Corp. 2004, 2014
* US Government Users Restricted Rights - Use, duplication or
* disclosure restricted by GSA ADP Schedule Contract with IBM Corp.
*
* C compiler, extended mode
xlc:      use               = DEFLT

* XPLINK C compiler, extended mode
xlc_x:    use               = DEFLT

* 64 bit C compiler, extended mode
xlc_64:   use               = DEFLT

* C compiler, common usage C
cc:       use               = DEFLT

* XPLINK C compiler, common usage C
cc_x:     use               = DEFLT

* 64 bit C compiler, common usage C
cc_64:    use               = DEFLT

* Strict ANSI C 89 compiler
c89:      use               = DEFLT

* XPLINK Strict ANSI C 89 compiler
c89_x:    use               = DEFLT
```

```
* 64 bit Strict ANSI C 89 compiler
c89_64:   use               = DEFLT

* ISO/IEC 9899:1999 Standard Compliant C Compiler
c99:      use               = DEFLT

* XPLINK ISO/IEC 9899:1999 Standard Compliant C Compiler
c99_x:    use               = DEFLT

* 64 bit ISO/IEC 9899:1999 Standard Compliant C Compiler
c99_64:   use               = DEFLT

* ANSI C++ compiler
cxx:      use               = DEFLT
          xlC               = /usr/lpp/cbclib/xlc/bin/.orig/xlC
          ipa               = /bin/cxx

* XPLINK ANSI C++ compiler
cxx_x:    use               = DEFLT
          xlC               = /usr/lpp/cbclib/xlc/bin/.orig/xlC
          ipa               = /bin/cxx

* 64 bit ANSI C++ compiler
cxx_64:   use               = DEFLT
          xlC               = /usr/lpp/cbclib/xlc/bin/.orig/xlC
          ipa               = /bin/cxx

* ANSI C++ compiler
c++:      use               = DEFLT
          xlC               = /usr/lpp/cbclib/xlc/bin/.orig/xlC
          ipa               = /bin/cxx

* XPLINK ANSI C++ compiler
c++_x:    use               = DEFLT
          xlC               = /usr/lpp/cbclib/xlc/bin/.orig/xlC
          ipa               = /bin/cxx

* 64 bit ANSI C++ compiler
c++_64:   use               = DEFLT
          xlC               = /usr/lpp/cbclib/xlc/bin/.orig/xlC
          ipa               = /bin/cxx

* C++ compiler, extended mode
xlC:      use               = DEFLT
          xlC               = /usr/lpp/cbclib/xlc/bin/.orig/xlC
          ipa               = /bin/cxx

* XPLINK C++ compiler, extended mode
xlC_x:    use               = DEFLT
          xlC               = /usr/lpp/cbclib/xlc/bin/.orig/xlC
          ipa               = /bin/cxx

* 64 bit C++ compiler, extended mode
xlC_64:   use               = DEFLT
          xlC               = /usr/lpp/cbclib/xlc/bin/.orig/xlC
          ipa               = /bin/cxx

* C++ compiler, extended mode
xlc++:    use               = DEFLT
          xlC               = /usr/lpp/cbclib/xlc/bin/.orig/xlC
          ipa               = /bin/cxx

* XPLINK C++ compiler, extended mode
xlc++_x:  use               = DEFLT
          xlC               = /usr/lpp/cbclib/xlc/bin/.orig/xlC
          ipa               = /bin/cxx
```

```
* 64 bit C++ compiler, extended mode
xlc++_64: use               = DEFLT
          xlC               = /usr/lpp/cbclib/xlc/bin/.orig/xlC
          ipa               = /bin/cxx

* common definitions
DEFLT:    cppcomp           = /usr/lpp/cbclib/xlc/exe/ccndrvr
          ccomp             = /usr/lpp/cbclib/xlc/exe/ccndrvr
          ipacomp           = /usr/lpp/cbclib/xlc/exe/ccndrvr
          ipa               = /bin/c89
          as                = /bin/c89
          ld_c              = /bin/c89
          ld_cpp            = /bin/cxx
          xlC               = /usr/lpp/cbclib/xlc/bin/xlc
          xlCcopt           = -D_XOPEN_SOURCE
          sysobj            = cee.sceeobj:cee.sceecpp
          syslib            = cee.sceelkex:cee.sceelked:cbc.sccnobj:sys1.csslib
          syslib_x          = cee.sceebnd2:cbc.sccnobj:sys1.csslib
          exportlist_c      = NONE
          exportlist_cpp    = cee.sceelib(c128n):cbc.sclbsid(iostream,complex)
          exportlist_c_x    = cee.sceelib(celhs003,celhs001)
          exportlist_cpp_x  = cee.sceelib(celhs003,celhs001,celhscpp,c128):
cbc.sclbsid(iostream,complex)
          exportlist_c_64   = cee.sceelib(celqs003)
          exportlist_cpp_64 = cee.sceelib(celqs003,celqscpp,c64):cbc.sclbsid(iosx64)
          steplib           = NONE
```

Invoking the compiler

The z/OS XL C/C++ compiler is invoked using the following syntax, where *invocation* can be replaced with any valid z/OS XL C/C++ invocation command:



The parameters of the compiler invocation command can be names of input files, compiler options, and linkage-editor options. Compiler options perform a wide variety of functions such as setting compiler characteristics, describing object code and compiler output to be produced, and performing some preprocessor functions.

To compile without binding, use the **-c** compiler option. The **-c** option stops the compiler after compilation is completed and produces as output, an object file `file_name.o` for each `file_name.c` input source file, unless the **-o** option was used to specify a different object filename. The binder is not invoked. You can bind the object files later using the invocation command, specifying the object files without the **-c** option.

Note:

1. Any object files produced from an earlier compilation with the same name as expected object files in this compilation are deleted as part of the compilation process, even if new object files are not produced.
2. By default, the invocation command calls both the compiler and the binder. It passes binder options to the binder. Consequently, the invocation commands also accept all binder options.

Invoking the binder

All invocation commands invoke the binder using the c89 utility, so all binder options must follow the syntax supported by the c89 utility. Standard libraries required to bind your program are controlled by the `sysobj`, `syslib`, and `exportlist` attributes in the configuration file.

The specified object files are processed by the binder to create one executable file. Invoking the compiler with one of the invocation commands, automatically calls the binder unless you specify one of the following compiler options: -E, **-c**, -P, **-qsyntaxonly**, **-qpponly**, or **-#**.

All input and output files supported by the c89 utility are valid for all invocation commands.

Supported options

In addition to -W syntax for specifying keyword options, the xlc utility supports AIX **-q** options syntax and several new flag options.

–q options syntax

The following principles apply to the use of z/OS option names with **-q** syntax:

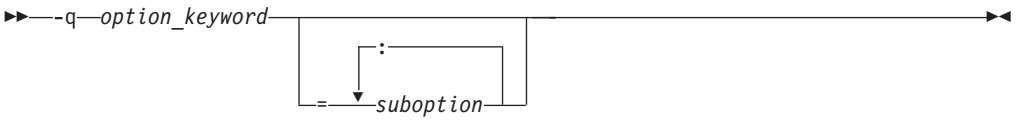
- Any valid abbreviation of a z/OS option name that matches (in full or in part) the spelling of the corresponding option on AIX, can be specified using **-q** syntax. For example, ATTRIBUTE can be specified as **-qatt**, **-qattr**, **-qattri**, **-qattrib**, **-qattribu**, **-qattribut**, and **-qattribute**. This is true even if the AIX option name is longer, as in the case of **-qbitfields**, which can be specified as **-qbitf**, **-qbitfi**, **-qbitfie**, **-qbitfiel**, **-qbitfield**, and **-qbitfields**. This is the common case that applies to most z/OS options except any suboptions.
- Any z/OS-specific option name and its valid abbreviation can also be specified using **-q** syntax; for example, DBRMLIB.
- Any z/OS option name that has a different spelling from the corresponding AIX option name can not be specified using **-q** syntax. For example, CHECKOUT, EXH, ILP32, LP64, SSCOMM, and TEST can not be specified using **-q** syntax. Instead use, **-qinfo**, **-qeh**, **-q32**, **-q64**, **-qcpluscmt**, and **-qdebug=format=isd**. For historical reasons, OBJECTMODEL and PHASEID are exceptions to this principle, as both can be specified using **-q** syntax. However, **-qobjmodel** and **-qphsinfo** should be used instead to enhance portability with AIX.

Options that do not exist on AIX, and are not required to accomplish a z/OS-specific task, and their effect can be accomplished by other means, are not supported with **-q** syntax. For example, use -D instead of DEFINE, -U instead of UNDEFINE, and **-co** instead of OBJECT.

Suboptions with negative forms of **-q** options are not supported, unless they cause an active compiler action, as in the case of **-qnokeyword=<keyword>**.

Compiler options for AIX that do not apply to z/OS are accepted and ignored with a diagnostic message. For a brief description of the compiler options that can be specified with xlc, type **xlc** or any other supported command name. For detailed descriptions of the compiler options that can be specified with xlc, refer to *z/OS XL C/C++ User's Guide*.

The following syntax diagram shows how to specify keyword options using **-q** syntax:



In the diagram, *option_keyword* is an option name and the optional *suboption* is a value associated with the option. Keyword options with no suboptions represent switches that may be either on or off. The *option_keyword* by itself turns the switch on, and the *option_keyword* preceded by the letters NO turns the switch off. For example, **-qLIST** tells the compiler to produce a listing and **-qNOLIST** tells the compiler not to produce a listing. If an option that represents a switch is set more than once, the compiler uses the last setting.

Some keyword options only have values. Keywords which have values are specified as `keyword=value` pairs. In `-qfloat=ieee`, for instance, `ieee` is a value.

Some keyword options have suboptions, which in turn have values. Suboptions which have values are specified as `suboption=value` pairs. In `-qipa=level=2`, for instance, `level` is a suboption and `2` is a value.

Keyword options and suboptions may appear in mixed case letters in the command that invokes the xlc utility. Keyword options that have suboptions can also be preceded by the letters NO in which case they are similar to off switches and do not allow suboptions. This is a noticeable departure from the z/OS options, which allow suboptions even if they are preceded by the letters NO. However, the function that the z/OS behavior provides can easily be emulated by specifying all desired suboptions with an *option_keyword* followed by the same *option_keyword* that is preceded by the letters NO. The subsequent specification of the same *option_keyword* unlocks all previously specified suboptions.

Example: NODEBUG(FORMAT(DWARF)) is equivalent to **-qdebug=format=dwarf -qnodebug**

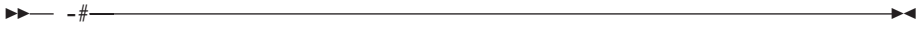
The compiler recognizes all AIX **-q** options, but only those that have a matching z/OS native option are accepted and processed. All other AIX **-q** options are ignored with an informational message.

Note: The GENASM compiler option is not supported with **-q** syntax. Use the -S flag option instead, which is described in "Flag options syntax."

Flag options syntax

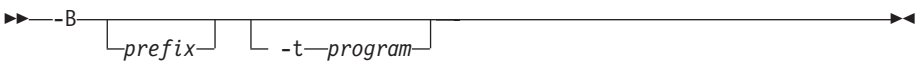
Except for the -W, -D, and -U flag options, all flag options that are supported by the c89 utility are supported by the xlc utility with the same semantics. The xlc utility does not recognize constructs such as **-Wl,I** or **-Wl,p**. All other aspects of the -W flag are the same as with the c89 utility. -D and -U flag options are not preprocessed by the xlc utility. Instead, they are converted to the DEFINE and UNDEFINE native options and are passed to the compiler. The xlc utility also supports several additional flag options, which are described below:

-# Displays language processing commands but does not invoke them; output goes to stdout.



-B Determines substitute path names for programs such as the assembler and binder, where program can be:

- `a` (assembler)
- `c` (z/OS XL C/C++ compiler)
- `l` (binder)
- `L` (IPA Link)



Note:

1. The optional prefix defines part of a path name to the new programs. The compiler does not add a / between the prefix and the program name.
2. To form the complete path name for each program, the xlc utility adds prefix to the program names indicated by the **-t** option. The program names can be any combination of z/OS XL C/C++ compiler, assembler, IPA Link and binder.
3. If **-Bprefix** is not specified, or if -B is specified without the prefix, the default path (/usr/lpp/cbclib/xlc/bin/) is used.
4. **-tprograms** specifies the programs for which the path name indicated by the -B option is to be applied.
5. **-Bprefix** and **-tprograms** options override the path names of the programs that are specified inside the configuration file indicated by the **-Fconfig_file** option.

   Example: To compile `myprogram.c` using a substitute compiler and binder from `/lib/tmp/mine/`, enter:

   ```
   xlc myprogram.c -B/lib/tmp/mine/
   ```

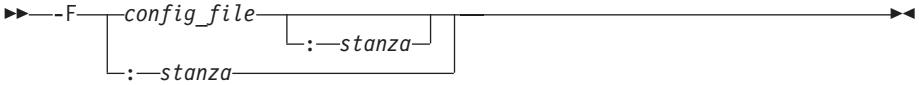
   Example: To compile `myprogram.c` using a substitute binder from `/lib/tmp/mine/`, enter:

   ```
   xlc myprogram.c -B/lib/tmp/mine/ -tl
   ```

-F Names an alternative configuration file (.cfg) for the xlc utility.

Suboptions are:

- *config_file* (specifies the name of an xlc configuration file.)
- *stanza* (specifies the name of the command used to invoke the compiler. This directs the compiler to use the entries under *stanza* in the *config_file* to set up the compiler environment.)



Note:

1. The default configuration file supplied at installation time is called /usr/lpp/cbclib/xlc/etc/xlc.cfg. Any file names or stanzas that you specify on the command line override the defaults specified in the /usr/lpp/cbclib/xlc/etc/xlc.cfg configuration file.
2. The -B, **-t**, and -W options override entries in the configuration file indicated by the -F option.

Example: To compile `myprogram.c` using a configuration file called `/usr/tmp/mycbc.cfg`, enter:

```
xlc myprogram.c -F/usr/tmp/mycbc.cfg
```

-M Instructs the compiler to generate a dependency file or dependency files that can be used by the make utility. By default, the dependency file name and path is the same as the -o compile option but with `.u` suffix. Dependency file name can be overridden by the **-MF** option. The default suffix can be modified through "usuffix" configuration file attribute.

The compiler will generate as many dependency files as there are source files specified.

-M is the equivalent of specifying **-qmakedep**.

Example: To compile `myprogram.c` and create an output file named `myprogram.u`, enter:

```
xlc -c -M myprogram.c
```

Example: The following is a simple makefile that uses **-M** feature. You can refer to *z/OS UNIX System Services Programming Tools* for more information about the make utility and makefiles.

```
CFLAGS = -M -qLSE=lib1 -qfloat=ieee

all: program

# Compile recipe;  will also regenerate dependencies, used on the
next compile %.o: %.c
 xlc -c $(CFLAGS) $^

program: file1.o file2.o
 xlc $(CFLAGS) -o program $&

#This line will include the generated file1.u and file2.u only
if they exist .INCLUDE .IGNORE : file1.u file2.u
```

-MF If **-M** or **-qmakedep** is specified, this option is used to override the file path name of the dependency file.

In the syntax, *file* can be either a file name or a directory. If a directory is specified, the default dependency file name is used (as per the **-M** option) and placed in this directory. The directory must exist. If a relative file name is specified, it is relative to the current working directory.

Note:

1. The argument of *file* can not be the name of a dataset.
2. If the file specified by **-MF** already exists, it will be overwritten. Moreover, if the output path specified does not exist or is write-protected, an error message will be issued.
3. If you specify a single file name for the **-MF** option when compiling multiple source files, each generated dependency file overwrites the previous one. Only a single output file will be generated for the last source file specified on the command line.

Example: You can refer to the following table for detail usage of **-M** and **-MF**:

Table 36. Example of using -M and -MF

Description	Command	Dependency File
-MF is not specified	`xlc -c -M t.c`	./t.u is generated
	`xlc -M -c -o obj.o t.c`	./obj.u is generated
	`xlc -c -M -o dir/ t.c`	./dir/t.u is generated if ./dir is writable
-MF specifies a file	`xlc -c -qmakedep -MF dep.u t.c`	./dep.u is generated
	`xlc -c -o obj.o -M -MF ../dep.x t.c`	../dep.x is generated
	`xlc -c -M -MF dir/dep.d a.c b.c`	./dir/dep.d is generated for b.c **only**.
-MF specifies a directory	`xlc -c -M -MF dir/ a.c b.c`	./dir/a.u and ./dir/b.u are generated for a.c and b.c respectively if ./dir/ is writable

-O Optimizes generated code.

-O2 Same as -O.

-O3 Performs memory and compile-time intensive optimizations in addition to those executed with -O2. The -O3 specific optimizations have the potential to alter the semantics of a user's program. The compiler guards against these optimizations at -O2 and the option **-qstrict** is provided at -O3 to turn off these aggressive optimizations.

-O4 Equivalent to -O3 **-qipa** and **-qhot**.

-O5 Equivalent to -O3 **-qipa=level=2** and **-qhot**.

-P Produces preprocessed output in a file that has a suffix that is defined by `isuffix`, `isuffix_host`, `ixxsuffix`, and `ixxsuffix_host`. The default for host files is `.CEX` and for z/OS UNIX files is `.i`.

As with the -E option, the -C option can be combined with the -P option to preserve the comments.

-S

Produces an assembler source file for C source that is compiled with the METAL compiler option. The **-o** option can be used to override the default file name produced by -S. The default file name is the C source file name with the suffix determined by the `ssuffix` and `ssuffix_host` attributes in the configuration file.

When you specify the -o option, the assembler source file name is based on the name specified with the option. For example, when you specify `xlc -S -qmetal -c -o foo.x hello.c`, the output assembler source file name is `foo.x`. The following specifications have the same result:

```
xlc -S -qmetal hello.c
xlc -S -qmetal -o hello.s hello.c
xlc -S -qmetal -c hello.c
xlc -S -qmetal -c -o hello.s hello.c
```

-t Adds the prefix specified by the -B option to the designated programs, where programs are:

- `a` (assembler)
- `c` (z/OS XL C/C++ compiler)
- `L` (Interprocedural Analysis tool - link phase)
- `l` (binder)

Note: This option must be used together with the -B option.

If -B is specified but the prefix is not, the default prefix is /usr/lpp/cbclib/xlc/bin/. If **-Bprefix** is not specified at all, the prefix of the standard program names is /usr/lib/cbclib/xlc/bin/.

If -B is specified but **-tprograms** is not, the default is to construct path names for all of the standard program names: `a`, `c`, `L`, and `l`.

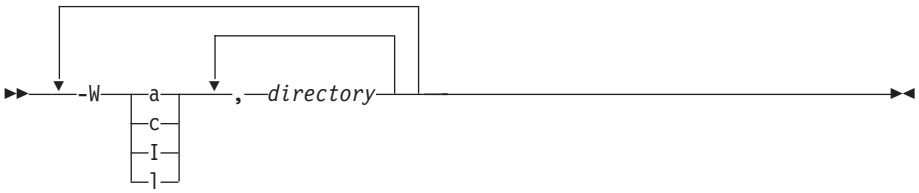
Example: To compile `myprogram.c` so that the name `/u/new/compilers/` is prefixed to the binder and assembler program names, enter:

```
xlc myprogram.c -B/u/new/compilers/ -tla
```

-W Passes the listed options to a designated compiler program where programs are:

- `a` (assembler)
- `c` (z/OS XL C/C++ compiler)
- `I` (Interprocedural Analysis tool - compile phase)
- `l` (binder)

Note: When used in the configuration file, the -W option requires the escape sequence back slash comma (\,) to represent a comma in the parameter string.



Example: To compile myprogram.s so that the option **map** is passed to the binder and the option list is passed to the assembler, enter:

```
xlc myprogram.s -Wl,map -Wa,list
```

Example: In a configuration file, use the **\,** sequence to represent the comma (,):

```
-Wl\,map,-Wa\,list
```

Specifying compiler options

Compiler options perform a wide variety of functions, such as setting compiler characteristics, describing the object code and compiler output to be produced, and performing some preprocessor functions. You can specify compiler options in one or more of the following ways:

- On the command line
- In your source program
- In a configuration file

The compiler uses default settings for the compiler options not explicitly set by you in these listed ways. The defaults can be compiler defaults, installation defaults, or the defaults set by the c89 utility or the xlc utility. The compiler defaults are overridden by installation defaults, which are overridden by the defaults set by the c89 utility or the xlc utility.

When specifying compiler options, it is possible for option conflicts and incompatibilities to occur. z/OS XL C/C++ resolves most of these conflicts and incompatibilities in a consistent fashion, as follows:

```
Source  overrides    Command   overrides   Configuration    overrides   Default
 file  ----------->   line    ---------->      file        -----------> settings
```

Options that do not follow this scheme are summarized in the following table:

Table 37. Compiler option conflict resolution

Option	Conflicting Options	Resolution
-qxref	-qxref=FULL	-qxref=FULL
-qattr	-qattr=FULL	-qattr=FULL
-E	-o	-E
-#	-v	-#
-F	-B | -t |-W | -qpath| *configuration file settings*	-B| -t | -W |-qpath
-qpath	-B| -t	-qpath overrides -B and -t

In general, if more than one variation of the same option is specified (with the exception of xref and attr), the compiler uses the setting of the last one specified. Compiler options specified on the command line must appear in the order you want the compiler to process them.

If a command-line flag is valid for more than one compiler program (for example -B, -W, or -I applied to the compiler, binder, and assembler program names), you must specify it in `options`, or `asopt` in the configuration file. The command-line flags must appear in the order that they are to be directed to the appropriate compiler program.

Three exceptions to the rules of conflicting options are the -I*directory* or `-I//dataset_name`, **-l***library*, and -L*directory* options, which have cumulative effects when they are specified more than once.

Specifying compiler options on the command line

There are two kinds of command-line options:

- **-qoption_keyword** (compiler-specific)
- Flag options (available to z/OS XL C/C++ compilers in z/OS UNIX System Service environment)

Command-line options in the **-q option_keyword** format are similar to on and off switches. For most **-q** options, if a given option is specified more than once, the last appearance of that option on the command line is the one recognized by the compiler. For example, **qsource** turns on the source option to produce a compiler listing, and **-qnosource** turns off the source option so that no source listing is produced.

Example: The following example would produce a source listing for both `MyNewProg.C` and `MyFirstProg.C` because the last source option specified (**-qsource**) takes precedence:

```
xlC -qnosource MyFirstProg.C -qsource MyNewProg.C
```

You can have multiple **-q option_keyword** instances in the same command line, but they must be separated by blanks. Option keywords can appear in mixed case, but you must specify the **-q** in lowercase.

Example: You can specify any **-q option_keyword** before or after the file name:

```
xlC -qLIST -qnomaf file.c
xlC file.c -qxref -qsource
```

Some options have suboptions. You specify these with an equal sign following the **-qoption**. If the option permits more than one suboption, a colon (:) must separate each suboption from the next.

Example: The following example compiles the C source file file.c using the option **-qipa** to specify the inter procedural analysis options. The suboption `level=2` tells the compiler to use the full inter procedural data flow and alias analysis, **map** tells the compiler to produce a report, and the **noobj** tells the compiler to produce only an IPA object without a regular object. The option **-qattr** with suboption `full` will produce an attribute listing of all identifiers in the program.

```
xlc -qipa=level=2:map:noobj -qattr=full file.c
```

Specifying flag options

The z/OS XL C/C++ compilers use a number of common conventional flag options. Lowercase flags are different from their corresponding uppercase flags. For example, **-c** and -C are two different compiler options:

- **-c** specifies that the compiler should only preprocess, compile, and not invoke the binder
- -C can be used with -E or -P to specify that user comments should be preserved

Some flag options have arguments that form part of the flag. Here is an example: `xlC stem.c -F/home/tools/test3/new.cfg:myc -qflag=w` where `new.cfg` is a custom configuration file.

You can specify flags that do not take arguments in one string; for instance, `xlc -0cv file.c` has the same effect as `xlc -O -v -c test.c`.

Specifying compiler options in a configuration file

The default configuration file, (/usr/lpp/cbclib/xlc/etc/xlc.cfg), specifies information that the compiler uses when you invoke it. This file defines values used by the compiler to compile C or C++ programs. You can make entries to this file to support specific compilation requirements or to support other C or C++ compilation environments.

Options specified in the configuration file override the default settings of the option. Similarly, options specified in the configuration file are in turn overridden by options set in the source file and on the command line.

Specifying compiler options in your program source files

You can specify compiler options within your program source by using `#pragma` directives. Options specified with pragma directives in program source files override all other option settings.

Specifying compiler options for architecture-specific 32-bit or 64-bit compilation

You can use z/OS XL C/C++ compiler options to optimize compiler output for use on specific processor architectures. You can also instruct the compiler to compile in either 32-bit or 64-bit mode.

The compiler evaluates compiler options in the following order, with the last allowable one found determining the compiler mode:

1. Compiler default (32-bit mode)
2. Configuration file settings
3. Command line compiler options (**-q32**, **-q64**, **-qarch**, **-qtune**)
4. Source file statements (**#pragma options(ARCH(suboption),TUNE(suboption))**)

The compilation mode actually used by the compiler depends on a combination of the settings of the **-q32**, **-q64**, **-qarch**, and **-qtune** compiler options, subject to the following conditions:

- Compiler mode is set according to the last-found instance of the **-q32**, or **-q64** compiler options. If neither of these compiler options is chosen, the compiler mode is set to 32-bit.
- Architecture target is set according to the last-found instance of the **-qarch** compiler option, provided that the specified **-qarch** setting is compatible with the compiler mode setting. If the **-qarch** option is not set, the compiler assumes a **-qarch** setting of 5.

- Tuning of the architecture target is set according to the last-found instance of the **-qtune** compiler option, provided that the **-qtune** setting is compatible with the architecture target and compiler mode settings. If the **-qtune** option is not set, the compiler assumes a default **-qtune** setting according to the **-qarch** setting in use.

Possible option conflicts and compiler resolution of these conflicts are described below:

- **-q32** or **-q64** setting is incompatible with user-selected **-qarch** option.

  Resolution: **-q32** or **-q64** setting overrides **-qarch** option; compiler issues a warning message, sets **-qarch** to 5, and sets the **-qtune** option to the **-qarch** setting's default **-qtune** value.
- **-q32** or **-q64** setting is incompatible with user-selected **-qtune** option.

  Resolution: **-q32** or **-q64** setting overrides **-qtune** option; compiler issues a warning message, and sets **-qtune** to the **-qarch** settings's default **-qtune** value.
- **-qarch** option is incompatible with user-selected **-qtune** option.

  Resolution: Compiler issues a warning message, and sets **-qtune** to the **-qarch** setting's default **-qtune** value.
- Selected **-qarch** and **-qtune** options are not known to the compiler.

  Resolution: Compiler issues a warning message, sets **-qarch** to 5, and sets **-qtune** to the **-qarch** setting's default **-qtune** setting. The compiler mode (32 or 64-bit) is determined by the **-q32** or **-q64** compiler settings.

xlC — Compile C and C++ source code, link-edit and create an executable file

See **xlc**.

When working in the shell, to view man page information about **xlC**, type `man xlc`.

xlc++ — Compile C and C++ source code, link-edit and create an executable file

See **xlc**.

When working in the shell, to view man page information about **xlc++**, type `man xlc`.

xargs — Construct an argument list and run a command

Format

xargs [**–I** *placeholder*] [**–i** *[placeholder]*] [**–L** *number*] [**–l** *[number]*] [**–n** *number*] [**–ptx**] [**–E** *[eofstr]*] [**–e** *[eofstr]*] [**–s** *size*] [*command* [*argument ...*]]

Description

The **xargs** command line typically contains the skeleton, or *template*, of another command. This template looks like a normal command, except that it lacks some arguments. **xargs** adds arguments from standard input (the standard input) to complete the command, then runs the resulting command. If more input remains, it repeats this process.

In a double-byte locale, some options may accept a double-byte string as an argument. In these cases, an incorrect double-byte string would be detected during command-line parsing.

Restriction: The maximum length of a constructed command is LINE_MAX bytes.

Options

xargs gets the needed arguments from standard input (the standard input). Different options tell how the standard input is to be interpreted to obtain these arguments.

–I *placeholder*
Specifies that each line in the standard input (the standard input) is to be considered as a single argument. The *placeholder* following the **–I** is a string that can appear multiple times in the command template. **xargs** strips the input line of any leading white space characters and inserts it in place of the *placeholder* string. For example, with:

```
xargs –I '{}' mv dir1/'{}' dir2/ '{}'
```

The standard input should consist of lines giving names of files that you want moved from `dir1` to `dir2`. **xargs** substitutes these names for the {} placeholder in each place that it appears in the command template.

When **xargs** creates arguments for the template command, no single argument can be longer than 255 characters after the input has replaced the placeholders. The **–x** option is automatically in effect if **–I** or **–i** is used. If you omit the *placeholder* string, it defaults to the string { }. Thus we could write our preceding example as:

```
xargs –i mv dir1/ '{}' dir2/ '{}'
```

In a double-byte locale, *placeholder* may contain double-byte characters.

–i *placeholder*
Behaves like **–I**, except that the *placeholder* is optional. If you omit the *placeholder* string, it defaults to the string { }. Thus, the previous example could be written as:

```
xargs –i mv dir1/ '{{ ' dir2/'{ } '
xargs –i /{}/ mv dir1/ '{}' dir2/ '{}
```

–L *number*
Specifies that **xargs** read *number* lines from the standard input and concatenate them into one long string (with a blank separating each of the original lines). **xargs** then appends this string to the command template and runs the resulting command. This process is repeated until **xargs** reaches the end of the standard input if there are fewer than *number* lines left in the file the last time the command is run, **xargs** just uses what is there.

With this option, a line must contain at least one nonblank character; blank lines are skipped and do not count toward the number of lines being added to the template. **xargs** considers a line to end at the first newline character, unless the last character of the line is a blank or a tab; in this case, the current line is considered to extend to the end of the next non-empty line.

If you omit the **–L** or **–l** option, the default number of lines read from the standard input is 1. The **–x** option is automatically in effect if **–l** is used.

–l *number*

Acts like the **–L** option, but the *number* argument is optional. *number* defaults to 1.

–n *number*

Specifies **xargs** is to read the given number of arguments from the standard input and put them on the end of the command template. For example:

```
xargs –n 2 diff
```

obtains two arguments from the standard input, appends them to the **diff** command, and then runs the command. It repeats this process until the standard input runs out of arguments. When you use this option, **xargs** considers arguments to be strings of characters separated from each other by white space characters (blanks, horizontal tabs, or newlines). Empty lines are always skipped (that is, they don't count as arguments). If you want an input argument to contain blanks or horizontal tabs, enclose it in double quotes or single quotes. If the argument contains a double-quote character ("), you must enclose the argument in single quotes. Conversely, if the argument contains a single quote (') (or an apostrophe), you must enclose the argument in double quotes. You can also put a backslash (\) in front of a character to tell **xargs** to ignore any special meaning the character may have (for example, white space characters, or quotes).

xargs reads fewer than *number* arguments if:

- The accumulated command line length exceeds the *size* specified by the **–s** option (or {LINE_MAX} if you did not specify **–s**)
- The last iteration has more than zero, but less than *number* arguments remaining

If you do not specify the **–n** option, the default number of arguments read from the standard input is 1.

Typically, an **xargs** command uses exactly one of the options just described. If you specify more than one, **xargs** uses the one that appears last on the command line. If the command has none of these options, **xargs** keeps reading input until it fills up its internal buffer, concatenating arguments to the end of the command template. When the buffer is full, **xargs** runs the resulting command, and then starts constructing a new command. For example:

```
ls | xargs echo
```

prints the names of files in the working directory as one long line. When you invoke **xargs** this way, the total length of all arguments must be less than the size specified by the **–s** option.

If no command template appears on the command line, **xargs** uses **echo** by default. When **xargs** runs a command, it uses your search rules to find the command; this means that you can run shell scripts as well as normal programs.

The command you want to execute should be in your search $PATH.

xargs ends prematurely if it cannot run a constructed command or if an executed command returns a nonzero status.

If an executed command is a shell program, it should explicitly contain an **exit** command to avoid returning a nonzero by accident; see **sh** for details.

You can use the following options with any of the three main options.

–E *[eofstr]*
Defines *eofstr* to represent end-of-file on the standard input. For example:

```
–E :::
```

tells **xargs** that **:::** represents the end of the standard input, even if an input file continues afterward. If there is no **–E** or **–e** option, a single underscore (_) marks the end of the input.

In a double-byte locale, *eofstr* may contain double-byte characters.

–e *[eofstr]*
Acts like **–E** but the *eofstr* argument is optional. If you specify **–e** without *eofstr*, there is no end-of-file marker string, and _ is taken literally instead of as an end-of-file marker. **xargs** stops reading input when it reaches the specified end-of-file marker or the true end of the file.

–p Prompts you before each command. This option turns on the **–t** option so that you see each constructed command before it is run. Then **xargs** displays **?...**, asking if you really want to run this command. If you type a string beginning with **y**, **xargs** runs the command as displayed; otherwise, the command is not run, and **xargs** constructs a new command.

–s *size* Sets the maximum allowable size of an argument list to *size* bytes (where *size* is an integer). The value of *size* must be less than or equal to the system variable LINE_MAX. If you omit the **–s** option, the default allowable size of an argument list is LINE_MAX. The length of the argument list is the length of the entire constructed command; this includes the length of the command name, the length of each argument, plus one blank for separating each item on the line.

–t Writes each constructed command to **stderr** just before running the command.

–x Kills **xargs** if it creates a command that is longer than the size given by the **–s** option (or {LINE_MAX} is **–s** was not specified). This option comes into effect automatically if you specify **–i** or **–l**.

Examples

The following displays file names in three columns:

```
ls | xargs –n 3 echo
```

Localization

xargs uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion of all commands

1–125 Failure due to any of the following:
- **xargs** could not assemble a command line
- One or more invocations of *command* returned a nonzero exit status.
- Some other error occurred

126 **xargs** found *command* but could not invoke it

127 **xargs** could not find *command*

Portability

POSIX.2, X/Open Portability Guide, UNIX systems.

The **–e**, **–E**, **–i**, **–I**, **–l**, **–L**, and **–p** options are extensions of the POSIX standard.

Related information

echo, **find**, **sh**

---

yacc — Use the yacc compiler

Format

yacc [**–dhlmqtv**] [**–b** *file.prefix*] [**–D** *file.h*] [**–o** *file.c*] [**–p** *prefix*] [**–P** *yyparse.c*] [**–V** *stats*] *gram.y*

Description

yacc converts a context-free LALR(1) grammar found in the input file *gram.y* into a set of tables that together with additional C code constitute a parser to recognize that grammar. If you specify an input file named **-**, **yacc** reads the grammar from the standard input. By default, **yacc** places the parsing tables and associated C code into the file **y.tab.c**.

You can find detailed information about writing parsers using **yacc** in *z/OS UNIX System Services Programming Tools*.

Options

–b *file_prefix*
Uses *file_prefix* instead of y as the prefix for all output filenames. For example, **yacc** names the parsing table *file_prefix***.tab.c** rather than **y.tab.c**.

–D *file.h*
Generates the file *file.h*, which contains the constant definition statements for token names. This lets other modules of a multimodule program access these symbolic names. This is the same as **–d**, except that the user specifies the include file name.

–d Generates the file **y.tab.h**, which contains the constant definition statements for token names. This lets other modules of a multimodule program access these symbolic names. This is the same as **–D**, except that the user does not specify the header file name.

–h Displays a brief list of the options and quits.

–l Disables the generation of **#line** statements in the parser output file, which are used to produce correct line numbers in compiler error messages from *gram.y*.

–m Displays memory usage, timing, and table size statistics on the standard output.

–o *file.c*
Places the generated parser tables into *file.c* instead of the default **y.tab.c**.

–P *yyparse.c*
Indicates that the C parser template is found in the file **yyparse.c**. If you do not specify this option, this parser template is located in **/etc/yyparse.c**.

–p *prefix*
By default, **yacc** prefixes all variables and defined parameters in the generated parser code with the two letters `yy` (or `YY`). In order to have more than one **yacc**-generated parser in a single program, each parser must have unique variable names. **–p** uses the string *prefix* to replace the `yy` prefix in variable names. *prefix* should be entirely in lowercase because **yacc** uses an uppercase version of the string to replace all `YY` variables. We recommend a short prefix (such as `zz`) because some C compilers have name length restrictions for identifiers. You can also set this identifier with a **%prefix** directive in the grammar file.

–q Disables the printing of warning messages.

–t Enables debugging code in the generated parser. **yacc** does not normally compile this code because it is under the control of the preprocessor symbol `YYDEBUG`.

This option is therefore equivalent to either setting `YYDEBUG` on the C compiler command line or specifying **#define YYDEBUG** statement in the first section of the grammar.

–V *stats*
Writes a verbose description of the parsing tables and any possible conflicts to the file *stats*.

This is the same as **-v** except that the user specifies the file name.

–v writes a verbose description of the parsing tables and any possible conflicts to the file **y.output**.

Files

yacc uses the following files:

/usr/lib/liby.a
yacc function library.

/usr/lib/libyxp.a
yacc archive library with functions compiled with XPLINK. Includes two versions: 64-bit addressing mode and 31-bit addressing mode.

y.output
Default statistics file when you specify **-v**.

y.tab.c Default file for the generated parser.

y.tab.h Default header file when you specify **–d**.

/etc/yyparse.c
Default parser template.

Localization

yacc uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_CTYPE**
- **LC_MESSAGES**
- **LC_SYNTAX**
- **NLSPATH**

For more information, see Appendix F, "Localization," on page 997.

Usage notes

In a double-byte environment, **yacc** can use double-byte characters, although this practice is possibly nonportable.

1. Comments and rule names can contain double-byte characters.
2. double-byte characters can be used in symbolic token names (generated by *%token* statements only if the C preprocessor and compiler will interpret them correctly. Symbolic token names are converted directly into **#define** statements and are then interpreted by the preprocessor and the compiler.
3. You can use double-byte characters as literal token definitions (a double-byte character surrounded by apostrophes), although this will generate a warning and might create a conflict with an assigned token name.

Exit values

0 Successful completion

1 Failure due to any of the following:
- *number* rules never reduced
- Reduce-reduce conflict
- Shift-reduce conflict
- *NAME* should have been defined earlier
- \000 not permitted
- EOF encountered while processing *%union*
- EOF in string or character constant
- EOF inside comment
- Use of $*number* not permitted
- Nonterminal *number*, entry at *number*
- Action does not terminate
- Bad *%start* construction
- Bad syntax in *%type*
- Bad syntax on $<*ident*> clause
- Bad syntax on first rule
- Inability to find parser
- Inability to open input file
- Inability to open table file
- Inability to open temporary file
- Inability to open **y.output**
- Inability to place goto
- Inability to reopen action temporary file
- Default action causes potential type clash
- EOF before *%}*
- *%prec syntax* not permitted
- *nnn* construction not permitted

- Comment not permitted
- Option not permitted
- Incorrect or missing ' or "
- Incorrect rule: missing semicolon, or |?
- Internal **yacc** error
- Incorrect escape, or incorrect reserved word
- Item too big
- More than *number* rules
- Must return a value, since *LHS* has a type
- Must specify type for *name*
- Must specify type of $*number*
- Newline in string.
- No space in action table
- Nonterminal *symbol* not permitted after *%prec*
- Nonterminal *symbol* never derives any token string
- Nonterminal *symbol* not defined
- Optimizer cannot open temporary file
- Out of space in optimizer
- Out of state space
- Redeclaration of precedence of *symbol*
- Redeclaration of type of *symbol*
- Syntax error
- Token incorrect on *LHS* of grammar rule
- Too many characters in ID's and literals
- Too many look-ahead sets
- Too many nonterminals
- Too many states
- Too many terminals
- Type redeclaration of nonterminal *symbol*
- Type redeclaration of token *symbol*
- Unexpected EOF before *%*
- Unterminated < ...> clause
- Working set overflow
- **yacc** state or nolook error

Messages

Possible error messages include:

No input file
You did not specify a grammar file **gram.y** on the command line.

No parser produced
Analysis of the input grammar shows that it contains inaccessible or ungrounded nonterminal symbols. Check the preceding report and revise the grammar.

Out of memory at size bytes
The specified grammar is too complex to process within the memory resources of the current configuration.

Limits

yacc dynamically allocates all internal tables so that grammar size and complexity are limited only by available memory.

Portability

POSIX.2, POSIX.2 C-Language Development Utilities Option, X/Open Portability Guide, UNIX systems.

The **–D**, **–h**, **–m**, **–p**, **–q**, **–S**, **–s**, and **–V** options are extensions of the POSIX standard.

Related information

lex

z/OS UNIX System Services Programming Tools

zcat — Uncompress and display data

Format

zcat –DVv [*file ...*]

Description

zcat takes one or more compressed data files as input. The data files should be compressed with the **compress** command. If no data files are specified on the command line, **zcat** reads standard input (**stdin**). You can also pass **stdin** to **zcat** by specifying **–** as one of the files on the command line.

zcat uncompresses the data of all the input files, and writes the result on standard output (**stdout**). **zcat** concatenates the data in the same way **cat** does.

The names of compressed input files are expected to end in **.Z**. If a specified input file name does not end in this suffix, **zcat** automatically adds the **.Z**. For example, if the command line specifies file **abc**, **zcat** looks for **abc.Z**.

zcat is equivalent to:

```
uncompress -c
```

Options

–D Uncompresses files that were compressed using the dictionary option of **compress**.

–V Prints the version number of **uncompress** that **zcat** calls.

–v Prints the name of each file as it is uncompressed.

Localization

zcat uses the following localization environment variables:
- **LANG**
- **LC_ALL**
- **LC_MESSAGES**
- **NLSPATH**

See Appendix F, “Localization,” on page 997 for more information.

Exit values

0 Successful completion

1 Failure due to any of the following:
- Unknown command line option
- File is not in compressed format
- File was compressed with a number of bits **zcat** cannot handle
- There is no space for decompress tables
- The compressed file is corrupt

Portability

UNIX systems

Related information

cat, **compress**, **uncompress**

zlsof — Displays information about open files, sockets, and pipes

Format

zlsof [**-p**[*pids*] | [**-a**[*asids*] | [**-j**[*jobs*]] [**-u**[*users*]] [**-c**] [**-d**] [**-t**] [**-i**] [**-l**] [**-n**] [**-su**] [**-v**] [**-m** *maxtime*] [**-rw**[*seconds*]] [*pathname* | *pipe* | *socket*]

Description

The **zlsof** utility displays information about open files, sockets, and pipes (including named pipes, which are also known as FIFO special files). The display includes the file name or inode number, associated PID, user, file system, and whether the file was locked by the byte range lock manager (BRLM).

Filters are provided to limit output. Filters include specific processes, ASIDs, jobs, users, files, file systems, sockets, and pipes

The default output for an unauthorized invoker consists of open file information for processes that are associated with the user. If the invoker is authorized, the default output consists of open file information for all processes in the system.

You can also use the **-rw** option to monitor file system usage.

Operands

pathname | *socket* | *pipe*
If a *pathname* is given, only the usage of that file is listed. If *pathname* is a mount point, all files in use within that file system are listed.

If *socket* or *pipe* is entered, the output will show only the socket or pipe and FIFO summary usage.

Options

–p *pid* PID filter: an optional list of process IDs that are separated by commas. The output will show the process IDs. `-p` is the default output format. For example:

```
-p 11,22,37
```

–j *job* Job filter: an optional list of job names that are separated by commas. The output will show the job names. For example:

```
-j resolver,cea
```

–a *asid* ASID filter: an optional list of ASIDs that are separated by commas. The output will show the ASIDs. For example:

```
-a 23,1d
```

–u *user*
User filter: a list of user IDs that are separated by commas. For example:

```
-u wjs,jhc
```

–c Omits the current directory and root.

–d Displays all deleted, but open files. This option also sets **-i -s**. To use this option, you must have UID=0 or be permitted to the BPX.SUPERUSER resource in the FACILITY class.

–t Shows the tally of file types open by process.

–i Shows the inode numbers instead of file names.

–n Derives the real path names for files. This option is disabled after *maxtime* seconds (see option -m)

–su Sets the effective UID to 0, if it is not already 0. To use this option, you must have UID=0 or be permitted to BPX.SUPERUSER resource in the FACILITY class.

–l Indicates files with byte range locks. To use this option, you must have UID=0 or be permitted to BPX.SUPERUSER resource in the FACILITY class.

-v Verbose mode. Prints running status and information.

-m *maxatime*
No longer derives the file names after *maxtime* seconds. The default is 60. Use this option with the **-n** option.

-rw Monitors matching file systems for read and write activity for a specified time. If a length of time is not specified, 20 seconds is used. To use this option, you must have UID=0 or be permitted to BPX.SUPERUSER resource in the FACILITY class.

The output consists of two parts: First, the initial file or file system usage information that matches the input PIDs, ASIDs, jobs, users, and path name filters is displayed; second, the summary read and write activity for the corresponding file systems is provided.

Note: This option causes the command to be suspended for the specified time period while I/O counts are accumulated.

Examples

1. The following display shows output with a PID filter applied:

```
SY1:/> zlsof -p 1,2,3,16777220
zlsof 120515: Searching for all file usage by process 1,2,3,16777220
Command       PID User     File System    Mountpoint  Inode/file
BPXPINPR        1 IBMUSER  ZOS21.ROOT.HFS /           r 3
                           ZOS21.ROOT.HFS /           c 3
EZBREINI        2 RESOLVER ZOS21.ROOT.HFS /           r 3
                           ZOS21.ROOT.HFS /           c 3
EZBREUPS        3 RESOLVER ZOS21.ROOT.HFS /           r 3
                           ZOS21.ROOT.HFS /           c 3
CEAPSRVR 16777220 CEA      ZOS21.ROOT.HFS /           r 3
                           ZOS21.ROOT.HFS /           c 3
CEAPSRVR 16777220 CEA                     socket: 1
End of output
```

2. The following display illustrates output with a user filter applied.

```
SY1:/> zlsof -u wellie1
zlsof 120515: Searching for all file usage by user wellie1
Command       PID User    File System    Mountpoint  Inode/file
obrowse 83886089 WELLIE1  ZOS21.ROOT.HFS /           r 3
                          ZOS21.ROOT.HFS /           c 3
                          ZOS21.ROOT.HFS /           1259 /dev/ttyp0001
                          ZOS21.ROOT.HFS /           1259 /dev/ttyp0001
                          ZOS21.ROOT.HFS /           1259 /dev/ttyp0001
-sh     83886091 WELLIE1  ZOS21.ROOT.HFS /           r 3
                          ZOS21.ROOT.HFS /           c 3
                          ZOS21.ROOT.HFS /           1259 /dev/ttyp0001
                          ZOS21.ROOT.HFS /           1259 /dev/ttyp0001
                          ZOS21.ROOT.HFS /           1259 /dev/ttyp0001
                          ZOS21.ROOT.HFS /           1259 /dev/ttyp0001
                          ZOS21.ROOT.HFS /           1301 /tmp/.sh_history
OMVS    83886095 WELLIE1  ZOS21.ROOT.HFS /           r 3
                          ZOS21.ROOT.HFS /           21 tmp
                          ZOS21.ROOT.HFS /           1258 /dev/ptyp0001
                          ZOS21.ROOT.HFS /           1323 //instruct.txt
```

3. The following display lists deleted, but open, files. The **-d** option is used.

```
SY1:/> zlsof -d
zlsof 120515: Searching for all file usage for deleted files
Command       PID User    File System   Mountpoint     Size Inode/file
OMVS     83886095 WELLIE1 ZOS21.ROOT.HFS /               1 1323 //instruct.txt
End of output
```

Usage notes

1. In the output, the inode or file can be prefixed by one of the following letters:
   c Indicates the current directory for the process
   r Indicates the current root for the process.
   w This process is waiting on a byte range lock for the file.
   h This process is holding a byte range lock for the file.
2. If the **–c** option is used, lines with **c** and **r** are suppressed.
3. If the **–l** option is not used, **w** and **h** are not displayed.
4. The **–p**, **–j** and **–a** options are mutually exclusive.
5. If neither **–n** nor **–i** are specified, the output format will contain any portion of the file name that was retained by the system in addition to the inode number.
6. Use **--** to separate the last option flag from the operand if the operand starts with **–** or the last option flag takes an optional parameter that is not specified. For example, `zlsof -j pipe` will filter on job name PIPE but `zlsof -j -- pipe` will filter on pipe and show job names in the output.

7. **zlsof** is available as a TSO/E command and a shell command. It can also be executed as a system REXX exec, using the F AXR,ZLSOF system command.

Exit values

0 The command was successfully processed.

1 A failure occurred.

Related information

fuser

Chapter 3. TSO/E commands

This part describes the Time Sharing Option Extensions (TSO/E) OMVS command that you use to invoke the shell and the TSO/E commands that you can use to work with the z/OS UNIX file system.

The OMVS command invokes the z/OS shell. You can enter the OMVS command from TSO/E or from the ISPF command processor panel.

You can use the **man** command to view descriptions of TSO/E commands. To do this, you must prefix all commands with **tso**. For example, to view a description of the MOUNT command, you would enter:

```
man tsomount
```

The commands for working with the file system are:

- BPXBATCH
- BPXMTEXT
- BPXTRACE
- ISHELL
- MKDIR
- MKNOD
- MOUNT
- OBROWSE
- OCOPY
- OEDIT
- OGET
- OGETX
- OPUT
- OPUTX
- OSHELL
- OSTEPLIB
- UNMOUNT
- ZLSOF

You can enter these TSO/E commands from:

- TSO/E
- The Interactive System Productivity Facility (ISPF) command processor panel (typically, option 6 on the ISPF menu).

  Option 6 is usually preferable, because it does not convert into uppercase the commands that you enter. You should enter a TSO/E command from an ISPF panel that does not convert all the parameters into uppercase; some panels, such as the main ISPF panel, convert what you enter into uppercase. z/OS UNIX System Services is case-sensitive.
- The shell

Note:

1. The relative path name is relative to the working directory (usually the HOME directory) of the TSO/E session, not the shell session.
2. Use absolute path names when entering any TSO/E commands.
3. Avoid using spaces or single quotation marks within path names.

BPXBATCH — Run shell commands, shell scripts, or executable files

Format

```
BPXBATCH SH  [program_name] | PGM program_name
```

where *program_name* is an optional parameter that is passed to SH or a required parameter when PGM is used.

Description

BPXBATCH makes it easy for you to run, from your TSO/E session, shell scripts or z/OS XL C/C++ executable files that reside in z/OS UNIX files. To use it when running shell scripts and executable files that reside in files through job control language (JCL), see BPXBATCH.

With BPXBATCH, you can allocate stdin only as z/OS UNIX files for passing input. You can allocate stdout, stderr or stdenv as MVS data sets or z/OS UNIX text files. The stdenv file for containing environment variables or the stderr and stdout files for saving job output can be allocated as SYSOUT, PDSE, PDS or sequential data sets. If you do not allocate them, stdin, stdout, stderr, and stdenv default to **/dev/null**. Allocate the standard files using the data definition PATH keyword options, or standard data definition options for MVS data sets, for stdenv, stdout and stderr.

Note: The stream of data in the file associated with the STDIN DD is supplied as input to either the target shell program (for the SH case) or target z/OS UNIX program (PGM case) via File Descriptor 0, which is the traditional UNIX standard input (stdin). This data is then read and handled by the shell or the designated program. BPXBATCH itself does nothing with the data in the file.

To display BPXBATCH syntax using multiple commands, use one of the following:

```
BPXBATCH SH
PXBATCH SH [program_name]
PXBATCH PGM program_name
```

In addition to using BPXBATCH, a user who wants to perform a local spawn without being concerned about environment setup (that is, without having to set specific environment variables which could be overwritten if they are also set in the user's profile) can use BPXBATSL. It provides users with an alternate entry point into BPXBATCH, and forces a program to run using a local spawn instead of fork/exec as BPXBATCH does. This ultimately allows a program to run faster.

The following example contains DD statements that are accessible to a program that was given control from BPXBATSL:

```
//jobname JOB ...

//stepname EXEC PGM=BPXBATSL,PARM='PGM program_name'
/* The following 2 DDs are still available in the program which gets
/* control from BPXBATSL.
//DD1       DD DSN=MVSDSN.FOR.APPL1,DISP=SHR
//DD2       DD DSN=MVSDSN.FOR.APPL2,DISP=SHR
/* The following DDs are processed by BPXBATSL to create file descriptors
/* for stdin, stdout, stderr
//STDIN   DD  PATH='/stdin-file-pathname',PATHOPTS=(ORDONLY)
//STDOUT  DD  PATH='/stdout-file-pathname',PATHOPTS=(OWRONLY,OCREAT,OTRUNC
//            PATHMODE=SIRWXU
//STDERR  DD  PATH='/stderr-file-pathname',PATHOPTS=(OWRONLY,OCREAT,OTRUNC
//            PATHMODE=SIRWXU
```

BPXBATSL is also useful when the user wants to perform a local spawn of their program, but also needs subsequent child processes to be fork/exec'ed. Formerly, with BPXBATCH, this could not be done because BPXBATCH and the requested program shared the same environment variables.

BPXBATSL is an alias of BPXBATCH.

BPXBATA2 and BPXBATA8 are provided as APF-authorized alternatives to BPXBATSL. They provide the capability for a target APF-authorized z/OS UNIX program to run in the same address space as the originating job, allowing it to share the same allocations and job log, and so on. BPXBATA2 is specifically intended to provide the capability for a PSW Key 2 APF-authorized z/OS UNIX program to be started. To ensure that the target program receives control PSW Key 2, a PPT entry for BPXBATA2 must be set up that specifies that BPXBATA2 starts up PSW Key 2. The same restrictions that apply to BPXBATSL also apply to BPXBATA2 and BPXBATA8, in addition to the following:

- The PGM keyword is the only invocation type that is supported. The SH keyword is not supported.
- The interfaces can only be used from started task address spaces.
- The z/OS UNIX program that is the target of the BPXBATA2 and BPXBATA8 job must be marked as an APF-authorized executable file.

Any other usage of the BPXBATA8 and BPXBATA2 interfaces than what is described is not supported and will cause the invoking job to fail.

Parameters

SH|PGM

Specifies whether BPXBATCH is to run a shell script or command, or a z/OS C/C++ executable file located in a z/OS UNIX file.

If neither SH nor PGM is specified, BPXBATCH assumes that the shell is to be started in order to run the shell script allocated by stdin.

SH Instructs BPXBATCH to start the shell and to run shell commands or scripts provided from stdin or the specified *program_name*. BPXBATCH passes all of the argument data, blanks included as is, to the shell as one parameter.

```
BPXBATCH PARM='SH command string'
```

If you specify SH with no *program_name* information, BPXBATCH attempts to run anything read in from stdin.

SH is the default.

PGM

Instructs BPXBATCH to run the specified *program_name* as a called program. This is done either via a spawn or a fork and exec. BPXBATCH creates a process for the program to run in and then calls the program. BPXBATCH breaks each argument up that is separated by one or more blanks into multiple parameters passed to the target program, taking out the blanks.

```
BPXBATCH PARM='PGM arg1 ... argn'
```

Rule: If you specify PGM, you must also specify *program_name*.

All environment variables read from stdenv are set when the program is run, if stdenv was allocated. If the HOME and LOGNAME environment

variables are not specified in the stdenv file, or stdenv was not allocated, then HOME and LOGNAME, if possible, are set when the program is run.

Restriction: When using PGM, the *program_name* parameter cannot contain any shell-specific functions because they will not be resolved. If shell specific functions must be specified, then SH should be used to avoid possible errors or unpredictable results.

program_name
Specifies the shell command name or path name for the shell script or z/OS XL C/C++ executable file that you want to run. *program_name* can also contain option information. *program_name* must be in uppercase and lowercase letters.

When PGM and *program_name* are specified and the specified program name does not begin with a slash character (/), BPXBATCH prefixes the user's initial working directory information to the program path name.

Arguments that may be passed to the program specified by *program_name* are determined by the program being passed to PGM as a parameter. For more information about arguments that may be passed to the program, refer to the documentation of the program.

Examples

1. You want to run the shell script you specify with stdin.

```
ALLOCATE FILE(STDIN) PATH('/stdin_file_pathname')
PATHOPTS(ORDONLY)
BPXBATCH SH
```

2. You want to run the program **/usr/bin/payroll.**

```
BPXBATCH PGM /usr/bin/payroll
```

3. You want to run the script **shellscriptA** and put its output into the file **a.out** in a temporary directory.

```
BPXBATCH SH /u/usr/joe/shellscriptA > /tmp/a.out
```

BPXMTEXT - Display reason code text

See “bpxmtext — Display reason code text” on page 71.

BPXTRACE - Activate or deactivate traces for processes

See “bpxtrace — Activate or deactivate traces for processes” on page 71.

ISHELL — Invoke the ISPF shell

Format

```
ISHELL [initial_path] [-d]
```

Note: An alias of ISHELL is:

```
ISH
```

Description

ISHELL invokes the ISPF shell, a panel interface that helps you to set up and manage z/OS UNIX System Services functions.

You can use the ISHELL command to:
- List files in a directory

- Create, delete, or rename directories, files, and special files
- Browse files
- Edit files
- Copy files
- Display file attributes
- Search files for text strings
- Compare files or directories
- Run executable files
- Display the attributes and contents of a symbolic link
- Mount and unmount a z/OS UNIX file system
- Create a z/OS UNIX file system
- Set up character special files
- Set up standard directories for a root file system
- Set up existing users and groups for access to z/OS UNIX System Services

  For more information about setting up TSO/E users, see *z/OS UNIX System Services Planning*.

Some of these tasks require specific authority. For example:

- Mount authority is needed for mounting and unmounting file systems. See the section on mount authority in *z/OS UNIX System Services Planning* for an explanation about the mount authority that is needed for mounting and unmounting file systems.
- Superuser authority is needed when setting up character special files and setting up existing users and groups for z/OS UNIX access.
- RACF SPECIAL attribute is needed when setting up existing users and groups for z/OS UNIX access.

The last path name used on the main panel of ISHELL is kept and displayed again on the next invocation of ISHELL. In order to switch back to the home directory, erase the path name shown and press ENTER.

Field level and panel help are available throughout the dialog. For more information about ISHELL, see *z/OS UNIX System Services User's Guide* and the online help panels.

Parameters

initial_path
The path that you want to appear in ISHELL's main panel. For example: **ishell /tmp/**

-d Prevents ISHELL from suppressing ISPF server dialog errors. Because this option will cause ISHELL to terminate on errors, use it only at the direction of IBM Support.

Usage notes

1. In z/OS V1R11, OEDIT and OBROWSE were changed to use the ISPF edit and browse dialog services by default. To have ISHELL use the original dialog service, export the environment variable BPXWISHISPF=NO from **/etc/profile** or **$HOME/.profile**.
2. ISHELL starts a shell process in the background to find out the user's TZ setting from **/etc/profile** and **$HOME/.profile**. If the TZ setting is found, this value is used when displaying file time stamps. If not found, GMT is assumed. The environment variable BPXWISHTZ can be set to a time zone value to have

ISHELL use a local time zone that is different from your TZ setting. BPXWISHTZ must be specified in **/etc/profile** or in **.profile**.

Example: If the TZ setting does not specify GMT, to allow ISHELL users to return to GMT add the following line to **etc/profile** or **.profile:**

```
export BPXWISHTZ=GMT
```

MKDIR — Make a directory

Format

```
MKDIR 'directory_name'  MODE(directory_permission_bits) STICKY|NOSTICKY
```

Description

You can use the MKDIR command to create a directory in the file system.

Parameters

directory_name

Specifies the name of the directory to be created. The name can be a relative path name or an absolute path name. You must enclose it in single quotation marks. A relative path name is relative to the working directory of the TSO/E session (usually the HOME directory). Therefore, you should usually specify an absolute path name. The name can be up to 1023 characters long. The name is case-sensitive; the system stores each character in the case entered.

All directories in the path name prior to the specified directory must already exist. If the specified directory already exists, no new directory is created.

MODE(directory_permission_bits)

Specifies the directory permission bits as three octal numbers, from 0 to 7, separated by commas or blanks. The octal values represent read (r), write (w), and search (x) access for: user, group, and other.

User permission is the permission given to the directory owner. Group permission is the permission given to the group the owner is a member of. Other permission is the permission given to any other user.

The mode for a directory created by MKDIR is determined by the mode itself and applying a **umask** to it.

The access indicated by each of the numbers 0–7 is:

0 No access
1 Search (x) access
2 Write-only (w) access
3 Write and search (wx) access
4 Read-only (r) access
5 Read and search (rx) access
6 Read and write (rw) access
7 Read, write, and search (rwx) access

The default permissions set when a directory is created are 755, representing:

7 User: read, write, and search permission.
5 Group: read and search permission.
5 Other: read and search permission.

STICKY

Specifies that the sticky bit is to be set on for a directory so a user cannot remove or rename a file in the directory unless one or more of these conditions are true:

- The user owns the file
- The user owns the directory
- The user has superuser authority

NOSTICKY
Specifies that the sticky bit is to be set off in the directory. NOSTICKY is the default.

Return codes

0 Processing successful.
12 Processing unsuccessful. An error message has been issued.

Examples

1. You want to create a directory using an absolute path name giving read, write, and search access to the directory owner and no access to the group and other classes. The new directory name is to be **/tmp/bin**. The directory **/tmp** already exists. You enter:

   ```
   MKDIR '/tmp/bin' MODE(7,0,0)
   ```

2. You want to create a new directory under the working directory of your TSO/E session; therefore you can specify a relative path name. You want to name the new directory **u2**, and to set it up with the default permissions (755). You enter:

   ```
   MKDIR 'u2'
   ```

MKNOD — Create a character special file

Format

```
MKNOD 'pathname'
      MAJOR(device_major_number)
      MINOR(device_minor_number)
      MODE(file_permission_bits)
```

Description

MKNOD creates a character special file in a file system.

Restriction: MKNOD can be used only by a superuser.

Parameters

pathname
Specifies the name of the character special file to be created. The name can be a relative path name or an absolute path name. It must be enclosed in single quotes. A relative path name is relative to the working directory of the TSO/E session (usually the HOME directory). Therefore, you should usually specify an absolute path name. The name can be up to 1023 characters long. The name is case-sensitive; the system stores each character in the case entered. This operand is required.

All directories in the path name must exist. If the specified file already exists, no new file is created.

MAJOR(device_major_number)
Specifies the device major number, which can be a decimal number between 0 and 65 535 (64K minus 1). See *z/OS UNIX System Services Planning* for information about specifying the device major number. This operand is required.

MINOR(device_minor_number)
Specifies the device minor number, which can be a decimal number between 0 and 65 535 (64K minus 1). See *z/OS UNIX System Services Planning* for information about specifying the device minor number. This operand is required.

MODE(file_permission_bits)
Specifies the file permission bits as three octal numbers, from 0 to 7, separated by commas or blanks. The octal values represent read (r), write (w), and execute (x) access for: user, group, and other.

User permission is the permission given to the file owner. Group permission is the permission given to the group the owner is a member of. Other permission is the permission given to any other user.

The access indicated by each of the numbers from 0 to 7 is:
0 No access
1 Search (x) access
2 Write-only (w) access
3 Write and execute (wx) access
4 Read-only (r) access
5 Read and execute (rx) access
6 Read and write (rw) access
7 Read, write, and execute (rwx) access

When the MKNOD command is issued in the TSO interactive environment, the file is created with default permissions of 666, regardless of the user's umask setting, representing:
6 User: read and write access
6 Group: read and write access
6 Other: read and write access

Examples

1. You want to create a character special file using an absolute path name, giving read, write, and execute access to the file owner and no access to others. The file name is **tty1** in the existing directory **/dev**. The device major number is 2; the minor number is 1. You enter:

   ```
   MKNOD '/dev/tty1' MAJOR(2) MINOR(1) MODE(7,0,0)
   ```

2. You want to create a character special file named **ptty2** in the existing directory **/dev**. The device major number is 1; the device minor number is 457. You want the default permissions. You enter:

   ```
   MKNOD '/dev/ptty2' MAJOR(1) MINOR(457)
   ```

3. You want to create a new **tty** pair using an absolute path name. The file name is **ttyp0042** in the existing directory **/dev**. The device minor number is 42. You want the default permissions. You enter:

   ```
   MKNOD '/dev/ptyp0042' MAJOR(1) MINOR(42)
   MKNOD '/dev/ttyp0042' MAJOR(2) MINOR(42)
   ```

MOUNT — Logically mount a file system

Format

```
MOUNT FILESYSTEM(file_system_name)
      MOUNTPOINT(pathname)
      TYPE(file_system_type)
      MODE(RDWR|READ)
      PARM(parameter_string)
      TAG(NOTEXT|TEXT,ccsid)
      SETUID|NOSETUID
```

```
WAIT|NOWAIT
SECURITY|NOSECURITY
SYSNAME (sysname)
AUTOMOVE|AUTOMOVE(indicator,sysname1,sysname2,...,sysnameN)|
NOAUTOMOVE|UNMOUNT
```

The *Indicator* is either INCLUDE or EXCLUDE, which can also be abbreviated as I or E

Description

Use the MOUNT command to logically mount, or add, a mountable file system to the file system hierarchy. You can unmount any mounted file system using the UNMOUNT command. For descriptions of the valid MOUNT parameters for the zFS file system, see MOUNT in *z/OS Distributed File Service zFS Administration*.

For options that are specific to the temporary file system (TFS), see Mounting the TFS in *z/OS UNIX System Services Planning*.

Rule: You must have mount authority before you can issue the MOUNT command. See the section on mount authority in *z/OS UNIX System Services Planning*. The TSO MOUNT and UNMOUNT commands performs privileged operations if the user has read access to the BPX.SUPERUSER resource in the FACILITY class.

filesystem(file_system_name)
Specifies the name of the file system to be added to the file system hierarchy.

file_system_name
For the z/OS UNIX file system, this is the fully qualified name of the z/OS UNIX file system data set that contains the file system. It cannot be a partitioned data set member.

The file system name that is specified must be unique among previously mounted file systems. The file system name that is supplied is changed to all uppercase characters. You can enclose it in single quotation marks, but they are not required.

If file system('"file_system_name"') is specified, the file system name is not translated to uppercase.

MOUNTPOINT(pathname)
Specifies the path name of the mount point directory, the place within the file hierarchy where the file system is to be mounted. This operand is required.

pathname
Specifies the path name of the mount point. The path name must be enclosed in single quotation marks. The name can be a relative path name or an absolute path name. A relative path name is relative to the working directory of the TSO/E session (usually the HOME directory). Therefore, you should usually specify an absolute path name. It can be up to 1023 characters long. Path names are case-sensitive, so enter the path name exactly as it is to appear.

Rules: When specifying the path name, remember the following rules:

1. The mount point must be a directory. Any files in that directory are inaccessible while the file system is mounted.
2. Only one file system can be mounted to a mount point at any time.

TYPE(file_system_type)
Specifies the type of file system that will perform the logical mount request. The system converts the TYPE operand value to uppercase letters. This operand is required.

file_system_type
This name must match the TYPE operand of the FILESYSTYPE statement that activates this physical file system in the BPXPRMxx parmlib member. The file_system_type value can be up to 8 characters long.

MODE(RDWR|READ)
Specifies the type of access the file system is to be opened for.

RDWR
Specifies that the file system is to be mounted for read and write access. RDWR is the default if MODE is omitted.

READ
Specifies that the file system is to be mounted for read-only access.

The z/OS UNIX file system allows a file system that is mounted using the MODE(READ) option to be shared as read-only with other systems that share the same DASD.

PARM('parameter'
Specifies a parameter string to be passed to the file system type. The parameter format and content are specified by the file system type.

Refer to the following documentation for the appropriate file system-specific options:

- For HFS-specific options, see the BPXPRMxx section in *z/OS MVS Initialization and Tuning Reference*.
- For zFS-specific options, see Mount, in *z/OS Distributed File Service zFS Administration*.
- For NFS-specific options, see Mount processing parameters, in *z/OS Network File System Guide and Reference*.
- For TFS-specific options, see Mounting the TFS, in *z/OS UNIX System Services Planning*.

TAG(NOTEXT|TEXT,*ccsid*)
Specifies whether the file tags for untagged files in the mounted file system are implicitly set. File tagging controls the ability to convert a file's data during file reading and writing. Implicit, in this case, means that the tag is not permanently stored with the file. Rather, the tag is associated with the file during reading or writing, or when stat() type functions are issued. Either TEXT or NOTEXT, and ccsid must be specified when TAG is specified.

When the file system is unmounted, the tags are lost.

NOTEXT
Specifies that none of the untagged files in the file system are automatically converted during file reading and writing.

TEXT
Specifies that each untagged file is implicitly marked as containing pure text data that can be converted.

ccsid
Identifies the coded character set identifier to be implicitly set for the untagged file. *ccsid* is specified as a decimal value from 0 to 65535. However, when TEXT is specified, the value must be between 0 and 65535.

Other than this, the value is not checked as being valid and the corresponding code page is not checked as being installed.

SETUID|NOSETUID
Specifies whether the SETUID and SETGID mode bits on executables in this file system are respected. Also determines whether the APF extended attribute or the Program Control extended attribute is honored.

SETUID
Specifies that the SETUID and SETGID mode bits be respected when a program in this file system is run. SETUID is the default.

NOSETUID
Specifies that the SETUID and SETGID mode bits not be respected when a program in this file system is run. The program runs as though the SETUID and SETGID mode bits were not set. Also, if you specify the NOSETUID option on MOUNT, the APF extended attribute and the Program Control extended attribute are not honored.

WAIT|NOWAIT
Specifies whether to wait for an asynchronous mount to complete before returning.

WAIT
Specifies that MOUNT is to wait for the mount to complete before returning. WAIT is the default.

NOWAIT
Specifies that if the file system cannot be mounted immediately (for example, a network mount must be done), then the command will return with a return code indicating that an asynchronous mount is in progress.

SECURITY|NOSECURITY
Specifies whether security checks are to be enforced for files in this file system. When a z/OS UNIX file system is mounted with the NOSECURITY option enabled, any new files or directories that are created are assigned an owner of UID 0, no matter what UID issued the request.

SECURITY
Specifies that normal security checking is done. SECURITY is the default.

NOSECURITY
Specifies that security checking will not be enforced for files in this file system. A user can access or change any file or directory in any way.

Security auditing will still be performed if the installation is auditing successes.

The SETUID, SETGID, APF, and Program Control attributes may be turned on in files in this file system, but they are not honored while it is mounted with NOSECURITY.

SYSNAME (sysname)
For systems participating in shared file system, SYSNAME specifies the particular system on which a mount should be performed. This system will then become the owner of the file system mounted. This system must be IPLed with SYSPLEX(YES).

IBM recommends that you omit the SYSNAME parameter or specify SYSNAME(*system_name*) where *system_name* is the name of this system.

sysname
sysname is a 1–8 alphanumeric name of a system participating in shared file system.

AUTOMOVE(indicator,sysname1,...,sysnameN)|NOAUTOMOVE|UNMOUNT
These parameters apply only in a sysplex where systems are exploiting the shared file system capability. They specify what is to happens to the ownership of a file system when a shutdown, PFS termination, dead system takeover, or file system move occurs. The default setting is AUTOMOVE where the file system will be randomly moved to another system (no system list used).

Indicator is either INCLUDE or EXCLUDE, which can also be abbreviated as I or E

AUTOMOVE
AUTOMOVE indicates that ownership of the file system can be automatically moved to another system participating in a shared file system. AUTOMOVE is the default.

AUTOMOVE(INCLUDE,sysname1,sysname2,...,sysnameN) or AUTOMOVE(I,sysname1,sysname2,...,sysnameN)
The INCLUDE indicator with a system list provides an ordered list of systems to which the file system's ownership could be moved. *sysnameN* may be a system name, or an asterisk (*). The asterisk acts as a wildcard to allow ownership to move to any other participating system and is only permitted in place of a system name as the last entry of a system list.

AUTOMOVE(EXCLUDE,sysname1,sysname2,...,sysnameN) or AUTOMOVE(E,sysname1,sysname2,...,sysnameN)
The EXCLUDE indicator with a system list provides a list of systems to which the file system's ownership should not be moved.

NOAUTOMOVE
NOAUTOMOVE prevents movement of the file system's ownership in some situations.

UNMOUNT
UNMOUNT allows the file system to be unmounted in some situations.

Guidelines: Follow these guidelines when unmounting the file system:

1. Define your version and sysplex root file systems as **AUTOMOVE**, and define your system-specific file systems as **UNMOUNT**.
2. Do not define a file system as **NOAUTOMOVE** or **UNMOUNT** and a file system underneath is as **AUTOMOVE**; in this case, the file system defined as **AUTOMOVE** will not be recovered after a system failure until the failing system is restarted.

See *z/OS UNIX System Services Planning* for more information about shared file systems.

Usage notes

1. The `/samples` directory contains sample MOUNT commands (called **mountx**).
2. When the mount is done asynchronously (NOWAIT was specified and return code 4 was returned), you can determine if the mount has completed with one of the following:
   - The **df** shell command
   - The DISPLAY OMVS,F operator command (see *z/OS MVS System Commands*)
   - The MOUNT table option on the File Systems pull-down in the ISPF Shell (accessed by the ISHELL command)

3. In order to mount a file system as the system root file system, the caller must be a superuser. Also, a file system can only be mounted as the system root file system if the root file system was previously unmounted.
4. If you have previously unmounted the root file system, a dummy file system or SYSROOT is displayed as the current root file system. During the time when SYSROOT is displayed as the root, any operation that requires a valid file system will fail. When you subsequently mount a new root file system on mount point /, that new file system will replace SYSROOT. When a new root file system has been mounted, you should terminate any current dubbed users or issue a **chdir** command, using a full path name to the appropriate directory. This way, the users can access the new root file system. Otherwise, an error will occur when a request is made requiring a valid file system.
5. Systems exploiting shared file system will have I/O to an OMVS couple data set. Because of these I/O operations to the CDS, each mount request requires additional system overhead. You will need to consider the effect that this will have on your recovery time if a large number of mounts are required on any system participating in shared file system.
6. The TAG parameter is intended for file systems that don't support storing the file tag, such as NFS remote file systems.
7. Do not use the TAG parameter simultaneously with the NFS Client Xlate option. If you do, the mount will fail.
8. The UNMOUNT keyword is not available to automounted file systems.

File system recovery and TSO MOUNT

File system recovery in a shared file system environment takes into consideration file system specifications such as AUTOMOVE | NOAUTOMOVE | UNMOUNT, and whether or not the file system is mounted read-only or read/write.

Generally, when an owning system fails, ownership over its AUTOMOVE mounted file systems is moved to another system and the file is usable. However, if a file system is mounted read/write and the owning system fails, then all file system operations for files in that file system will fail. This is because data integrity is lost when the file system owner fails. All files should be closed (BPX1CLO) and reopened (BPX1OPN) when the file system is recovered. (The BPX1CLO and BPX1OPN callable services are discussed in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.

For file systems that are mounted read-only, specific I/O operations that were in progress at the time the file system owner failed may need to be re-attempted. Otherwise, the file system is usable.

In some situations, even though a file system is mounted AUTOMOVE, ownership of the file system may not be immediately moved to another system. This may occur, for example, when a physical I/O path from another system to the volume where the file system resides is not available. As a result, the file system becomes unowned (the system will issue message BPXF213E when this occurs). This is true if the file system is mounted either read/write or read-only. The file system still exists in the file system hierarchy so that any dependent file systems that are owned by another system are still usable.

However, all file operations for the unowned file system will fail until a new owner is established. The shared file system support will continue to attempt recovery of AUTOMOVE file systems on all systems in the sysplex that are enabled

for shared file system. Should a subsequent recovery attempt succeed, the file system transitions from the unowned to the active state.

Applications using files in unowned file systems must close (BPX1CLO) those files and reopen (BPX1OPN) them after the file system is recovered.

File systems that are mounted NOAUTOMOVE will become unowned when the file system owner exits the sysplex. The file system will remain unowned until the original owning system restarts or until the unowned file system is unmounted. Since the file system still exists in the file system hierarchy, the file system mount point is still in use.

An unowned file system is a mounted file system that does not have an owner. The file system still exists in the file system hierarchy. As such, you can recover or unmount an unowned file system.

File systems associated with a 'never move' PFS will be unmounted during dead system recovery. For example, TFS is a 'never move' PFS and will be unmounted, as well as any file systems mounted on it, when the owning system leaves the sysplex.

As stated in "Usage notes" on page 920, the UNMOUNT keyword is not available to automounted file systems. However, during dead system recovery processing for an automounted file system (whose owner is the dead system), the file system is unmounted if it is not being referenced by any other system in the sysplex.

Return codes

0 Processing successful.
4 Processing incomplete. An asynchronous mount is in progress.
12 Processing unsuccessful. An error message has been issued.

Examples

1. To mount HFS.WORKDS on the directory /u/openuser, enter:

   ```
   MOUNT filesystem('HFS.WORKDS') MOUNTPOINT('/u/openuser') TYPE(HFS)
   ```

2. The following example mounts the z/OS UNIX directory /u/shared_data, which resides on the remote host named **mvshost1**, onto the local directory /u/jones/mnt. The command may return before the mount is complete, allowing the mount to be processed in parallel with other work. The SETUID and SETGID bits are honored on any executable programs:

   ```
   MOUNT filesystem('MVSHOST1.SHARE.DATA') MOUNTPOINT('/u/jones/mnt')
         TYPE(NFSC) PARM('mvshost1:/hfs/u/shared_data') NOWAIT SETUID
   ```

3. Examples for using the TAG parameter are:

   TAG(TEXT,819) identifies text files containing ASCII (ISO-8859-1) data.

   TAG(TEXT,1047) identifies text files containing EBCDIC (ISO-1047) data.

   TAG(NOTEXT,65535) tags files as containing binary or unknown data.

   TAG(NOTEXT,0) is the equivalent of not specifying the TAG parameter at all.

   TAG(NOTEXT,273) tags files with the German code set (ISO-273), but is ineligible for automatic conversion.

OBROWSE — Browse a z/OS UNIX file

Related information

Format

```
OBROWSE [-r xx] pathname
```

or

```
OBROWSE -r xx 'pathname'
```

or

```
OBROWSE
```

The path name is optional in the last example.

Description

The OBROWSE command browses files in the z/OS UNIX file system using the ISPF Browse facility.

If you enter the OBROWSE command without specifying a path name, the Browse Entry panel is displayed. From that panel, you can enter the directory name and file name of an existing file you want to browse. If you are browsing fixed-length records, you must also indicate the record length.

Parameters

pathname
Specifies the path name of the file to be browsed. The path name can be absolute or relative. It can be enclosed in single quotation marks. A relative path name is relative to the working directory of the TSO/E session (usually the HOME directory). Therefore, you should usually specify an absolute path name. If you enter the OBROWSE command from the shell, use the absolute path name. Avoid using spaces or single quotation marks within the path name.

Options

-o
By default, starting in V1R11, the ISPF browse dialog service is used when browsing z/OS UNIX files. Specify **-o** if you want OBROWSE to use the original dialog service.

-r *xx*
Sets the record length to be browsed for fixed length text files. *xx* is length. If **-r** *xx* is specified, the file will be processed as fixed length records. This lets you convert a variable length file to fixed length for viewing.

OCOPY — Copy an MVS data set member or z/OS UNIX file to another member or file

Format

```
OCOPY INDD(ddname1) OUTDD(ddname2)
BINARY | TEXT
CONVERT(character_conversion_table | YES | NO)
PATHOPTS (USE|OVERRIDE)
TO1047 | FROM1047
```

Description

You can use the OCOPY command to copy data between an MVS data set and the z/OS UNIX file system. For OCOPY, you need to use CONVERT for these two situations:
- Conversion between code pages IBM-037 and IBM-1047
- Conversion between ASCII and code page IBM-1047

The z/OS shell uses code page 1047, and MVS uses a country extended code page. You can convert data to or from code page 1047 while it is being copied.

If you are copying a file with double-byte data, do not use the CONVERT option.

Before using the OCOPY command, you must allocate the data set or file you are working with. When using the TSO/E ALLOCATE command or a JCL DD statement to allocate a file or data set, you can specify PATHMODE and PATHOPTS parameters along with the PATH parameter. For information about the use of these parameters with the JCL statement, see *z/OS MVS JCL Reference*. For information about the TSO/E ALLOCATE command, see *z/OS TSO/E Command Reference*.

You can use OCOPY to copy:
- A member of a partitioned data set (PDS or PDSE) to a file
- An MVS sequential data set to a file
- A file to a member of a PDS or PDSE
- A file to a sequential data set
- A file to a file
- A member of a PDS or PDSE to another member of a PDS or PDSE
- A member of a PDS or PDSE to a sequential data set
- An MVS sequential data set to another sequential data set
- An MVS sequential data set to a member of a PDS or PDSE

Both INDD and OUTDD can represent an MVS data set or a file. If the source (INDD) is an MVS data set and the target (OUTDD) is a z/OS UNIX file, then OCOPY copies an MVS data set to a file; the operation is the same as the OPUT command. If the source (INDD) is a z/OS UNIX file and the target (OUTDD) is an MVS data set, then OCOPY copies a file to an MVS data set; the operation is the same as the OGET command.

Both the target and source can be an MVS data set or member of a partitioned data set, or both can be a file. This function is typically used for code page conversion.

If PATHMODE, which sets the permission bits for a new file, is specified during allocation, it is used when creating a new file. If PATHMODE is not specified during the allocation of a new file, the allocation creates a file with the default permission of `000`, which means the user has no access to it.

Parameters

INDD(ddname1)
Specifies the ddname of the source. The ddname is up to 8 characters long.

OUTDD(ddname2)
Specifies the ddname of the target. The ddname is up to 8 characters long.

BINARY | TEXT
Specifies that the data to be copied is a binary file or text file.

BINARY
Specifies that the data to be copied is a binary file. The default is binary when copying a data set of undefined record format to a file.

When you specify BINARY, OCOPY operates without any consideration for <newline> characters or the special characteristics of DBCS data. For example, double-byte characters might be split between MVS data set records, or a "shift-out" state might span records.

TEXT
Specifies that the data to be copied is a text file. The default is text except when copying a data set of undefined record format to a file.

If you are using a DBCS-supported terminal, you should use TEXT. It is assumed that double-byte data in the file system includes the <newline> character in order to delineate line boundaries. Data within these lines that are delineated by <newline> characters must begin and end in the "shift-in" state.

CONVERT(character_conversion_table | YES | NO)
Specifies the character conversion table used to convert between the following:
- Code pages IBM-037 and IBM-1047
- The ASCII code page and IBM-1047

If this optional operand is omitted, the system copies the data without conversion.

Use this option for single-byte data only.

Specify the CONVERT value as one of the following:

character_conversion_table
Specify one of the following:

- **data_set_name(member_name)**. Specifies the name of the partitioned data set (library) and the name of the member that contains the character conversion table.
- **data_set_name**. Specifies the name of the partitioned data set (library) that contains the character conversion table as the default member. The default member name is BPXFX000. (BPXFX000 is an alias; when shipped by IBM, it points to BPXFX111.) A fully qualified data set name must be enclosed in single quotes.
- **(member_name)**. Specifies the name of the conversion table to be used. It is a member of a PDS. Since the data_set_name is omitted, the standard library concatenation is searched for the table. (The default library is SYS1.LINKLIB.)

  The following list summarizes what you can specify when you want to convert data to a different code page when copying single-byte data:
  - BPXFX100. Null character conversion table. Use this table if the square brackets at your workstation are at the same code points as the square brackets on code page 1047 (it is the default). Also use this table if you are using a DBCS terminal.
  - BPXFX111. Specifies a non-APL conversion table to convert between code pages IBM-037 and IBM-1047.
  - BPXFX211. Specifies an APL conversion table to convert between code pages IBM-037 and IBM-1047.
  - BPXFX311. Specifies an ASCII-EBCDIC conversion table to convert between code pages ISO8859-1 and IBM-1047.

YES
Specifies that the system is to perform conversion and use the default conversion table (BPXFX000) in the system library concatenation. (BPXFX000 is an alias; when shipped by IBM, it points to BPXFX111.)

NO Specifies that conversion not be done. NO is the same as omitting the CONVERT operand.

PATHOPTS(USE | OVERRIDE)
Specifies whether the OCOPY should use or override the PATHOPTS value specified during allocation. If the PATHOPTS is not specified in the allocation, OCOPY will open the file with the appropriate PATHOPTS.

USE
Specifies that the PATHOPTS value is to be enforced. If a file that was identified as read-only when it was allocated is identified as the output file for OCOPY, OCOPY fails. Similarly, if a write-only file is specified as the input file, OCOPY fails. USE is the default.

OVERRIDE
Specifies that the PATHOPTS value specified during allocation is to be ignored.

TO1047 | FROM1047

TO1047
Specifies that the TO section of the character conversion table is to be used. This is typically used to convert from code page IBM-037 or ASCII to code page IBM-1047.

FROM1047
Specifies that the FROM section of the conversion table is to be used. This is typically used to convert from code page IBM-1047 to code page IBM-037 or ASCII.

If the CONVERT operand is specified and this operand is omitted,

- Data copied from an MVS data set to a file uses the TO1047 section of the table.
- Data copied from a file to an MVS data set uses the FROM1047 section of the table.

If the CONVERT operand is specified for a copy from a file to a file or an MVS data set to an MVS data set, you must specify either TO1047 or FROM1047.

Usage notes

1. You can use OCOPY to copy a program object from a PDSE to the file system, and it will be executable there. If you have a load module in a partitioned data set, however, you must first use the IEBCOPY program to copy the load module from a partitioned data set to a PDSE and then subsequently use OCOPY to copy the module into the file system. The IEBCOPY converts the load module to a program object.

   Note: You can use the linkage editor to put the load module directly into the file system.
2. An executable file copied from the file system into an MVS data set is not executable under MVS. Some required directory information is lost during the copy. See *z/OS UNIX System Services User's Guide* for a discussion of copying executable files.

3. Data sets with spanned records are not allowed.
4. When you are copying into an existing file, data is appended to the end of the file if OAPPEND is specified in PATHOPTS. Otherwise, the existing file is overwritten.
5. Copying from text files in the z/OS UNIX file system to MVS data sets:
   - For text files, all <newline> characters are stripped during the copy. Each line in the file ending with a <newline> character is copied into a record of the MVS data set. You cannot copy a text file to an MVS data set in an undefined record format.
     - **For an MVS data set in fixed record format:** Any line longer than the record size is truncated. If the line is shorter than the record size, the record is padded with blanks.
     - **For an MVS data set in variable record format:** Any line longer than the largest record size is truncated and the record length is set accordingly. A change in the record length also occurs if the line is short.
6. Copying from binary files in the z/OS UNIX file system to MVS data sets:
   - For binary files, all data is preserved.
     - **For an MVS data set in fixed record format:** Data is cut into chunks of size equal to the record length. Each chunk is put into one record. The last record is padded with spaces or blanks.
     - **For an MVS data set in variable record format:** Data is cut into chunks of size equal to the largest record length. Each chunk is put into one record. The length of the last record is equal to the length of the data left.
     - **For an MVS data set in undefined record format:** Data is cut into chunks of size equal to the block size. Each chunk is put into one record. The length of the last record is equal to the length of the data left.
7. When you copy MVS data sets to text files in the z/OS UNIX file system, a <newline> character is appended to the end of each record. If trailing blanks exist in the record, the <newline> character is appended after the trailing blanks. MVS fixed block data sets have a fixed record length, which means that trailing blanks could exist up to the end of each record.
8. When you copy MVS data sets to binary files in the z/OS UNIX file system, the <newline> character is not appended to the record.

Return codes

0 Processing successful.
12 Processing unsuccessful. An error message has been issued.

Examples

1. The following commands copy an MVS sequential data set to a z/OS UNIX file. This is text data, and there is no code page conversion.
   - SYSUT1 is the ddname of the source data set, EMPLOYEE.DATA.
   - PATHNAME is the ddname of the target, which is the existing file **/u/admin/employee/data**.

   ```
   ALLOCATE FILE(sysut1) DATASET('employee.data')
   ALLOCATE FILE(pathname) PATH('/u/admin/employee/data')
   OCOPY INDD(sysut1) OUTDD(pathname) TEXT
   ```
2. The following commands copy a binary file into a member of a partitioned data set:
   - BINARY is the ddname of the source file, **bin/payroll**. This file is in the working directory.
   - MVSPDS is the ddname of the target data set member, APPL.CODES(PAYROLL)

```
ALLOCATE FILE(binary) PATH('/bin/payroll')
ALLOCATE FILE(mvspds) DATASET('appl.codes(payroll)')
OCOPY INDD(binary) OUTDD(mvspds) BINARY
```

3. The following commands copy system input from the MVS SYSIN data set to the file system and perform code page conversion:
   - SYSIN is the ddname of the source, IBMUSR.EMPLOYEE.DATA.
   - PATHNAME is the ddname of the target, **/u/admin/employee/data**. This file does not currently exist and is created by ALLOCATE.
   - This is text data.
   - The character conversion table is the default table, member BPXFX000 of the SYS1.BPXLATE data set. (BPXFX000 is an alias; when shipped by IBM, it points to BPXFX111.)
   - Because this is a copy from an MVS data set to a file, the section TO1047 of the conversion table is used by default.

     ```
     ALLOCATE FILE(sysin) DATASET('IBMUSR.EMPLOYEE.DATA')

     ALLOCATE FILE(pathname) PATH('/u/admin/employee/data')
     PATHMODE (sirwxu) PATHOPTS (ocreat, owronly)

     OCOPY INDD(sysin) OUTDD(pathname) TEXT CONVERT((BPXFX000))
     ```

     (BPXFX000 is an alias; when shipped by IBM, it points to BPXFX111.)
4. The following OCOPY command copies data from one MVS sequential data set to another MVS sequential data set and performs code page conversion. This example shows just the OCOPY command; the necessary ALLOCATE commands are not included.
   - SYSUT1 is the ddname of the source data set.
   - TRANSDD is the ddname of the target data set.
   - This is text data.
   - The data is converted using the user-specified character conversion table and the TO1047 section of the table.

     ```
     OCOPY INDD(sysut1) OUTDD(transdd) TEXT CONVERT('sys1.mylib(mytab)') TO1047
     ```

OEDIT — Edit a z/OS UNIX file

Format

```
OEDIT [-r xx] pathname
```

or

```
OEDIT [-r xx] 'pathname'
```

Description

The OEDIT command edits files in the z/OS UNIX file system using the ISPF Edit facility.

If you enter OEDIT without specifying a path name, the Edit Entry panel is displayed. From that panel, you can enter the directory name and file name of an existing file, or you can specify a directory name and file name for a new file. The Edit Entry panel also lets you specify an edit profile and an initial edit macro.

Parameters

pathname
Specifies the path name of the file to be edited. The path name can be absolute or relative. It can be enclosed in single quotation marks. A relative path name is relative to the working directory of the TSO/E session (typically the HOME directory). Therefore, you should typically specify an absolute path name. If you enter OEDIT from the shell, use the absolute path name. Avoid using spaces or single quotation marks within path names.

Options

-o By default, starting in V1R11, the ISPF edit dialog service is used when browsing z/OS UNIX files. Specify **-o** if you want OEDIT to use the original dialog service.

Rule: If the **-r** option flag is also specified, the **-o** option flag must be specified first.

–r *xx* Set the record length to be edited for fixed length text files. *xx* is the record length.

If **–r** *xx* is specified, the file will be processed as variable length but loaded into the editor as fixed length records and saved as fixed length records. This lets you convert a variable length file to fixed length. If any lines are longer than the specified record length, the edit session will not load the file and will issue the customary message that a line is too long.

Usage notes

1. ASCII files must be tagged as ISO8859-1 in order for OEDIT to automatically translate the file. Do not enter the OEDIT session and type `SOURCE ASCII`.
2. OEDIT attempts to load the file into a VB255 session. If this is an ISPF that supports wide edit (such as ISPF 4.1) and any line exceeds 235 characters, the width for the new session is the length of the longest line plus 25% to allow for some expansion.
3. The COPY command cannot copy in files that have records wider than the edit session.
4. The TSO region size must be large enough to hold the size of the file to be edited.
5. Two ISPF variables are available to edit macros:
   - HFSCWD this variable contains the path name for the directory in which the file being edited resides.
   - HFSNAME this variable contains the name of the file being edited.

OGET — Copy z/OS UNIX files into an MVS data set

Format

```
OGET  'pathname'
      mvs_data_set_name | mvs_data_set_name(member_name)
      BINARY | TEXT
      CONVERT(character_conversion_table | YES | NO)
```

Description

You can use the OGET command to copy a z/OS UNIX file:

- To a member of an MVS partitioned data set (PDS or PDSE)

- To an MVS sequential data set

and convert the data from code page 1047 to code page IBM-037 or ASCII while it is being copied. Do not use the CONVERT option when copying files that contain double-byte data. This option is used for single-byte data only, not for double-byte data.

Parameters

pathname
Specifies the path name of the file that is being copied to a data set. This operand is required. The path name is:

- A relative or absolute path name. A relative path name is relative to the working directory of the TSO/E session (usually the HOME directory). Therefore, you should usually specify an absolute path name.
- Up to 1023 characters long.
- Enclosed in single quotation marks.
- In uppercase or lowercase characters, which are not changed by the system.

mvs_data_set_name | mvs_data_set_name(member_name)
Specifies the name of an MVS sequential data set or an MVS partitioned data set member to receive the file that is being copied. One of these two operands is required. The data set name is:

- A fully qualified name that is enclosed in single quotation marks, or an unqualified name
- Up to 44 characters long
- Converted to uppercase letters by the system

BINARY | TEXT
Specifies whether the file being copied contains binary data or text.

BINARY
Specifies that the file being copied contains binary data.

When you specify BINARY, OGET operates without any consideration for <newline> characters or the special characteristics of DBCS data. For example, double-byte characters might be split between MVS data set records, or a "shift-out" state might span records.

TEXT
Specifies that the file being copied contains text. This is the default.

If you are using a DBCS-supported terminal, you should use TEXT. It is assumed that double-byte data in the file system includes the <newline> character in order to delineate line boundaries. Data within these lines that are delineated by <newline> characters must begin and end in the "shift-in" state.

CONVERT(character_conversion_table | YES | NO)
Specifies that the data being copied is to be converted from IBM-1047 to IBM-037 or ASCII. This operand is optional. If is omitted, the system copies the data without conversion.

Use this option for single-byte data only.

Specify the CONVERT value as one of the following:

character_conversion_table
Specify one of the following:

- **data_set_name(member_name)**. Specifies the name of the partitioned data set (PDS) and the name of the member that contains the character conversion table.
- **data_set_name**. Specifies the name of the partitioned data set (PDS) that contains the character conversion table. The table is the FROM1047 part in member BPXFX000. (This is an alias; when shipped by IBM, it points to BPXFX111.)
- **(member_name)**. Specifies the name of the conversion table to be used. It is a member of a PDS. Since the data_set_name is omitted, the standard library concatenation is searched for the table. (The default library is SYS1.LINKLIB.)

  The following list summarizes what you can specify when you want to convert data to a different code page when copying single-byte data:

  – BPXFX100. Null character conversion table. Use this table if the square brackets at your workstation are at the same code points as the square brackets on code page 1047 (it is the default). Also use this table if you are using a DBCS terminal.
  – BPXFX111. Specifies a non-APL conversion table to convert between code pages IBM-037 and IBM-1047.
  – BPXFX211. Specifies an APL conversion table to convert between code pages IBM-037 and IBM-1047.
  – BPXFX311. Specifies an ASCII-EBCDIC conversion table to convert between code pages ISO8859-1 and IBM-1047.

YES
Specifies that the system is to perform conversion and use the default conversion table (BPXFX000) in the standard library concatenation. (BPXFX000 is an alias; when shipped by IBM, it points to BPXFX111.)

NO Specifies that conversion not be done. NO is the same as omitting the CONVERT operand.

Do not use the CONVERT parameter on files containing double-byte data. double-byte data in the file system is in code page 939. If you need to convert to a code page other than 939, you use the **iconv** command.

Usage notes

1. For text files, all <newline> characters are stripped during the copy. Each line in the file ending with a <newline> character is copied into a record of the MVS data set. You cannot copy a text file to an MVS data set in an undefined record format.
   - **For an MVS data set in fixed record format:** Any line longer than the record size is truncated. If the line is shorter than the record size, the record is padded with blanks.
   - **For an MVS data set in variable record format:** Any line longer than the largest record size is truncated; the record length is set to the length of the line. A change in the record length also occurs if the line is short.

   For text mode transfer, if the line is longer than the record size, the line is truncated (for DBCS, perhaps in the middle of a double-byte character or in "shift-in" state). If the line is shorter than the record size, the record is padded with blanks.
2. For binary files, all data is preserved.

- **For an MVS data set in fixed record format:** Data is cut into chunks of size equal to the record length. Each chunk is put into one record. The last record is padded with spaces or blanks.
- **For an MVS data set in variable record format:** Data is cut into chunks of size equal to the largest record length. Each chunk is put into one record. The length of the last record is equal to the length of the data left.
- **For an MVS data set in undefined record format:** Data is cut into chunks of size equal to the block size. Each chunk is put into one record. The length of the last record is equal to the length of the data left.

For binary mode transfers, double-byte characters might be split between MVS data set records, or a "shift-out" state might span records.

3. If the MVS data set does not exist, OGET allocates a new data set, a sequential data set of variable record format. However, OGET does not allocate a new partitioned data set. The record length of the new data set is either 255 or the size of the longest line in the z/OS UNIX file system file, whichever is larger. Dynamic allocation services determine the block size and space, based on installation-defined defaults. If the defaults are not sufficient, you should allocate a new MVS data set and then specify it on OGET.

   A simple method of allocating a sufficient size is to specify a primary extent size and a secondary extent size equal to the number of bytes in the file being copied.
4. An executable file copied into an MVS data set is not executable under MVS, because some required directory information is lost during the copy to the partitioned data set.
5. Data sets with spanned records are not allowed.
6. If you are using a DBCS-supported terminal, the target MVS data set should be defined or defaulted to variable record format. The record length of the data set must be greater than or equal to the longest line in the z/OS UNIX file system file. (OGET can determine how long the longest line is if you ask it to allocate the target data set.)
7. OGET cannot be used to copy a load module out of a partitioned data set and into a file system. You have to use a binder to "flatten" the load module. For more information about copying load modules, see *z/OS UNIX System Services User's Guide*

Return codes

0 Processing successful.
12 Processing unsuccessful. An error message has been issued.

Examples

1. The following command copies a text file to an MVS sequential data set, converting from code page 1047 to code page IBM-037 using the default table BPXFX000. (BPXFX000 is an alias; when shipped by IBM, it points to BPXFX111.)
   - The path name of the file is **/u/admin/employee/data**.
   - The unqualified name of the sequential data set is EMPLOYEE.DATA.

   ```
   OGET '/u/admin/employee/data' EMPLOYEE.DATA TEXT CONVERT(YES)
   ```
2. The following command copies a text file to an MVS sequential data set, converting from code page 1047 to code page IBM-037 using conversion table BPXFX111 in the user's library data set.
   - The path name of the file is **/u/admin/employee/data**.

- The fully qualified name of the sequential data set is IBMUSR.EMPLOYEE.DATA.

```
OGET '/u/admin/employee/data' 'IBMUSR.EMPLOYEE.DATA'
        CONVERT('MY.LOADLIB(BPXFX111)')
```

OGETX — Copy z/OS UNIX files from a directory to an MVS PDS or PDSE

Format

```
OGETX  hfs_directory | hfs_file_name
       mvs_PDS_name | mvs_data_set_name(member_name)
       ASIS
       BINARY | TEXT
       CONVERT(character_conversion_table | YES | NO)
       LC
       QUIET
       SUFFIX(suffix)
```

Description

You can use the OGETX command to:

- Copy files in a z/OS UNIX system directory to a member of an partitioned data set (PDS) or PDSE
- Copy an individual file to a sequential data set or member of a partitioned data set

and convert the data from code page 1047 to code page IBM-037 or ASCII while it is being copied.

Do not use the CONVERT option when copying files that contain double-byte data. This option is used for single-byte data only, not for double-byte data.

This command uses the ISPF/PDF Edit facility.

Parameters

hfs_directory | hfs_file_name
Specifies the path name of the z/OS UNIX directory or file name that is being copied to an MVS PDS or PDSE. The files are copied into members of the PDS or PDSE.

Use `hfs_directory` when a PDS is specified. When a sequential data set or PDS member is specified, then the file name must be used.

These limitations apply to an MVS data set name:

- It can use uppercase alphabetic characters *A* through *Z*, but not lowercase letters.
- It can use numeric characters `0` through `9`, and the special characters @, #, and $.
- It cannot begin with a numeric character.
- The member name cannot be more than 8 characters. If a file name is longer than 8 characters or uses characters that are not allowed in an MVS data set name, the file is not copied.

The LC operand lets you copy z/OS UNIX system file names that are lowercase, mixed case, or uppercase.

Single quotation marks around the directory name or file name are optional.

mvs_PDS_name | mvs_data_set_name(member_name)
mvs_PDS_name specifies the name of an MVS PDS or PDSE to receive the z/OS UNIX system files that are being copied.
mvs_data_set_name(member_name) specifies the name of an MVS partitioned data set member to receive the file that is being copied. The name is:
- A fully qualified name that is enclosed in single quotation marks, or an unqualified name
- Up to 44 characters long, with an additional 8 characters for the member name
- Converted to uppercase letters

ASIS
Specifies that the _ character in path names *not* be translated to the @ character in member names. (It is a common convention to use @ symbols in PDS member names to correspond with the _ symbol in path names.)

BINARY | TEXT
Specifies whether the files in the directory being copied contains binary data or text. For more information, see Note 7 on page 936.

BINARY
Specifies that the files in the directory being copied contains binary data.

When you specify BINARY, OGET operates without any consideration for <newline> characters or the special characteristics of DBCS data. For example, double-byte characters might be split between MVS data set records, or a "shift-out" state might span records.

TEXT
Specifies that the files in the directory being copied contains text. This is the default.

If you are using a DBCS-supported terminal, you should use TEXT. It is assumed that double-byte data in the file system includes the <newline> character in order to delineate line boundaries. Data within these lines that are delineated by <newline> characters must begin and end in the "shift-in" state.

CONVERT(character_conversion_table | YES | NO)
Specifies that the data being copied is to be converted from code page 1047 to code page IBM-237 or ASCII; that is, the FROM1047 part of the specified character conversion table is used. This operand is optional. If it is omitted, the system copies the data without conversion.

Use this option for single-byte data only.

Specify the CONVERT value as one of the following:

character_conversion_table
Specify one of the following:
- **data_set_name(member_name)**. Specifies the name of the partitioned data set (PDS) and the name of the member that contains the character conversion table.
- **data_set_name**. Specifies the name of the partitioned data set (PDS) that contains the character conversion table. The table is the FROM1047 part in member BPXFX000. (This is an alias; when shipped by IBM, it points to BPXFX111.)

- **(member_name)**. Specifies the name of the conversion table to be used. It is a member of a PDS. Because the data_set_name is omitted, the standard library concatenation is searched for the table. (The default library is SYS1.LINKLIB.)

  The following list summarizes what you can specify when you want to convert data to a different code page when copying single-byte data:

  – BPXFX100. Null character conversion table. Use this table if the square brackets at your workstation are at the same code points as the square brackets on code page 1047 (it is the default). Also use it if you are using a DBCS terminal.
  – BPXFX111. Specifies a non-APL conversion table to convert between code pages IBM-037 and IBM-1047.
  – BPXFX211. Specifies an APL conversion table to convert between code pages IBM-037 and IBM-1047.
  – BPXFX311. Specifies an ASCII-EBCDIC conversion table to convert between code pages ISO8859-1 and IBM-1047.

YES
Specifies that the system is to perform conversion and use the default conversion table (BPXFX000) in the standard library concatenation. (BPXFX000 is an alias; when shipped by IBM, it points to BPXFX111.)

NO Specifies that conversion not be done. NO is the same as omitting the CONVERT operand.

Do not use the CONVERT parameter on files containing double-byte data. double-byte data in the file system is in code page 939. If conversion to a code page other than 939 is required, you should use the **iconv** command.

LC Specifies that the z/OS UNIX system file names can be lowercase, uppercase, or mixed. If LC is not specified, the z/OS UNIX system file names must be uppercase. File names are converted to uppercase member names.

QUIET
Turns off the echoing of the OGET command before a file is copied.

SUFFIX(suffix)
Specifies that files with the files created by (suffix) be copied and the suffix be dropped from the z/OS UNIX system file name when the PDS members are created.

A *suffix* is an optional additional file identifier that is appended to the file name following the first period (.). It is typically used to identify the type of file.

Usage notes

1. Avoid using OGETX with path names containing single quotation marks or spaces.
2. For text files, all <newline> characters are stripped during the copy. Each line in the file ending with a <newline> character is copied into a record of the MVS data set. You cannot copy a text file to an MVS data set in an undefined record format.
   - **For an MVS data set in fixed record format:** Any line longer than the record size is truncated. If the line is shorter than the record size, the record is padded with blanks.

- **For an MVS data set in variable record format:** Any line is longer than the largest record size is truncated; the record length is set accordingly. A change in the record length also occurs if the line is short.

3. For binary files, all data is preserved.
   - **For an MVS data set in fixed record format:** Data is cut into chunks of size equal to the record length. Each chunk is put into one record. The last record is padded with spaces or blanks.
   - **For an MVS data set in variable record format:** Data is cut into chunks of size equal to the largest record length. Each chunk is put into one record. The length of the last record is equal to the length of the data left.
   - **For an MVS data set in undefined record format:** Data is cut into chunks of size equal to the block size. Each chunk is put into one record. The length of the last record is equal to the length of the data left.
4. Data sets with spanned records are not allowed.
5. Before the copy, the OGET command for a file is echoed, unless you specify the QUIET option. If you did not specify QUIET and if the command is not echoed for a file, it has not met the copy criteria and is not copied.
6. If more than one file name is the same, the file is overwritten on each subsequent copy. For example, if you specify a copy of **Pgma** and **pgma** and use LC, the first file copied is overwritten. Or if you copy **pgma.h** and **pgma.c** and specify SUFFIX, the first file copied is overwritten.
7. If the target data set is a PDS with an undefined record format, the files may be treated as load modules. A load module is copied by link-editing it into the target library. For the program to be able to execute, the entry point must be at the beginning of the load module.

   For OGETX to treat the file as a load module, do not specify either TEXT nor BINARY.
8. If the source for the copy is a file, the target can be specified as a PDS. The member name used is the file name, which is in uppercase and has had any suffixes removed. Any remaining characters in the member name that are not valid in member names cause the copy to fail. You do not have to specify a file as a target with a sequential data set, or a directory as a target with a PDS. The ASIS option is not affected.

Examples

1. The following command copies the files in the z/OS UNIX system directory **/usr/sbllib** to the MVS PDS named DATAFILE, removing any suffixes appended to the z/OS UNIX system files and accepting lowercase file names.

   ```
   OGETX /usr/sbllib/ DATAFILE LC SUFFIX
   ```

   The members **/usr/sbllib/program1.c**, **/usr/sbllib/list.prg**, and **usr/sbllib/program2.c** become DATAFILE(PROGRAM1), DATAFILE(LIST), and DATAFILE(PROGRAM2).
2. The following command copies the files with the suffix of **c** in the z/OS UNIX system directory **/usr/sbllib** to the MVS PDS named DATAFILE, removing the **.c** suffix appended to the z/OS UNIX system files and accepting lowercase file names.

   ```
   OGETX /usr/sbllib/ DATAFILE LC SUFFIX(c)
   ```

   The members **/usr/sbllib/program1.c**, **/usr/sbllib/list.prg**, and **usr/sbllib/program2.c** become DATAFILE(PROGRAM1) and DATAFILE(PROGRAM2).

OMVS — Invoke the z/OS shell

Format

```
OMVS ALARM | NOALARM
     AUTOSCROLL | NOAUTOSCROLL
     CONVERT(character_conversion_table)
     DBCS | NODBCS
     DEBUG(NO | YES | EVENT | DATA)
     ECHO | NOECHO
     ENDPASSTHROUGH(ATTN | CLEAR | CLEARPARTITION |
         ENTER | NO | PA1 | PA3 | PF1 | PF2 | PF3 ... PF24 | SEL)
     ESCAPE('escape-characters')
     LINES(n)
     PFn
         (ALARM | NOALARM |
          AUTOSCROLL | NOAUTOSCROLL |
          BACKSCR |
          BOTTOM |
          CLOSE |
          CONTROL |
          ECHO | NOECHO |
          FWDRETR |
          HALFSCR
          HELP |
          HIDE | NOHIDE |
          NEXTSESS |
          NO |
          OPEN |
          PFSHOW | NOPFSHOW |
          PREVSESS |
          QUIT |
          QUITALL |
          REFRESH |
          RETRIEVE
          RETURN |
          SCROLL |
          SUBCOMMAND |
          TOP |
          TSO )
     PFSHOW | NOPFSHOW
     RUNOPTS('LE/370-runtime-options')
     SESSIONS(n)
     SHAREAS | NOSHAREAS
     WRAPDEBUG(n)
```

Description

Use the OMVS command to invoke the z/OS shell. You can select options on the OMVS command to customize aspects of the shell interface, such as the function keys.

After you are working in a shell session, you can switch to subcommand mode, return temporarily to TSO/E command mode, or end the session by exiting the shell.

Parameters

ALARM | NOALARM
Controls the sounding of the 3270 alarm to alert you to particular events. The default is ALARM.

ALARM
Causes the 3270 alarm to sound when the <alert> character is encountered in data being sent to the workstation.

NOALARM
Prevents the 3270 alarm from sounding when the <alert> character is encountered in data being sent to the workstation.

AUTOSCROLL | NOAUTOSCROLL
Controls the setting of the autoscroll function. The default is AUTOSCROLL.

AUTOSCROLL
Specifies automatic scrolling of input and output written to the screen.

NOAUTOSCROLL
Specifies that there not be automatic scrolling.

CONVERT(character_conversion_table)
Specifies the character conversion table used to convert between the z/OS code page and the code page used in the shell.

data_set_name(member_name)
Specifies the name of the partitioned data set (PDS) and the name of the member that contains the character conversion table.

data_set_name
Specifies the name of the partitioned data set containing the character conversion table to be used.

(member_name)
Specifies the name of the character conversion table to be used. It is the name of a member in a partitioned data set.

If both the member_name and data_set_name are omitted, member FSUMQ000 in the default module search order is used as the character conversion table. Table 38 lists the various formats of the OMVS CONVERT command:

Table 38. Various formats of the OMVS CONVERT command (OMVS command)

Command format	What it does
OMVS CONV((BPXFX111))	See Note 1.
OMVS CONV('SYS1.XXXX')	Looks for SYS1.XXXX(FSUMQ000). See Note 2.
OMVS CONV('SYS1.XXXX(BPXFX111)')	Looks for SYS1.XXXX(BPXFX111)
OMVS CONV(XXXX)	Looks for *prefix*.XXXX(FSUMQ000)
OMVS CONV(XXXX(BPXFX111))	Looks for *prefix*.XXXX(BPXFX111)

Table 38. Various formats of the OMVS CONVERT command (OMVS command) (continued)

Command format	What it does

Note:
1. If the data_set_name is omitted, z/OS UNIX locates member_name using the default search order for modules in the system library concatenation. The located member_name is used as the character conversion table. For example, if you specify:
`OMVS CONVERT((BPXFX111))`
the character conversion table is BPXFX111 in the default module search order in the system library concatenation.
If the member name is omitted, the OMVS command looks in the specified data_set_name for member FSUMQ000, to use it as the character conversion table. For example, if you specify:
`OMVS CONVERT('SYS1.XLATE') ...`
OMVS uses SYS1.XLATE(FSUMQ000) as the character conversion table.
2. FSUMQ000 is an alias; when shipped by IBM, it points to BPXFX100, the default null character conversion table.	

Table 39 lists the character conversion tables supplied with the OMVS command. It shows the locale name, the conversion table to specify, and the default escape character for that table. If you are using the **De_CH.IBM-500** locale, you must specify BPXFX450 as the conversion table, and the default escape character for that particular table is the topic sign, §. To specify BPXFX450 as the conversion table, issue:

```
CONVERT((BPXFX450))
```

Table 39. Locales, their conversion tables, and default escape characters (OMVS command)

Shell and Utilities locale	3270 code page	Shell code page	Conversion table	Default escape character
De_CH.IBM-500	IBM-500	IBM-500	BPXFX450	§
De_DE.IBM-273	IBM-273	IBM-273	BPXFX473	§
De_DK.IBM-277	IBM-277	IBM-277	BPXFX477	¤
En_GB.IBM.285	IBM-285	IBM-285	BPXFX485	¯ (the overline character)
En_JP.IBM-1027	IBM-1047	IBM-1047	BPXFX100	¢
En_US.IBM-037	IBM-037	IBM-037	BPXFX437	¢
En_US.IBM-1047(For APL terminals)	IBM-037	IBM-1047	BPXFX211	¢
En_US.IBM-1047	IBM-037	IBM-047	BPXFX111	¢
Es_ES.IBM-284	IBM-284	IBM-284	BPXFX484	¨
Fi_FI.IBM-278	IBM-278	IBM-278	BPXFX478	§
Fr_BE.IBM-500	IBM-500	IBM-500	BPXFX450	§
Fr_CA.IBM-037	IBM-037	IBM-037	BPXFX437	¢
Fr_CA.IBM-1047	IBM-037	IBM-1047	BPXFX111	¢
Fr_CH.IBM-500	IBM-500	IBM-500	BPXFX450	§
Fr_FR.IBM-297	IBM-297	IBM-297	BPXFX497	§
Is_IS.IBM-871	IBM-871	IBM-871	BPXFX471	¨

Table 39. Locales, their conversion tables, and default escape characters (OMVS command) (continued)

Shell and Utilities locale	3270 code page	Shell code page	Conversion table	Default escape character
It_IT.IBM-280	IBM-280	IBM-280	BPXFX480	§
Ja_JP.IBM-939	IBM-939	IBM-939	BPXFX100	¢
Ja_JP.IBM-1027	IBM-1027	IBM-1027	BPXFX100	¢
Nl_BE.IBM-500	IBM-500	IBM-500	BPXFX450	§
Nl_NL.IBM-037	IBM-037	IBM-037	IBM-037	¢
Nl_NL.IBM-1047	IBM-037	IBM-1047	BPXFX111	¢
No_NO.IBM-277	IBM-277	IBM-277	BPXFX477	¤
Pt_PT.IBM-037	IBM-037	IBM-037	BPXFX437	¢
Pt_PT.IBM-1047	IBM-037	IBM-1047	BPXFX111	¢
Sv_SE.IBM-278	IBM-278	IBM-278	BPXFX478	§
Xx_XX.**IBM-1047**	IBM-1047	IBM-1047	BPXFX100	¢

DBCS | NODBCS
Specifies whether to use DBCS on 3270-type terminals. The default is DBCS processing.

DBCS
Causes OMVS to automatically determine whether the terminal supports DBCS. If so, DBCS processing takes place. It also enables the OMVS command to handle double-byte data in translated messages. This operand is ignored if you're not using a DBCS terminal.

Double-byte data, including escape character strings, cannot be supplied for any of the OMVS command operands. The following data strings used by OMVS must contain single-byte characters only:
- Escape characters
- Conversion table data set name
- Conversion table member name
- Password or password phrase used to access the conversion table, if one is required

Restriction: OMVS supports only code pages 939, 1027, and 1047 on DBCS. The null character conversion table (BPXFX100) should be used with DBCS terminals. (It is the default.)

NODBCS
Specifies that OMVS operate in SBCS mode only. If you are logged on to a terminal that supports DBCS, this operand allows you to bypass DBCS processing.

DEBUG(NO | YES | EVENT | DATA)
Controls the collection and output of debugging information. The default is NO; change the default setting only if IBM requests it.

NO Indicates that no debugging information is to be written.

YES
Indicates that debugging information is collected while the OMVS command runs.

EVENT
Causes additional debugging information to be written whenever certain internal events occur in the OMVS command.

DATA
Causes any data received from or sent to the workstation to be written. Also, debug information for internal events is recorded.

Also, the ddname for the OMVS debug data set is always SYSFSUMO.

ECHO | NOECHO
Enables OMVS to control the visibility of the input area. The default is NOECHO.

ECHO
Allows OMVS to hide or unhide the input area.

NOECHO
Prevents OMVS from hiding and unhiding the input area.

ENDPASSTHROUGH(ATTN | CLEAR | CLEARPARTITION | ENTER | NO | PA1 | PA3 | PF1 | PF2 | PF3 ... PF24 | SEL)
Specifies a 3270 key that ends TSO/3270 passthrough mode and forces OMVS to return to the shell session. Because this key would be used only during application development, the default is ENDPASSTHROUGH(NO). All 3270 keys can be used by the 3270 application.

ATTN
Specifies the 3270 <Attention> key. In some 3270 applications, this key may be changed to <PA1> before it is seen by the TSO/E OMVS command. If so, OMVS will never see the <Attention> key; specify <PA1>instead of <ATTN>.

With some terminal connections, the <ATTN> key may not be available.

CLEAR
Specifies the 3270 CLEAR key. In some TS0/3270 applications, the TSO/E OMVS command will not see <CLEAR> when the CLEAR key is pressed. In these cases, specifying ENDPASSTHROUGH(CLEAR) will have no effect.

CLEARPARTITION
Specifies the 3270 <Clear Partition> key. This key is effective only if the application is using explicit 3270 partitions.

ENTER
Specifies the 3270 ENTER key. This key is useful only if the 3270 application is completely driven by PF or PA keys.

NO No breakout key; this is the default.

PA1
Specifies the 3270 <PA1>key. For some TSO/3270 applications, <PA1> is changed to <ATTN> before OMVS sees it. In these cases, you should specify ENDPASSTHROUGH(ATTN).

In general, the provider of the TSO/3270 application needs to tell the user whether <PA1>, <ATTN>, or <CLEAR> can be used for ENDPASSTHROUGH.

PA3
Specifies the 3270 <PA3> key. The <PA3> key may not be available on some keyboards.

PF*n*
Specifies the 3270 function keys 1–9.

PF*nn*
Specifies the 3270 function keys 10–24.

SEL
Specifies the 3270 Cursor Select key. This key is useful only when the 3270 application creates fields on the 3270 screen that can be selected by a light pen.

ESCAPE('escape-characters')
Specifies an escape character as the first character in a two-character sequence that is the EBCDIC equivalent of an ASCII control character (for example, the EBCDIC "ød" is the equivalent of the ASCII "Ctrl-D"). When an escape character is typed in the input area, the next character typed is converted into a special character before it is passed to the shell.

You can enter a string up to eight escape characters, enclosed in single quotes with no space between them. (Do not use nonprintable EBCDIC characters.)

The default escape character depends on the character conversion table being used. (See Table 39 on page 939 for a list of default characters and the conversion tables they are used with.) To enter <Ctrl-D>, for example, type in `ød` or `øD` in the input area.

If the last character in the input area is one of the escape characters, the <newline> character normally appended to the input data is suppressed. For example, to enter only a <Ctrl-Q> with no final <newline>, type the string `øQø` in the input area, and press <Enter>.

LINES(n)
Controls the amount of output data the OMVS command keeps for scrolling. The default is roughly four screenfuls. You can specify that between 25 and 3000 lines should be kept in the output buffer.

PFn(ALARM | NOALARM | AUTOSCROLL | NOAUTOSCROLL | BACKSCR | BOTTOM | CLOSE | CONTROL | ECHO | NOECHO FWDRETR | HALFSCR | HELP | HIDE | NOHIDE NEXTSESS | NO | OPEN | PFSHOW | NOPFSHOW | PREVSESS | QUIT | QUITALL | REFRESH | RETRIEVE | RETURN | SCROLL | SUBCOMMAND | TOP | TSO)
Customizes the settings for the function keys that you use while working in the z/OS shell or in subcommand mode. in <PF*n*> The *n* is a one- or two-digit function key number from 1 to 24. Do not use a leading zero for a one-digit number. More than one function key can be assigned the same function. For example, both <PF1> and <PF13> are assigned the Help function by default.

All PF keys can be abbreviated using the usual TSO/E rules. For example,

- OPEN can be abbreviated as O, OP, or OPE.
- NEXTSESS can be abbreviated as NE, NEX, NEXT, NEXTS, NEXTSE, or NEXTSES.
- PFSHOW can be abbreviated as PF, and NOPFSHOW can be abbreviated as NOPF.

ALARM | NOALARM
A toggle key used to turn on and off the 3270 alarm that sounds when an <alert> character is written to the output area (also available in subcommand mode).

The label for this PF key (in the PF key lines at the bottom of the screen) shows up as either ALARM or NOALARM, depending on the current toggle setting. If it is ALARM, pressing this PF key turns the alarm on. If it is NOALARM, pressing this PF key turns the alarm off.

AUTOSCROLL | NOAUTOSCROLL
A toggle key used to turn the autoscroll function on and off (also available in subcommand mode). The screen automatically scrolls forward when new input is written to the screen.

The label for this PF key (in the PF key lines at the bottom of the screen) shows up as either AUTOSCROLL or NOAUTOSCROLL, depending on the current toggle setting. If it is AUTOSCROLL, pressing this PF key turns the autoscroll function on. If it is NOAUTOSCROLL, pressing this PF key turns the autoscroll function off.

BACKSCR
Scrolls the screen backward one full screen, redisplaying previously displayed output lines. The scrolling ends when the oldest available saved line is reached. (This option is also available in subcommand mode.)

If you first move the cursor into the output area, the line with the cursor becomes the top line.

BOTTOM
Scrolls help information forward to the last panel of information, and scrolls output forward the last full screen (also available in subcommand mode).

CLOSE
Ends the displayed session and switches to another one, or returns to TSO/E if the only session was closed (also available in subcommand mode).

CONTROL
Treats all characters in the input area as if they were preceded by an escape character. Also, no trailing <newline> is appended to the data.

ECHO | NOECHO
A toggle key used to control whether the shell command can hide or unhide the OMVS command input area.

The label for this PF key (in the PF key lines at the bottom of the screen) shows up as either ECHO or NOECHO, depending on the current toggle setting. If it is ECHO, pressing this PF key allows the current shell command to hide or unhide the OMVS command input area. If it is NOECHO, pressing this PF key prevents the current shell command from hiding or unhiding the OMVS input area.

FWDRETR
Retrieves the oldest available input line from a stack of saved input lines, starting with the oldest and moving up to the most recent line (also available in subcommand mode).

HALFSCR
Scrolls half the displayed screen forward, allowing room for more output data. If the output area on the screen is not full, half the displayed lines are scrolled off the screen. If you first move the cursor into the output area, the line with the cursor becomes the middle line. (This option is also available in subcommand mode.)

HELP
Temporarily suspends the session and displays the help information for the OMVS command. The scrolling function keys can be used to look at the help information. To exit the help information, press the Return function key. (This option is also available in subcommand mode.)

HIDE | NOHIDE
Temporarily hides or unhides the input data you type on the shell command line. If you press this PF key while the input area is hidden, the input area is made visible. If it is not hidden, the input area is hidden.

The input area stays hidden or unhidden until:

- You press <Enter>.
- You press the HIDE | NOHIDE PF key.
- You switch to another session, escape to TSO/E and return, or enter subcommand mode and return.

If OMVS is running in NOECHO mode, the input area will be visible after you take one of these actions. If OMVS is running in ECHO mode, the visibility of the input area depends on the shell command you are running.

NEXTSESS
Switches to the next (higher-numbered) session (also available in subcommand mode).

NO
Deactivates a function key so that it doesn't do anything (also available in subcommand mode).

OPEN
Starts a new shell session and switches to it (also available in subcommand mode).

PFSHOW | NOPFSHOW
Toggles on and off the display of the active function key settings at the bottom of the screen (also available in subcommand mode, and can be used as PF and NOPF).

PREVSESS
Switches to the previous (lower-numbered) session (also available in subcommand mode).

QUIT
Ends the displayed session and switches to another one, or returns to TSO/E if the only session was closed (also available in subcommand mode).

QUITALL
Ends all shell sessions and causes OMVS to end and to return to TSO/E (also available in subcommand mode).

REFRESH
Updates the screen with the latest output data. Use this function key if the display of output is incomplete, but the session is now displaying `INPUT` status. For more information about the status field, see *z/OS UNIX System Services User's Guide*. (This option is also available in subcommand mode.)

RETRIEVE
Retrieves the most recently entered input line from a stack of saved input lines, starting with the most recent and moving down to the oldest available line (also available in subcommand mode).

RETURN
If help information is displayed, returns you to the session you were in. If you are in subcommand mode, returns you to the shell. (This option is also available in subcommand mode.)

SCROLL
Scrolls the last line of output data to the top of the screen, making room for more output data. If Help information is displayed, its data is scrolled. If you first move the cursor into the output area, the line with the cursor becomes the top line. (This option is also available in subcommand mode.)

SUBCOMMAND
If you press this key when the command line is blank, it leaves the shell session and enters subcommand mode.

To run a subcommand without switching to subcommand mode, type the subcommand at the command line and then press the function key. You can enter the OMVS subcommands at the command line when you are in subcommand mode.

TOP
Scrolls help information backward to the first panel, and scrolls output backward to a screen full of the oldest available output (also available in subcommand mode).

TSO
If you press this key when the command line is blank, it temporarily suspends a shell session or subcommand mode, and you are in a TSO/E session. You can enter TSO/E commands. Press <PA1> or the <Attention> key to exit TSO/E command mode and return to the session you were in. (This option is also available in subcommand mode.)

To run a TSO/E command without suspending the shell session or subcommand mode, type the command at the command line and then press the function key. When the command completes, you can continue working in the shell session or subcommand mode.

Function key defaults:

PF1(HELP)
PF2(SUBCOMMAND)
PF3(RETURN)
PF4(TOP)
PF5(BOTTOM)
PF6(TSO)
PF7(BACKSCR)
PF8(SCROLL)
PF9(NEXTSESS)
PF10(REFRESH)
PF11(FWDRETR)
PF12(RETRIEVE)
PF13(HELP)
PF14(SUBCOMMAND)
PF15(RETURN)
PF16(TOP)
PF17(BOTTOM)
PF18(TSO)
PF19(BACKSCR)
PF20(SCROLL)
PF21(NEXTSESS)
PF22(REFRESH)
PF23(FWDRETR)
PF24(RETRIEVE)

PFSHOW | NOPFSHOW
Specifies that the PF keys be shown at the bottom of the screen. The default is PFSHOW.

PFSHOW
Specifies that PF keys be shown at the bottom of the screen.

NOPFSHOW
Specifies that PF keys not be shown at the bottom of the screen.

RUNOPTS('run-time-options')
Specifies a string containing run-time options, which are passed to Language Environment when the TSO/E OMVS command starts up, and to the initial login shell program in the _CEE_RUNOPTS environment variable. These options are the same as those passed to other Language Environment programs run from the TSO READY prompt.

The options string can be from 1 to 1000 characters in length, and should contain valid run-time options. It should not contain options such as POSIX(OFF), TRAP(OFF), TRAP(ON,NOSPIE), or MSGFILE(), or characters such as slashes, unbalanced parentheses or quotes, or imbedded NULL characters. Specifying such options or using these characters will cause unpredictable problems when the TSO/E OMVS command runs.

If the RUNOPTS operand is omitted, OMVS uses the RUNOPTS string defined in the BPXPRMxx member of SYS1.PARMLIB that is active for the OMVS kernel. If no RUNOPTS string was defined in BPXPRMxx, no default run-time options are used when the TSO/E OMVS command starts up.

For more information, refer to *z/OS Language Environment Programming Guide* which contains a discussion about restrictions on _CEE_RUNOPTS environment variable settings.

SESSIONS(n)
Specifies the initial number of sessions to be started. The default is 1, and the allowed range is 1 to 100; most users will use two or three sessions.

Note: You can specify a number from 1 to 100 without getting a syntax error on the command. Normally, you cannot start more than several sessions before getting an error message. If you try to start too many sessions (the limit depends on the size of your TSO/E address space), your TSO/E user ID runs out of storage and various unpredictable errors may occur. You may have to log off your TSO/E user ID before you can continue.

SHAREAS | NOSHAREAS
Specifies whether to run the shell program in a separate address space. Both OMVS and the shell will run in the TSO/E address space when OMVS is invoked with the SHAREAS parameter.

OMVS will use SHAREAS as the default if the shell program is not a SETUID or SETGID program and the owning UID or GID is not the same as the current user.

SHAREAS
Runs the shell program in the same TSO/E address space as OMVS. SETUID and SETGID shell programs cannot be run with the SHAREAS option unless your UID or GID owns the shell program.

Note: If you end OMVS while in SHAREAS mode, the shell process ends immediately. (It may get killed, but it will usually end by itself when the TTY is closed.)

NOSHAREAS
Runs the shell program in a separate address space. SETUID and SETGID shell programs usually require this option.

WRAPDEBUG(n)
Controls how many lines of debug data OMVS writes out before wrapping around to the top of the debug data set. This option is effective only if the **DEBUG(YES) DEBUG(EVENT)**, or **DEBUG(DATA)** options are used.

The **WRAPDEBUG(n)** value specifies how many lines of debug data OMVS writes out before wrapping around to the top of the debug data set. The default number of lines is 10 000. The value of **n** must be between 100 and 1 000 000 000. The debug data set must be large enough to hold **n** 80-byte lines of debug data. If the debug data set is too small, debug recording stops when the data set fills up.

Subcommands

When the shell is active, you can enter subcommand mode by pressing the Subcommand function key. While in subcommand mode, you can enter subcommands on the command line or use function keys.

ALARM
Turns on the 3270 alarm which sounds when an <alert> character is written to the output area.

AUTOSCROLL
Activates automatic forward scrolling of output as new input is written to the screen.

BACKSCR
Scrolls the screen backward one full screen, redisplaying previously deleted output lines. The scrolling ends when the oldest available saved line is reached.

BOTTOM
If the help information is displayed, it is scrolled forward to the last panel of information. If output is displayed, it is scrolled forward to the last screen of output.

CLOSE
Ends the displayed session and switches to another one, or returns to TSO/E if the only session was closed.

ECHO
Allows the current shell command to control whether the OMVS input area is visible or hidden. The HIDE subcommand, NOHIDE subcommand, and HIDE | NOHIDE PF keys can temporarily override the input area visibility set by the current shell command.

HALFSCR
Scrolls half the displayed screen forward, allowing room for more output data.

HELP
Displays help information for the OMVS command. To view the help information, use the scrolling function keys. To return from Help to the session, press the Return function key.

? is a short form for the Help subcommand.

HIDE
Temporarily hides the input data you type on the shell command line. The input area stays hidden until you do one of the following actions:

- Press <Enter>.
- Press the HIDE | NOHIDE PF key.
- Switch to another session, escape to TSO and return, or enter subcommand mode and return.

If OMVS is running in NOECHO mode, the input area will be visible after you take one of these actions. If it is running in ECHO mode, whether you can see the input area depends on the shell command you are running.

NEXTSESS
Switches to the next (higher-numbered) session.

NOALARM
Prevents the 3270 alarm from sounding when the <alert> character is encountered in data being sent to the workstation.

NOAUTOSCROLL
Turns off the automatic scrolling (AUTOSCROLL) function.

NOECHO
Causes the OMVS input area to remain visible regardless of the current shell command. You can use the HIDE subcommand and the PF key to temporarily hide the input area.

NOHIDE
Temporarily unhides the input data you type on the shell command line. The input area remains visible until you do one of the following actions:

- Press <Enter>.
- Press the HIDE | NOHIDE PF key.
- Switch to another session, escape to TSO and return, or enter subcommand mode and return.

If OMVS is running in NOECHO mode, the input area remains visible after you take one of these actions. If OMVS is running in ECHO mode, the visibility of the input area depends on the shell command you are running.

NOPFSHOW
Turns off the display of the function key settings and escape characters at the bottom of the screen.

OPEN
Starts a new shell session and switches to it.

PFSHOW
Displays the current function key settings and escape characters on the bottom two lines of the display screen. A maximum of two screen lines is used. If some function key settings do not fit on the two lines, they are not displayed.

PREVSESS
Switches to the previous (lower-numbered) session.

QUIT
Ends the displayed session and switches to another one, or returns to TSO/E if the only session was closed.

QUITALL
Ends all shell sessions and causes OMVS to end and to return to TSO/E.

RETURN
Returns from subcommand mode to the shell session. If help information is being displayed, the session returns to subcommand mode and you must enter the RETURN command again to return to the shell.

SCROLL
Scrolls forward the data displayed on the screen, approximately one full screen.

TOP
Scrolls help information backward to the first panel. Scrolls output backward to a display of the oldest available output.

TSO
Invokes TSO/E command mode. In this mode, you can enter TSO/E commands. Press <PA1>or the <Attention> key to return to subcommand mode.

Usage notes

1. The OMVS command is a Language Environment application. OMVS overrides the default MSGFILE ddname (SYSOUT) and uses ddname SYSFSUMM.

   Normally, any Language Environment error messages from the OMVS command are displayed on the TSO/E terminal. If you want to redirect these messages, you need to allocate the SYSFSUMM ddname instead of the SYSOUT ddname, as is usual with Language Environment applications.
2. The language of the OMVS command messages is determined by the PROFILE PLANGUAGE setting when OMVS is invoked. Do not change PROFILE PLANGUAGE while OMVS is running

Return codes

0 Processing successful.

12 Processing unsuccessful. An error message has been issued.

Examples

These examples explain how to use the multi-session capability of OMVS:

1. To start *2* sessions automatically when starting OMVS, enter:
   ```
   OMVS SESSIONS(2)
   ```
2. To assign the NEXTSESS function to a PF key, enter:
   ```
   OMVS PF1(NEXTSESS)
   ```

OPUT — Copy an MVS data set member into a z/OS UNIX file

Format

```
OPUT  mvs_data_set_name | mvs_data_set_name(member_name)
      'pathname'
      BINARY | TEXT
      CONVERT(character_conversion_table | YES | NO)
```

Description

You can use the OPUT command to:

- Copy a member of an MVS partitioned data set (PDS or PDSE) to a file
- Copy an MVS sequential data set to a file

and convert the data from code page IBM-037 or ASCII to code page IBM-1047.

Do not use the CONVERT option when copying files that contain double-byte data. This option is used for single-byte data only, not for double-byte data.

Parameters

mvs_data_set_name | mvs_data_set_name(member_name)
Specifies the name of an MVS sequential data set or an MVS partitioned data set member that is being copied.

- A fully qualified name that is enclosed in single quotation marks, or an unqualified name (an unqualified name is not enclosed in single quotation marks)
- Up to 44 characters long, with an additional 8 characters for the member name
- Converted to uppercase characters by the system

pathname
Specifies the path name of the file to receive the data set member that is being copied. The target file cannot be a directory. All directories in the path name prior to the file name directory must already exist. The path name is:

- A relative or absolute path name. A relative path name is relative to the working directory of the TSO/E session (usually the **HOME** directory). Therefore, you should usually specify an absolute path name.
- Up to 1023 characters long.
- Enclosed in single quotation marks.
- In uppercase or lowercase characters, which are not changed by the system.

BINARY | TEXT
specifies that the data set being copied contains binary data or text.

BINARY
Specifies that the data set being copied contains binary data. This is the default for a data set of undefined record format.

TEXT
Specifies that the data set being copied contains text. This is the default for a data set of fixed record format or variable record format.

CONVERT(character_conversion_table | YES | NO)
Specifies that the data being copied is to be converted from IBM-037 or ASCII to EBCDIC Latin 1/Open Systems Interconnection code page 01047—that is, that the TO1047 part of the specified character conversion table will be used. This operand is optional. If this operand is omitted, the system copies the data without conversion.

You can use this option for single-byte data, but not for double-byte data.

Specify the CONVERT value as one of the following:

character_conversion_table
Specify one of the following:

- **data_set_name(member_name)**. Specifies the name of the partitioned data set (PDS) and the name of the member that contains the character conversion table.

- **data_set_name**. Specifies the name of the partitioned data set (PDS) that contains the character conversion table. The table is the FROM1047 part in member BPXFX000. (This is an alias; when shipped by IBM, it points to BPXFX111.)
- **(member_name)**. Specifies the name of the conversion table to be used. It is a member of a PDS. Because the data_set_name is omitted, the standard library concatenation is searched for the table. (The default library is SYS1.LINKLIB.)

  The following list summarizes what you can specify when you want to convert data to a different code page when copying single-byte data:
  - BPXFX100. Null character conversion table. Use this table if the square brackets at your workstation are at the same code points as the square brackets on code page 1047 (it is the default). Also use it if you are using a DBCS terminal.
  - BPXFX111. Specifies a non-APL conversion table to convert between code pages IBM-037 and IBM-1047.
  - BPXFX211. Specifies an APL conversion table to convert between code pages IBM-037 and IBM-1047.
  - BPXFX311. Specifies an ASCII-EBCDIC conversion table to convert between code pages ISO8859-1 and IBM-1047.

YES
The system will perform conversion and use the default conversion table (BPXFX000) in the system library concatenation. (BPXFX000 is an alias; when shipped by IBM, it points to BPXFX111.)

NO Specifies no conversion. NO is the same as omitting the CONVERT operand.

Usage notes

1. If the specified file does not exist, OPUT creates a new file. For a new text file, the mode (permission bits) is 600. When the mode is 600, the user has read and write access; others have nothing. For a new binary file, the mode (permission bits) is 700. When the mode is 700, the user has read, write, and execute access; others have nothing.
2. If the specified file exists, the new data overwrites the existing data. The mode of the file is unchanged.
3. You can use OPUT to copy a program object from a PDSE to the file system, and it will be executable there. If you have a load module in a partitioned data set, however, you must first use the IEBCOPY program to copy the load module from a partitioned data set to a PDSE and then subsequently use OPUT to copy the module into the file system. IEBCOPY converts load modules to a program object. See *z/OS UNIX System Services User's Guide* for a discussion of copying executable files.
4. Data sets with spanned record lengths are not allowed.
5. When you copy MVS data sets to text files in the z/OS UNIX file system, a <newline> character is appended to the end of each record. If trailing blanks exist in the record, the <newline> character is appended after the trailing blanks. MVS fixed block data sets have a fixed record length, which means that trailing blanks could exist up to the end of each record.
6. When you copy MVS data sets to binary files in the z/OS UNIX file system, the <newline> character is not appended to the record.

Return codes

0 Processing successful.
12 Processing unsuccessful. An error message has been issued.

Examples

1. This command copies an MVS sequential data set to a file, converting from code page IBM-037 to code page 1047.
   - The unqualified name of the sequential data set is EMPLOYEE.DATA.
   - The path name of the file is **/u/admin/employee/data**.

   ```
   OPUT EMPLOYEE.DATA '/u/admin/employee/data' TEXT CONVERT(YES)
   ```
2. This command copies an MVS sequential data set to a file converting to code page 1047 using the conversion table BPXFX000 in the user's library data set.
   - The fully qualified name of the sequential data set is IBMUSR.EMPLOYEE.DATA.
   - The path name of the file is **/u/admin/employee/data**.

   ```
   OPUT 'IBMUSR.EMPLOYEE.DATA' '/u/admin/employee/data'
          TEXT CONVERT(MY.LOADLIB(BPXFX000))
   ```
3. This command copies a binary file from a PDSE to a file in the file system.
   - APPL.LOADLIB(PAYROLL) is the fully qualified name of the member of the PDSE.
   - **bin/payroll** is the path name of the file; the directory **bin** is in the working directory.
   - There is no code page conversion.

   ```
   OPUT 'APPL.LOADLIB(PAYROLL)' '/bin/payroll' binary
   ```

OPUTX — Copy members from an MVS PDS or PDSE to a z/OS UNIX system directory

Format

```
OPUTX  mvs_PDS_name | mvs_data_set-name(member_name)
       hfs_directory | hfs_file_name
       ASIS
       BINARY | TEXT
       CONVERT(character_conversion_table | YES | NO)
       LC
       MODE
       QUIET
       SUFFIX(suffix)
```

Description

You can use the OPUTX command to:

- Copy members from an MVS partitioned data set (PDS) or PDSE to a directory in the z/OS UNIX file system.
- Copy a sequential data set or member of a PDS to a file

and convert the data from code page IBM-037 or ASCII to code page IBM-1047 while it is being copied.

Restriction: Do not use the CONVERT option when copying files that contain double-byte data. This option is used for single-byte data only, not for double-byte data.

This command uses the ISPF/PDF Edit facility.

Parameters

hfs_directory | HFS_file_name
Specifies the directory name or file name of a file in the z/OS UNIX file system that is to receive the PDS members that are being copied. The name can be up to 1023 characters long. Single quotes around the directory name or file name are optional.

Use `hfs_directory` when a PDS is specified. When a sequential data set or PDS member is specified, then the file name must be used.

mvs_PDS_name | mvs_data_set_name(member_name)
Specifies the name of an MVS partitioned data set or an MVS partitioned data set member that is being copied into a z/OS UNIX file system. The data set name is:

- A fully qualified name that is enclosed in single quotes, or an unqualified name (an unqualified name is not enclosed in single quotes)
- Up to 44 characters long, with an additional 8 characters for the member name
- Converted to uppercase letters

ASIS
Specifies that the @ character in member names *not* be translated to the _ character in path names. (It is a common convention to use @ symbols in PDS member names to correspond with the _ symbol in path names.)

BINARY | TEXT
Specifies whether the data set being copied contains binary data or text.

BINARY
Specifies that the data set being copied contains binary data. BINARY is the default for a data set of undefined record format.

TEXT
Specifies that the data set being copied contains text. TEXT is the default for a data set of fixed record format or variable record format.

CONVERT(character_conversion_table | YES | NO)
Specifies that the data being copied be converted from code page IBM-037 to EBCDIC Latin 1/Open Systems Interconnection code page 01047. That is, the TO1047 part of the specified character conversion table is used. This operand is optional. If this operand is omitted, the system copies the data without conversion.

You can use this option for single-byte data, but not for double-byte data.

Specify the CONVERT value as one of the following:

character_conversion_table
Specify one of the following:

- **data_set_name(member_name)**. Specifies the name of the partitioned data set (PDS) and the name of the member that contains the character conversion table.
- **data_set_name**. Specifies the name of the partitioned data set (PDS) that contains the character conversion table. The table is the FROM1047 part in member BPXFX000. (This is an alias; when shipped by IBM, it points to BPXFX111.)

- **(member_name)**. Specifies the name of the conversion table to be used. It is a member of a PDS. Because the data_set_name is omitted, the standard library concatenation is searched for the table. (The default library is SYS1.LINKLIB.)

  The following list summarizes what you can specify when you want to convert data to a different code page when copying single-byte data:

  – BPXFX100. Null character conversion table. Use this table if the square brackets at your workstation are at the same code points as the square brackets on code page 1047 (it is the default). Also use it if you are using a DBCS terminal.
  – BPXFX111. Specifies a non-APL conversion table to convert between code pages IBM-037 and IBM-1047.
  – BPXFX211. Specifies an APL conversion table to convert between code pages IBM-037 and IBM-1047.
  – BPXFX311. Specifies an ASCII-EBCDIC conversion table to convert between code pages ISO8859-1 and IBM-1047.

YES
Specifies that the system is to perform conversation and use the default conversion table (BPXFX000) in the standard library concatenation. (BPXFX000 is an alias; when shipped by IBM, it points to BPXFX111.)

NO Specifies that conversion not be done. NO is the same as omitting the CONVERT operand.

LC Specifies that the member name be converted to a lowercase file name.

MODE
Specifies the file mode for any members copied into the z/OS UNIX file system. The mode can be specified as three or four octal digits. (The digits can be separated by commas.) Invalid mode specifications are ignored.

If the specified file does not exist, OPUTX creates a new file. For a new text file, the mode (permission bits) is 600. When the mode is 600, the user has read and write access; others have none. For a new binary file, the mode (permission bits) is 700. When the mode is 700, the user has read, write, and search access; others have none.

QUIET
Turns off the echoing of the OPUTX command before the member or data set is copied.

SUFFIX(suffix)
Specifies that a suffix specified by (suffix) be appended to the member names in creating the file names for the z/OS UNIX system.

A suffix is an optional additional file identifier that is appended to the file name following a period (**.**). It is typically used to identify the type of file. For example, **.c** typically indicates a C language source file and **.h** indicates a C language header file. Suffixes can be any length and you can append as many as you want, but the file name, including suffixes, cannot exceed 255 characters for z/OS UNIX.

Usage notes

1. Avoid using OPUTX with path names containing quotes or spaces.
2. If the specified file does not exist, OPUTX creates a new file. For a new text file, the mode (permission bits) is 600. When the mode is 600, the user has read

and write access; others have nothing. For a new binary file, the mode (permission bits) is 700. When the mode is 700, the user has read, write, and search access; others have nothing.

3. If the specified file exists, the new data overwrites the existing data. The mode of the file is unchanged.
4. Data sets with spanned records are not allowed.
5. When you copy MVS data sets to text files in the z/OS UNIX file system, a <newline> character is appended to the end of each record. If trailing blanks exist in the record, the <newline> character is appended after the trailing blanks. MVS fixed block data sets have a fixed record length, which means that trailing blanks could exist up to the end of each record.
6. When you copy MVS data sets to binary files in the z/OS UNIX file system, the <newline> character is not appended to the record.
7. Before the copy, the OPUTX command for a data set or member is echoed, unless you specify the QUIET option. If you did not specify QUIET and if the command is not displayed, the data set or member is not copied.
8. If the source data set is a PDS with an undefined record format, the members might be treated as load modules. A load module is copied by link-editing it into the target file in the file hierarchy. For the program to be able to run from the file hierarchy, the entry point must be at the beginning of the load module.

   For OPUTX to treat the file as a load module, neither BINARY or TEXT can be specified.
9. If the source for the copy is a sequential data set or a PDS member and the target is a directory, the file name used is the last qualifier of the data set name or the member name. You do not have to specify a file as the target with a sequential data set, or a directory as the target with a PDS. The LC and ASIS options are not affected.

Examples

The following command copies files in a PDS into a directory in the z/OS UNIX file system and specifies that:

- The name of the partitioned data set (PDS) is DATAFILE
- The directory is **/usr/sbllib**
- The files are given a suffix of **.c**

```
OPUTX DATAFILE '/usr/sbllib/' LC SUFFIX(c)
```

Assuming the PDS has members PROGRAM1, PROGRAM2, and PROGRAM3, these members are copied as **/usr/sbllib/program1.c**, **/usr/sbllib/program2.c**, and **/usr/sbllib/program3.c**.

OSHELL — Invokes BPXBATCH from TSO/E

Format

```
OSHELL
```

Description

OSHELL uses BPXBATCH to run the shell command or shell script:

```
oshell shell_command
```

For example, to display process information, enter:

```
oshell ps –ej
```

For more information about BPXBATCH, see BPXBATCH

Restriction: When you use OSHELL, do not use an & to run a shell command in the background.

Some examples of using the OSHELL command are:
- List files in a directory
- Create, delete, or rename directories, files, and special files
- Display contents of a file
- Copy files
- Display file attributes
- Search files for text strings
- Compare files or directories
- Run executable files
- Display the attributes and contents of a symbolic link
- Set up character special files
- Set up standard directories for a root file system

Some of these tasks may require superuser authority.

OSTEPLIB — Build a list of files

Format

```
OSTEPLIB pathname
```

Description

Use the OSTEPLIB command to build a list of files that are sanctioned by your installation as valid step libraries for programs that have the set-user-ID or set-group-ID bit set. This permission setting allows a program to have temporary access to files that are not normally accessible to other users. Step libraries have many uses; for example, selected users can test new versions of runtime libraries before the new versions are made generally available.

You must have superuser authority to issue OSTEPLIB.

The sanctioned list is valid if it conforms to the following rules:
- You can include comment lines in the list. Each comment line must start with /* and end with */.
- You must follow standard MVS data set naming conventions in naming the files in the list.
- Each data set name must be fully qualified and cannot be enclosed in quotation marks.
- Each data set name must be on a line by itself, with no comments.
- You can put blanks before and after each data set name. Entirely blank lines in the list are ignored.
- You can use the * character to specify multiple files that begin with the same characters. For example, if you list SYS1.*, you are sanctioning any file that begins with *SYS1.* as a step library.

Following is an example of a file that contains a correctly formatted list of sanctioned step libraries:

```
/*****************************************************************/
/*                                                               */
/*Name: Sample Sanctioned List for set-user-ID and set-group-ID  */
/*      files                                                    */
/*                                                               */
/*Updated by:   May only be updated by OSTEPLIB TSO/E command    */
/*                                                               */
/*Description:  Contains a list of data set names that may       */
/*              be used as STEPLIB libraries for SETUID          */
/*              programs                                         */
/*                                                               */
/*              Wild cards may be used to specify multiple       */
/*              data set names that have the same prefix         */
/*              characters.                                      */
/*                                                               */
/*****************************************************************/

/*****************************************************************/
/*Sanction all data set names beginning with SYS1.CEE            */
/*****************************************************************/
SYS1.CEE*

/*****************************************************************/
/*Sanction data set containing vers. 2 of the C run time library */
/*****************************************************************/
ADMIN.CEE.RTLV2
```

Parameters

pathname

Specifies the path name of the file to contain the list of sanctioned step libraries. The path name can be absolute or relative to the root. Avoid using the space character or single quotation mark (apostrophe) within the path name. The path name cannot be enclosed in single quotes.

If you omit the path name operand, the new sanctioned list file is created with the same file name as the old one and replaces it when it has been validated.

UNMOUNT — Remove a file system from the file hierarchy

Format

```
UNMOUNT FILESYSTEM(file_system_name)
        DRAIN | FORCE | IMMEDIATE | NORMAL | REMOUNT(RDWR|READ|SAMEMODE) | RESET
```

Description

The UNMOUNT command removes a file system from the file system hierarchy. The alias for this command is UMOUNT.

Restrictions: Be aware of these restrictions when using the UNMOUNT command.

- A file system that has file systems mounted on it cannot be unmounted. Any child file systems must be unmounted first.
- A file system cannot be explicitly remounted in the mode that the file system is already mounted in.

Rule: You must have mount authority before you can issue the UNMOUNT command. See the section on mount authority in *z/OS UNIX System Services Planning*.

Parameters

FILESYSTEM(file_system_name)
Specifies the name of the file system to be removed from the file system. The name supplied is changed to all uppercase characters. This operand is required.

file_system_name
The fully qualified name of the data set that contains the file system. The file system name supplied is changed to all uppercase characters.

Specify the name of file system exactly as it was specified when the file system was originally mounted. You can enclose it in single quotes, but they are not required.

If FILESYSTEM("'file_system_name'") is specified, the file system name will not be translated to uppercase.

DRAIN
Specifies that an unmount drain request is to be made. The system will wait for all use of the file system to be ended normally before the unmount request is processed or until another UNMOUNT command is issued.

UNMOUNT can be specified with IMMEDIATE to override a previous UNMOUNT DRAIN request for a file system. If this is used in the foreground, your TSO/E session waits until the UNMOUNT request has completed. <ATTN> (or <PA1>) does not terminate the command.

UNMOUNT DRAIN is not supported in a sysplex environment. If an UNMOUNT DRAIN is issued in a sysplex, the following behavior is exhibited:

- If there is no activity in the file system, UNMOUNT DRAIN will perform the unmount, but it will behave like an UNMOUNT NORMAL.
- If there is activity in the file system, UNMOUNT DRAIN will return a Return_value of -1 with Return_code EINVAL and Reason_code JrNotSupInSysplex.

FORCE
Specifies that the system is to unmount the file system immediately. Any users accessing files in the specified file system receive failing return codes. All data changes to files in the specified file system are saved, if possible. If the data changes to the files cannot be saved, the unmount request continues and data is lost.

Rule: An UNMOUNT IMMEDIATE request must be issued before you can request a UNMOUNT FORCE of a file system. Otherwise, UNMOUNT FORCE fails.

IMMEDIATE
Specifies that the system is to unmount the file system immediately. Any users accessing files in the specified file system receive failing return codes. All data changes to files in the specified file system are saved. If the data changes to files cannot be saved, the unmount request fails.

NORMAL
Specifies that if no user is accessing any of the files in the specified file system, the system processes the unmount request. Otherwise, the system rejects the unmount request. NORMAL is the default.

REMOUNT(RDWR|READ|SAMEMODE)
Specifies that the specified file system be remounted and its mount mode changed, if necessary. REMOUNT takes an optional argument of RDRW, READ, UNMOUNT, or SAMEMODE.

- If REMOUNT is specified without any arguments, the mount mode is changed from RDWR to READ, or READ to RDWR.
- If RDWR is specified and the current mode is READ, the file system is remounted in RDWR mode.
- If READ is specified and the current mode is RDWR, the file system is remounted in READ mode.
- If SAMEMODE is specified, the file system is remounted (internally unmounted and remounted) without changing the mount mode. You can use this option to attempt to regain use of a file system that had I/O errors.

REMOUNT is supported in a sysplex.

If a problem occurs with the remount, determine the failure, correct the problem, and try the remount again. The file system might not be available until the problems are corrected.

RESET
A reset request stops a previous UNMOUNT DRAIN request.

Restriction: UNMOUNT RESET is not supported in a sysplex because UNMOUNT DRAIN is not supported in a sysplex environment (see the description for **DRAIN**).

Usage notes

1. The `/samples` directory contain sample UNMOUNT commands (called **unmountx**).
2. If you unmount a TFS file system, all data stored in that file system is discarded. For more information about TFS, see *z/OS UNIX System Services Planning*.
3. The root file system can be unmounted, but the IMMED operand must be specified. Because unmounting the root stops all file system activity, a subsequent mount of a root file system should be done as soon as possible.
4. While the root file system is unmounted, a dummy file system root named SYSROOT is displayed as the current root file system. During this time, any operation that requires a valid file system will fail. When the new root file system is subsequently mounted, you should terminate any currently dubbed users or issue a **chdir** using a full path name to the appropriate directory so that the users can access the new root file system.
5. If the file system that you are unmounting is an NFS-supported file system, the UNMOUNT command may receive an EAGAIN return code if the request was made before an internal caching clock has expired. That is, there is a 60-second delay from last use before termination is possible. Try the request again.
6. Currently a move of a file system that has open FIFOs causes all FIFOs to be marked stale. They must be closed and reopened. Rather than do this on a remount, a remount attempt of a file system with open FIFOs will be rejected with EINVAL, JrFIFOInFileSys. FIFOs break on move or remount because FIFOs are always function-shipped to the file system owner, regardless of the mount mode. For remount, although the owner does not change, the vfs_umounts on all systems in the sysplex result in the XPFS control blocks (XFS, Xnodes) being released. These blocks contain owner information. Rejecting remount if open FIFOs is not expected to impact customers, since

remount is typically done on a read-only file system to switch it to RDWR, and then back to READ, and FIFOs are not useful in a read-only file system.

Return codes

0 Processing successful.
12 Processing unsuccessful. An error message has been issued.

Examples

1. The following command specifies a normal unmount by default:

   ```
   UNMOUNT FILESYSTEM('HFS.WORKDS')
   ```

2. Before you request a forced unmount of a file system, you must issue an immediate unmount request:

   ```
   UNMOUNT FILESYSTEM('HFS.WORKDS') IMMEDIATE
   UNMOUNT FILESYSTEM('HFS.WORKDS') FORCE
   ```

3. To unconditionally change the mount mode of a file system:

   ```
   UNMOUNT FILESYSTEM(HFS.OMVS.BIN) REMOUNT
   ```

4. To change the mount mode of a file system to read/write, provided it is currently read-only:

   ```
   UNMOUNT FILESYSTEM(HFS.OMVS.BIN) REMOUNT(RDWR)
   ```

ZLSOF - Displays information about open files, sockets, and pipes

See “zlsof — Displays information about open files, sockets, and pipes” on page 904.

Chapter 4. REXX system commands

This part describes the REXX system commands.

The REXX system commands for working with the file system are:

- **bpxmtext**
- **zslof**

You can enter these commands through System REXX as an MVS system command. See the section *Communication with System REXX* in *z/OS MVS System Commands*. Some UNIX commands may require mixed case arguments or run longer than the System REXX time limit. Communication with System REXX describes using lower case and other quote rules. It also describes how to override the default time limit and how to use command prefixes. In order to use z/OS UNIX facilities, it is necessary to logon to the console with a user ID that has access to z/OS UNIX. Also, depending on the command, the use ID might also need to have superuser authority or be permitted to the BPX.SUPERUSER resource in the FACILITY class.

bpxmtext - Display reason code text

See “bpxmtext — Display reason code text” on page 71.

zlsof - Display information about open files, sockets, and pipes

See “zlsof — Displays information about open files, sockets, and pipes” on page 904.

Appendix A. Summary of z/OS UNIX shell commands

The following list presents z/OS shell commands and utilities grouped by the task a user might want to perform. Similar tasks are organized together. Stub commands (**cancel**, **cu** and **lpstat**) are not listed because their functions are not supported by z/OS UNIX System Services.

The list also shows the command name, the standard or specification it satisfies, and its function. XPG4.2 refers to X/Open CAE Issue 4 Version 2 Specifications. XPG5.0 refers to X/Open CAE Issue 5 Specifications.

General use

at	POSIX.2	XPG4.2	Run a command at a specified time
batch	POSIX.2	XPG4.2	Run commands when the system is not busy
bpxmtext	—	—	Display reason code text
ceebldtx	—	—	Transform message source files into loadable message text files
clear	—	—	Clear the screen of all previous output
command	POSIX.2	XPG4.2	Run a simple command
confighfs	—	—	Invoke vfs_pfsctl functions for HFS file systems
date	POSIX.2	XPG4.2	Display the date and time
echo	POSIX.2	XPG4.2	Write arguments to standard output
edcmtext	—	—	Display errnojr reason code text
exec	POSIX.2	XPG4.2	Run a command and open, close, or copy the file descriptors
man	POSIX.2	XPG4.2	Print sections of the online reference manual
nice	POSIX.2	XPG4.2	Run a command at a different priority
passwd	—	—	Change user passwords and password phrases
print	—	—	Return arguments from the shell
printf	POSIX.2	XPG4.2	Write formatted output
sh	POSIX.2	XPG4.2	Invoke a shell (command interpreter)
tcsh	—	—	Invoke a tcsh shell
time	POSIX.2	XPG4.2	Display processor and elapsed times for a command
uptime	—	—	Report how long the system has been running
wall	—	—	Broadcast a message to logged-in users
whence	—	—	Tell how the shell interprets a command name
whoami	—	—	Display your effective user name
xlc	—	—	Compiler invocation using a customizable configuration file
xlC	—	—	C++ compiler invocation using a customizable configuration file
xlc++	—	—	C++ compiler invocation using a customizable configuration file

Controlling your environment

alias	POSIX.2	XPG4.2	Display or create a command alias
asa	POSIX.2	XPG4.2	Interpret ASA/Fortran carriage control
automount	—	—	Configure the automount facility
cal	—	XPG4.2	Display a calendar for a month or year
calendar	—	XPG4.2	Display all current appointments
captoinfo	—	—	Prints terminal entries in the termcap file
chcp	—	—	Set or query ASCII/EBCDIC code pages for the terminal
configstk	—	—	Configure the AF_UENT stack
env	POSIX.2	XPG4.2	Display environments, or set an environment for a process

export	POSIX.2	XPG4.2	Set the export attributes for variables, or show currently exported variables
fc	POSIX.2	XPG4.2	Process a command history list
hash	—	XPG4.2	Create a tracked alias
history	—	—	Process a command history list
id	POSIX.2	XPG4.2	Return the user identity
infocmp	—	—	Compare and print the terminal description
ipcrm	—	—	Remove message queue, semaphore set, or shared memory identifiers
ipcs	—	—	Report status of the interprocess communication facility
lm	—	—	Start the login monitor for OCS support
locale	POSIX.2	XPG4.2	Get locale-specific information
localedef	POSIX.2	XPG4.2	Define the locale environment
logger	POSIX.2	XPG4.2	Log messages
logname	POSIX.2	XPG4.2	Return a user's login name
newgrp	POSIX.2	XPG4.2	Change to a new group
ocsconfig	—	—	Configure, unconfigure, or query an OCS object
printenv	—	—	Display the value of environment variables
r	—	—	Process a command history list
readonly	POSIX.2	—	Mark a variable as read-only
return	POSIX.2	XPG4.2	Return from a shell function or **.** (dot) script
script	—	—	Makes a typescript of a terminal session
set	POSIX.2	XPG4.2	Set or unset command options and positional parameters
shift	POSIX.2	XPG4.2	Shift positional parameters
stty	POSIX.2	XPG4.2	Set or display terminal options
su	—	—	Change the user ID connected with a session
sysvar	—	—	Display static system symbols
tic	—	—	Compile term descriptions into terminfo database entries
touch	POSIX.2	XPG4.2	Change the file access and modification times
tput	POSIX.2	XPG4.2	Change characteristics of terminals
tso	—	—	Run a TSO command from the shell
tsocmd	—	—	Run a TSO/E command from the shell (including authorized commands)
tty	POSIX.2	—	Return the user's terminal name
uconvdef	—	—	Create binary conversion tables
unalias	POSIX.2	XPG4.2	Remove alias definitions
uname	POSIX.2	XPG4.2	Display the name of the current operating system
unset	POSIX.2	XPG4.2	Unset values and attributes of variables and functions
who	POSIX.2	XPG4.2	Display information about current users

Daemons

cron	—	—	Run commands at specified dates and times
inetd	—	—	Handle login requests
rlogind	—	—	Validate rlogin requests
uupd	—	—	Invoke **uucico** for TCP/IP connections from remote UUCP systems

Managing directories

basename	POSIX.2	XPG4.2	Return the nondirectory components of a path name
cd	POSIX.2	XPG4.2	Change the working directory
chgrp	POSIX.2	XPG4.2	Change the group owner of a file or directory

chmod	POSIX.2	XPG4.2	Change the mode of a group or directory
chown	POSIX.2	XPG4.2	Change the owner or group of a file or directory
chroot	—	—	Change the root directory for the execution of a command
dircmp	—	XPG4.2	Compare directories
dirname	POSIX.2	XPG4.2	Return the directory components of a path name
ls	POSIX.2	XPG4.2	List file and directory names and attributes
mkdir	POSIX.2	XPG4.2	Make a directory
mount	—	—	Logically mount a file system
mv	POSIX.2	XPG4.2	Rename or move a file or directory
pathchk	POSIX.2	XPG4.2	Check a path name
pwd	POSIX.2	XPG4.2	Return the working directory name
rm	POSIX.2	XPG4.2	Remove a directory entry
rmdir	POSIX.2	XPG4.2	Remove a directory
unlink	—	XPG5.0	Removes a directory entry

Managing files

amblist	—	—	Display formatted information from object and executable files
as	—	—	Use the HLASM assembler to produce object files
cat	POSIX.2	XPG4.2	Concatenate or display text files
chaudit	—	—	Change audit flags for a file
chlabel	—	—	Set the multilevel security label to files and directories
cksum	POSIX.2	XPG4.2	Calculate and display checksums and byte counts
cmp	POSIX.2	XPG4.2	Compare two files
col	—	XPG4.2	Remove reverse line feeds
comm	POSIX.2	XPG4.2	Show and select or reject lines common to two files
compress	—	XPG4.2	Lempel-Ziv file compression
copytree	—	—	Make a copy of a file hierarchy while preserving all file attributions
cp	POSIX.2	XPG4.2	Copy a file
csplit	POSIX.2	XPG4.2	Split text files
ctags	POSIX.2	XPG4.2	Create tag files for **ex**, **more**, and **vi**
dot or **.**	—	XPG4.2	Run a shell file in the current environment
cut	POSIX.2	XPG4.2	Cut out selected fields of each line of a file
dd	POSIX.2	XPG4.2	Convert and copy a file
df	POSIX.2	XPG4.2	Display the amount of free space in the file system
diff	POSIX.2	XPG4.2	Compare two text files and show the differences
du	POSIX.2	XPG4.2	Summarize usage of file space
ed	POSIX.2	XPG4.2	Use the **ed** line-oriented text editor
egrep	—	XPG4.2	Search a file for a specified pattern
ex	POSIX.2	XPG4.2	Use the **ex** text editor
exrecover daemon	—	—	Retrieve **vi** and **ex** files
extattr	—	—	Set, reset, or display extended attributes for files
expand	POSIX.2	XPG4.2	Expand tabs to spaces
fgrep	—	XPG4.2	Search a file for a specified pattern
file	POSIX.2	XPG4.2	Determine file type
filecache	—	—	Manage file caches
find	POSIX.2	XPG4.2	Find a file meeting specified criteria
fold	POSIX.2	XPG4.2	Break lines into shorter lines
head	POSIX.2	XPG4.2	Display the first part of a file
iconv	—	XPG4.2	Convert characters from one code set to another
join	POSIX.2	XPG4.2	Join two sorted, textual relational databases
line	—	XPG4.2	Copy one line of standard input

link	—	XPG5.0	Create a hard link to a file
ln	POSIX.2	XPG4.2	Create a link to a file
mkfifo	POSIX.2	XPG4.2	Make a FIFO special file
mknod	—	—	Make a FIFO or character special file
mount	—	—	Logically mount a file system
more	POSIX.2	XPG4.2	Display files on a page-by-page basis
mv	POSIX.2	XPG4.2	Rename or move a file or directory
nl	—	XPG4.2	Number lines in a file
nm	POSIX.2	XPG4.2	Display symbol table of object, library, and executable files
obrowse	—	—	Browse a file
od	POSIX.2	XPG4.2	Dump a file in a specified format
oedit	—	—	Edit a file
pack	—	XPG4.2	Compress files by Huffman coding
paste	POSIX.2	XPG4.2	Merge corresponding or subsequent lines of a file
patch	POSIX.2	XPG4.2	Change a file using diff output
pcat	—	XPG4.2	Display Huffman-packed lines on standard output
pg	—	XPG4.2	Display files interactively
sed	POSIX.2	XPG4.2	Start the **sed** noninteractive stream editor
sort	POSIX.2	XPG4.2	Start the sort-merge utility
spell	—	XPG4.2	Detect spelling errors in files
split	POSIX.2	XPG4.2	Split a file into manageable pieces
strings	POSIX.2	XPG4.2	Display printable strings in binary files
sum	—	XPG4.2	Calculate and display checksums and block counts
tabs	POSIX.2	XPG4.2	Set tab stops
tail	POSIX.2	XPG4.2	Display the last part of a file
tee	POSIX.2	XPG4.2	Duplicate the output stream
tr	POSIX.2	XPG4.2	Translate characters
tsort	—	XPG4.2	Sort files topologically
umask	POSIX.2	XPG4.2	Set or return the file mode creation mask
uncompress	—	XPG4.2	Undo Lempel-Zev compression of a file
unexpand	POSIX.2	XPG4.2	Compress spaces into tabs
uniq	POSIX.2	XPG4.2	Report or filter out repeated lines in a file
unmount	—	—	Remove a file system from the file hierarchy
unpack	—	XPG4.2	Decode Huffman packed files
uudecode	POSIX.2	XPG4.2	Decode a transmitted binary file
uuencode	POSIX.2	XPG4.2	Encode a file for safe transmission
vi	POSIX.2	XPG4.2	Use the display-oriented interactive text editor
wc	POSIX.2	XPG4.2	Count newlines, words, and bytes
zcat	—	XPG4.2	Uncompress and display data

Printing files

cancel	—	—	Cancel print queue requests (stub command)
infocmp	—	—	Compare and print the terminal description
lp	POSIX.2	XPG4.2	Send a file to a printer
lpstat	—	—	Show status of print queues (stub command)
pr	POSIX.2	XPG4.2	Format a file in paginated form and send it to standard output

Computing and managing logic

bc	POSIX.2	XPG4.2	Use the arbitrary-precision arithmetic calculation language
break	POSIX.2	XPG4.2	Exit from a for, while, or until loop in a shell script
colon or **:**	POSIX.2	XPG4.2	Do nothing, successfully

continue	POSIX.2	XPG4.2	Skip to the next iteration of a loop in a shell script
dot or **.**	POSIX.2	XPG4.2	Run a shell file in the current environment
eval	POSIX.2	XPG4.2	Construct a command by concatenating arguments
exec	POSIX.2	XPG4.2	Run a command and open, close, or copy the file descriptors
exit	POSIX.2	XPG4.2	Return to the parent process from which the shell was called or to TSO/E
expr	POSIX.2	XPG4.2	Evaluate arguments as an expression
false	POSIX.2	XPG4.2	Return a nonzero exit code
grep	POSIX.2	XPG4.2	Search a file for a specified pattern
left bracket or **[**	—	XPG4.2	Test for a condition
let	—	—	Evaluate an arithmetic expression
test	POSIX.2	XPG4.2	Test for a condition
trap	POSIX.2	XPG4.2	Intercept abnormal conditions and interrupts
true	POSIX.2	XPG4.2	Return a value of `0`

Controlling processes

bg	POSIX.2	XPG4.2	Move a job to the background
bpxtrace	—	—	Activate or deactivate traces for processes
crontab daemon	POSIX.2	XPG4.2	Schedule regular background jobs
fg	POSIX.2	XPG4.2	Bring a job into the foreground
jobs	POSIX.2	XPG4.2	Return the status of jobs in the current session
kill	POSIX.2	XPG4.2	End a process or job, or send it a signal
nohup	POSIX.2	XPG4.2	Start a process that is immune to hangups
ps	POSIX.2	XPG4.2	Return the status of a process
renice	POSIX.2	XPG4.2	Change priorities of a running process
sleep	POSIX.2	XPG4.2	Suspend execution of a process for an interval of time
stop	POSIX.2	XPG4.2	Suspend a process or job
submit	—	—	Submit a batch job for background processing
suspend	POSIX.2	XPG4.2	Send a SIGSTOP to the current shell
time	POSIX.2	XPG4.2	Display processor and elapsed times for a command
times	—	XPG4.2	Get process and child process times
wait	POSIX.2	XPG4.2	Wait for a child process to end
ulimit	—	XPG4.2	Set process limits

Writing shell scripts

autoload	—	—	Indicate function name not defined
dspmsg	—	—	Display selected messages from message catalogs
functions	—	—	Display or assign attributes to functions
getconf	POSIX.2	XPG4.2	Get configuration values
getopts	POSIX.2	XPG4.2	Parse utility options
integer	—	—	Mark each variable with an integer value
read	POSIX.2	XPG4.2	Read a line from standard input
type	—	XPG4.2	Tell how the shell interprets a name
typeset	—	—	Assign attributes and values to variables
xargs	POSIX.2	XPG4.2	Construct an argument list and run a command

Developing or porting application programs

ar	POSIX.2	XPG4.2	Create or maintain library archives

awk	POSIX.2	XPG4.2	Process programs written in the **awk** language
c89	POSIX.2	XPG4.2	Compile, link-edit, and assemble Standard C source code and create an executable file on z/OS
c++/cxx	—	—	Compile, link-edit, and assemble C++ and Standard C source code and create an executable file on z/OS
cc	—	XPG4.2	Compile, link-edit, and assemble Common Usage C source code and create an executable file on z/OS
dbx	—	—	Use the debugger
dbgld	—	—	Create a module map for debugging
dspcat	—	—	Display all or part of a message catalog
gencat	—	XPG4.2	Create or edit message catalogs
lex	POSIX.2	XPG4.2	Generate a program for lexical tasks
make	POSIX.2	XPG4.2	Maintain program-generated and interdependent files
mkcatdefs	—	—	Preprocess a message source file
runcat	—	—	Pipe output from mkcatdefs to gencat
strip	POSIX.2	XPG4.2	Remove unnecessary information from an executable file
yacc	POSIX.2	XPG4.2	Use the **yacc** compiler

Communicating with the system or other users

mail	—	XPG4.2	Read and send mail messages
mailx	POSIX.2	XPG4.2	Send or receive electronic mail
mesg	POSIX.2	XPG4.2	Allow or refuse messages
talk	POSIX.2	XPG4.2	Talk to another user
write	POSIX.2	XPG4.2	Write to another user

Working with archives

ar	POSIX.2	XPG4.2	Create or maintain library archives
cpio	—	XPG4.2	Copy in/out file archives
pax	POSIX.2	XPG4.2	Interchange portable archives
tar	—	XPG4.2	Manipulate the **tar** archive files to copy or back up a file

Working with UUCP

uucc	—	—	Compile UUCP configuration files
uucico daemon	—	—	Process UUCP file transfer requests
uucp	—	XPG4.2	Copy files between remote UUCP systems
uucpd	—	—	Invoke **uucico** for TCP/IP connections from remote UUCP systems
uulog	—	XPG4.2	Display log information about UUCP events
uuname	—	XPG4.2	Display list of remote UUCP systems
uupick	—	XPG4.2	Manage files sent by **uuto** and **uucp**
uustat	—	XPG42	Display status of pending UUCP transfers
uuto	—	XPG42	Copy files to users on remote UUCP systems
uux	—	XPG42	Request command execution on remote UUCP systems
uuxqt daemon	—	—	Carry out command requests from remote UUCP systems

Appendix B. Summary of tcsh shell commands

The following list presents the built-in tcsh shell commands, grouped by the task a user might want to perform, and their functions. Similar tasks are organized together.

General use

alloc	—	—	Show the amount of dynamic memory acquired
builtins	—	—	Print the names of all built-in commands
bye	—	—	Terminate the login shell
echo	—	—	Write arguments to standard output
echotc	—	—	Exercise the terminal capabilities in args
exec	—	—	Run a command and open, close, or copy the file descriptors
glob	—	—	Write each word to standard output
hashstat	—	—	Print a statistic line on hash table effectiveness
login	—	—	Terminate a login shell
logout	—	—	Terminate a login shell
nice	—	—	Run a command at a different priority
notify	—	—	Notify user of job status changes
repeat	—	—	Execute command count times
source	—	—	Read and execute commands from name
time	—	—	Display processor and elapsed times for a command
where	—	—	Report all instances of command
which	—	—	Display next executed command

Controlling your environment

@ (at)	—	—	Print the value of tcsh shell variables, or assign a value
alias	—	—	Display or create a command alias
bindkey	—	—	List all bound keys, or change key bindings
complete	—	—	List completions
history	—	—	Display a command history list
hup	—	—	Run command so it exits on a hang-up signal
newgrp	—	—	Change to a new group
onintr	—	—	Control the action of the tcsh shell on interrupts
printenv	—	—	Display the values of environment variables
rehash	—	—	Recompute internal hash table
sched	—	—	Print scheduled event list
set	—	—	Set or unset command options and positional parameters
setenv	—	—	Set environment variable name to value
settc	—	—	Tell tcsh shell the terminal capability cap value
setty	—	—	Control tty mode changes
shift	—	—	Shift positional parameters
telltc	—	—	List terminal capability values
unalias	—	—	Remove alias definitions
uncomplete	—	—	Remove completions whose names match pattern
unhash	—	—	Disable use of internal hash table
unlimit	—	—	Remove resource limitations

unset	—	—	Unset values and attributes of variables and functions
unsetenv	—	—	Remove environment variables that match pattern
watchlog	—	—	Report on users who are logged in.

Managing directories

cd	—	—	Change the working directory
chdir	—	—	Change the working directory
dirs	—	—	Print the directory stack
popd	—	—	Pop the directory stack
pushd	—	—	Make exchanges within directory stack

Computing and managing logic

break	—	—	Exit from a loop in a shell script
breaksw	—	—	Cause a break from a switch
continue	—	—	Skip to the next iteration of a loop in a shell script
default	—	—	Label default case in a switch statement
eval	—	—	Construct a command by concatenating arguments
exec	—	—	Run a command and open, close, or copy the file descriptors
exit	—	—	Return to the shell's parent process or to TSO/E
filetest	—	—	Apply a file inquiry operator to a file

Managing files

ls-F	—	—	List files

Controlling processes

bg	—	—	Move a job to the background
fg	—		Bring a job into the foreground
jobs	—	—	Return the status of jobs in the current session
kill	—	—	End a process or job, or send it a signal
limit	—	—	Limit consumption of processes
nohup	—	—	Start a process that is immune to hangups
stop	—	—	Suspend a process or job
suspend	—	—	Send a SIGSTOP to the current shell
time	—	—	Display processor and elapsed times for a command
wait	—		Wait for a child process to end

Appendix C. Regular expressions (regexp)

Related information

Many z/OS shell commands match strings of text in text files using a type of pattern known as a *regular expression*. A regular expression lets you find strings in text files not only by direct match, but also by extended matches, similar to, but much more powerful than the file name patterns described in **sh**.

The newline character at the end of each input line is never explicitly matched by any regular expression or part thereof.

expr and **ed** take *basic regular expressions*; all other shell commands accept *extended regular expressions*. **grep** and **sed** accept basic regular expressions, but will accept extended regular expressions if the **–E** option is used.

Regular expressions can be made up of normal characters or special characters, sometimes called *metacharacters*. Basic and extended regular expressions differ only in the metacharacters they can contain.

The basic regular expression metacharacters are:

```
¬ $ . * \( \) [ \{ \} \
```

The extended regular expression metacharacters are:

```
| ¬ $ . * + ? ( ) [ { } \
```

These have the following meanings:

. A dot character matches any single character of the input line.

¬ The ¬ character does not match any character but represents the beginning of the input line. For example, ¬A is a regular expression matching the letter A at the beginning of a line. The ¬ character is only special at the beginning of a regular expression, or after a (or |.

**$** This does not match any character but represents the end of the input line. For example, A$ is a regular expression matching the letter *A* at the end of a line. The $ character is only special at the end of a regular expression, or before a) or |.

[*bracket-expression***]**
A bracket expression enclosed in square brackets is a regular expression that matches a single character, or collation element. This bracket expression applies not only to regular expressions, but also to pattern matching as performed by the **fnmatch()** function (used in file name expansion).

- If the initial character is a circumflex (^), then this bracket expression is complemented. It matches any character or collation-element except for the expressions specified in the bracket expression. For pattern matching, as performed by the **fnmatch** function, this initial character is instead ! (the exclamation mark).
- If the first character after any potential circumflex is either a dash (-), or a closing square bracket (]), then that character matches exactly that character—that is, a literal dash or closing square bracket.

- You can specify collation sequences by enclosing their name inside square brackets and periods. For example, **[.ch.]** matches the multicharacter collation sequence `ch` (if the current language supports that collation sequence). Any single character is itself. Do not give a collation sequence that is not part of the current locale.
- Equivalence classes can be specified by enclosing a character or collation sequence inside square bracket equals. For example, `[=a=]` matches any character in the same equivalence class as `a`. This normally expands to all the variants of `a` in the current locale—for example, `a`, `\(a:`, `\(a'`, ... On some locales it might include both the uppercase and lowercase of a given character. In the POSIX locale, this always expands to only the character given.
- Within a character class expression (one made with square brackets), the following constructs can be used to represent sets of characters. These constructs are used for globalization and handle the different collation sequences as required by POSIX.

  [:alpha:]
  Any alphabetic character.

  [:lower:]
  Any lowercase alphabetic character.

  [:upper:]
  Any uppercase alphabetic character.

  [:digit:]
  Any digit character.

  [:alnum:]
  Any alphanumeric character (alphabetic or digit).

  [:space:]
  Any white space character (blank, horizontal tab, vertical tab).

  [:graph:]
  Any printable character, except the blank character.

  [:print:]
  Any printable character, including the blank character.

  [:punct:]
  Any printable character that is not white space or alphanumeric.

  [:cntrl:]
  Any nonprintable character.

  For example, given the character class expression:

  ```
  [:alpha:]
  ```

  you need to enclose the expression within another set of square brackets, as in:

  ```
  /[[:alpha:]]/
  ```
- Character ranges are specified by a dash (–), between two characters, or collation sequences. These indicates all character or collation sequences that collate between two characters or collation sequences. It does not refer to the native character set. For example, in the POSIX locale, `[a-z]` means all the lowercase alphabetics, even if they don't agree with the binary machine ordering. However, because many other locales do not collate in this manner, use of ranges are not recommended, and are not used in strictly conforming POSIX.2 applications. An endpoint of a range

can explicitly be a collation sequence; for example, `[[.ch.]-[.ll.]]` is valid. However, equivalence classes or character classes are not: `[[=a=]-z]` is not permitted.

`\` This character turns off the special meaning of metacharacters. For example, `\.` only matches a dot character. Note that `\\` matches a literal `\` character. Also note the special case of "*d*" described in the following paragraph.

`\`*d* For *d* representing any single decimal digit (from 1 to 9), this pattern is equivalent to the string matching the *d*th expression enclosed within the `()` characters (or `\(\)` for some commands) found at an *earlier point* in the regular expression. Parenthesized expressions are numbered by counting `(` characters from the left.

Constructs of this form can be used in the replacement strings of substitution commands (for example, the `sub` function of **awk**), to stand for constructs matched by parts of the regular expression.

regexp`*` A regular expression *regexp* followed by `*` matches a string of *zero* or more strings that matches *regexp*. For example, `A*` matches `A`, `AA`, `AAA` and so forth. It also matches the null string (zero occurrences of `A`).).

regexp`+`
A regular expression *regexp* followed by `+` matches a string of *one* or more strings that matches *regexp*.

regexp`?`
A regular expression *regexp* followed by `?` matches a string of one or zero occurrences of strings that matches *regexp*.

char`{`*n*`}` | *char*`\{`*n*`\}`
In this expression (and the ones to follow), *char* is a regular expression that stands for a single character—for example, a literal character or a period (`.`). Such a regular expression followed by a number in brace brackets stands for that number of repetitions of a character. For example, `X\{3\}` stands for `XXX`. In basic regular expressions, in order to reduce the number of special characters, { and } must be escaped by the \ character to make them special, as shown in the second form (and the ones to follow).

char`{`*min*`,}` | *char*`\{`*min*`,\}`
When a number, *min*, followed by a comma appears in braces following a single-character regular expression, it stands for at least *min* repetitions of a character. For example, `X\{3,\}` stands for at least three repetitions of `X`.

char`{`*min*`,`*max*`}` | *char*`\{`*min*`,`*max*`\}`
When a single-character regular expression is followed by a pair of numbers in braces, it stands for at least *min* repetitions and no more than *max* repetitions of a character. For example, `X\{3,7\}` stands for three to seven repetitions of `X`.

regexp1 | *regexp2*
This expression matches either regular expression *regexp1* or *regexp2*.

`(`*regexp*`)` | `\(`*regexp*`\)`
This lets you group parts of regular expressions. Except where overridden by parentheses, concatenation has the highest precedence. In basic regular expressions, in order to reduce the number of special characters, (and) must be escaped by the \ character to make them special, as shown in the second form.

Several regular expressions can be concatenated to form a larger regular expression.

Summary

The commands that use basic and extended regular expressions are as follows:

Basic **ed**, **expr**, **grep**, **sed**

Extended
awk, **grep** with **-E** option, **sed** with the **-E** option.

Table 40 summarizes the features that apply to the applicable shell commands.

Table 40. Regular Expression Features (regexp)

Notation	awk	ed	grep -E	expr	sed
.	Yes	Yes	Yes	Yes	Yes
^	Yes	Yes	Yes	No	Yes
$	Yes	Yes	Yes	Yes	Yes
[...]	Yes	Yes	Yes	Yes	Yes
[::]	Yes	Yes	Yes	Yes	Yes
*re**	Yes	Yes	Yes	Yes	Yes
re+	Yes	No	Yes	No	No
re?	Yes	No	Yes	No	No
re | *re*	Yes	No	Yes	No	No
d	Yes	Yes	Yes	Yes	Yes
(...)	Yes	No	Yes	No	No
\(...\)	No	Yes	No	Yes	Yes
\<	No	No	No	No	No
\>	No	No	No	No	No
\{ \}	Yes	No	Yes	No	Yes

Examples

The following patterns are given as illustrations, along with descriptions of what they match:

abc Matches any line of text containing the three letters `abc` in that order.

a.c Matches any string beginning with the letter `a`, followed by *any* character, followed by the letter `c`.

^.$ Matches any line containing exactly one character (the newline is not counted).

a(b*|c*)d
Matches any string beginning with a letter `a`, followed by either zero or more of the letter `b`, or zero or more of the letter `c`, followed by the letter `d`.

.* [a–z]+ .*
Matches any line containing a *word*, consisting of lowercase alphabetic characters, delimited by at least one space on each side.

(morty).*\1

morty.*morty
These expressions both match lines containing at least two occurrences of the string `morty`.

[[:space:][:alnum:]]
Matches any character that is either a white space character or alphanumeric.

Regular expressions (regexp)

Related information

Many z/OS shell commands match strings of text in text files using a type of pattern known as a *regular expression*. A regular expression lets you find strings in text files not only by direct match, but also by extended matches, similar to, but much more powerful than the file name patterns described in **sh**.

The newline character at the end of each input line is never explicitly matched by any regular expression or part thereof.

expr and **ed** take *basic regular expressions*; all other shell commands accept *extended regular expressions*. **grep** and **sed** accept basic regular expressions, but will accept extended regular expressions if the **–E** option is used.

Regular expressions can be made up of normal characters or special characters, sometimes called *metacharacters*. Basic and extended regular expressions differ only in the metacharacters they can contain.

The basic regular expression metacharacters are:
`¬ $ . * \( \) [ \{ \} \`

The extended regular expression metacharacters are:
`| ¬ $ . * + ? ( ) [ { } \`

These have the following meanings:

. A dot character matches any single character of the input line.

¬ The ¬ character does not match any character but represents the beginning of the input line. For example, `¬A` is a regular expression matching the letter `A` at the beginning of a line. The ¬ character is only special at the beginning of a regular expression, or after a `(` or `|`.

$ This does not match any character but represents the end of the input line. For example, `A$` is a regular expression matching the letter *A* at the end of a line. The `$` character is only special at the end of a regular expression, or before a `)` or `|`.

[*bracket-expression***]**
A bracket expression enclosed in square brackets is a regular expression that matches a single character, or collation element. This bracket expression applies not only to regular expressions, but also to pattern matching as performed by the **fnmatch()** function (used in file name expansion).

- If the initial character is a circumflex (^), then this bracket expression is complemented. It matches any character or collation-element except for the expressions specified in the bracket expression. For pattern matching, as performed by the **fnmatch** function, this initial character is instead ! (the exclamation mark).
- If the first character after any potential circumflex is either a dash (-), or a closing square bracket (]), then that character matches exactly that character—that is, a literal dash or closing square bracket.
- You can specify collation sequences by enclosing their name inside square brackets and periods. For example, **[.ch.]** matches the multicharacter collation sequence ch (if the current language supports that collation sequence). Any single character is itself. Do not give a collation sequence that is not part of the current locale.
- Equivalence classes can be specified by enclosing a character or collation sequence inside square bracket equals. For example, [=a=] matches any character in the same equivalence class as a. This normally expands to all the variants of a in the current locale—for example, a, \(a:, \(a', ... On some locales it might include both the uppercase and lowercase of a given character. In the POSIX locale, this always expands to only the character given.
- Within a character class expression (one made with square brackets), the following constructs can be used to represent sets of characters. These constructs are used for globalization and handle the different collation sequences as required by POSIX.

  [:alpha:]
  Any alphabetic character.

  [:lower:]
  Any lowercase alphabetic character.

  [:upper:]
  Any uppercase alphabetic character.

  [:digit:]
  Any digit character.

  [:alnum:]
  Any alphanumeric character (alphabetic or digit).

  [:space:]
  Any white space character (blank, horizontal tab, vertical tab).

  [:graph:]
  Any printable character, except the blank character.

  [:print:]
  Any printable character, including the blank character.

  [:punct:]
  Any printable character that is not white space or alphanumeric.

  [:cntrl:]
  Any nonprintable character.

  For example, given the character class expression:

  ```
  [:alpha:]
  ```

  you need to enclose the expression within another set of square brackets, as in:

```
/[[:alpha:]]/
```

- Character ranges are specified by a dash (–), between two characters, or collation sequences. These indicates all character or collation sequences that collate between two characters or collation sequences. It does not refer to the native character set. For example, in the POSIX locale, `[a-z]` means all the lowercase alphabetics, even if they don't agree with the binary machine ordering. However, because many other locales do not collate in this manner, use of ranges are not recommended, and are not used in strictly conforming POSIX.2 applications. An endpoint of a range can explicitly be a collation sequence; for example, `[[.ch.]-[.ll.]]` is valid. However, equivalence classes or character classes are not: `[[=a=]-z]` is not permitted.

`\` This character turns off the special meaning of metacharacters. For example, `\.` only matches a dot character. Note that `\\` matches a literal `\` character. Also note the special case of "*d*" described in the following paragraph.

`\`*d* For *d* representing any single decimal digit (from 1 to 9), this pattern is equivalent to the string matching the *d*th expression enclosed within the `()` characters (or `\(\)` for some commands) found at an *earlier point* in the regular expression. Parenthesized expressions are numbered by counting `(` characters from the left.

Constructs of this form can be used in the replacement strings of substitution commands (for example, the `sub` function of **awk**), to stand for constructs matched by parts of the regular expression.

*regexp** A regular expression *regexp* followed by `*` matches a string of *zero* or more strings that matches *regexp*. For example, `A*` matches `A`, `AA`, `AAA` and so forth. It also matches the null string (zero occurrences of `A`).).

regexp+

A regular expression *regexp* followed by `+` matches a string of *one* or more strings that matches *regexp*.

regexp?

A regular expression *regexp* followed by `?` matches a string of one or zero occurrences of strings that matches *regexp*.

char{n} | *char*`\{`*n*`\}`

In this expression (and the ones to follow), *char* is a regular expression that stands for a single character—for example, a literal character or a period (`.`). Such a regular expression followed by a number in brace brackets stands for that number of repetitions of a character. For example, `X\{3\}` stands for `XXX`. In basic regular expressions, in order to reduce the number of special characters, { and } must be escaped by the \ character to make them special, as shown in the second form (and the ones to follow).

char{min,} | *char*`\{`*min*`,\}`

When a number, *min*, followed by a comma appears in braces following a single-character regular expression, it stands for at least *min* repetitions of a character. For example, `X\{3,\}` stands for at least three repetitions of `X`.

char{min,max} | *char*`\{`*min*`,`*max*`\}`

When a single-character regular expression is followed by a pair of numbers in braces, it stands for at least *min* repetitions and no more than *max* repetitions of a character. For example, `X\{3,7\}` stands for three to seven repetitions of `X`.

regexp1 | *regexp2*
This expression matches either regular expression *regexp1* or *regexp2*.

(regexp) | **\(***regexp***\)**
This lets you group parts of regular expressions. Except where overridden by parentheses, concatenation has the highest precedence. In basic regular expressions, in order to reduce the number of special characters, (and) must be escaped by the \ character to make them special, as shown in the second form.

Several regular expressions can be concatenated to form a larger regular expression.

Summary

The commands that use basic and extended regular expressions are as follows:

Basic **ed**, **expr**, **grep**, **sed**

Extended
awk, **grep** with **-E** option, **sed** with the **-E** option.

Table 40 on page 974 summarizes the features that apply to the applicable shell commands.

Table 41. Regular Expression Features (regexp)

Notation	awk	ed	grep -E	expr	sed
.	Yes	Yes	Yes	Yes	Yes
^	Yes	Yes	Yes	No	Yes
$	Yes	Yes	Yes	Yes	Yes
[...]	Yes	Yes	Yes	Yes	Yes
[::]	Yes	Yes	Yes	Yes	Yes
*re**	Yes	Yes	Yes	Yes	Yes
re+	Yes	No	Yes	No	No
re?	Yes	No	Yes	No	No
re | *re*	Yes	No	Yes	No	No
d	Yes	Yes	Yes	Yes	Yes
(...)	Yes	No	Yes	No	No
\(...\)	No	Yes	No	Yes	Yes
\<	No	No	No	No	No
\>	No	No	No	No	No
\{ \}	Yes	No	Yes	No	Yes

Examples

The following patterns are given as illustrations, along with descriptions of what they match:

abc Matches any line of text containing the three letters abc in that order.

a.c Matches any string beginning with the letter a, followed by *any* character, followed by the letter c.

^.$ Matches any line containing exactly one character (the newline is not counted).

a(b*|c*)d
Matches any string beginning with a letter `a`, followed by either zero or more of the letter `b`, or zero or more of the letter `c`, followed by the letter `d`.

.* [a–z]+ .*
Matches any line containing a *word*, consisting of lowercase alphabetic characters, delimited by at least one space on each side.

(morty).*\1

morty.*morty
These expressions both match lines containing at least two occurrences of the string `morty`.

[[:space:][:alnum:]]
Matches any character that is either a white space character or alphanumeric.

Appendix D. Running shell scripts or executable files under MVS environments

This topic describes the IBM-supplied BPXBATCH program. It also discusses using OSHELL to run shell commands and scripts from MVS.

BPXBATCH

Related information

BPXBATCH makes it easy for you to run shell scripts and executable files that reside in z/OS UNIX files through the MVS job control language (JCL). If you do most of your work from TSO/E, using BPXBATCH saves you the trouble of going into the shell to run your scripts and executable files. REXX execs can also use BPXBATCH to run shell scripts and executable files.

In addition to using BPXBATCH, a user who wants to perform a local spawn without being concerned about environment setup (that is, without having to set specific environment variables which could be overwritten if they are also set in the user's profile) can use BPXBATSL. BPXBATSL provides users with an alternate entry point into BPXBATCH, and forces a program to run using a local spawn instead of fork/exec as BPXBATCH does. This ultimately allows a program to run faster.

BPXBATSL is also useful when the user wants to perform a local spawn of their program but also needs subsequent child processes to be fork/exec'ed. Formerly, this could not be done since BPXBATCH and the requested program shared the environment variables. Failure to meet the following conditions will result in a failure when BPXBATSL is invoked. For more details about these restrictions, see the descriptions of the spawn() function and BPX1SPN callable service in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*:

- The invoker must have an UID of 0 to issue a SH request
- The child process is not setuid or setgid to a value different from the parent
- The spawned file name is not an external link or a sticky bit file
- The parent has enough resources to allow the child process to reside in the same address space

BPXBATSL is an alias of BPXBATCH.

BPXBATA2 and BPXBATA8 are provided as APF-authorized alternatives to BPXBATSL. BPXBATA2 and BPXBATA8 provide the capability for a target APF authorized z/OS UNIX program to run in the same address space as the originating job, allowing it to share the same allocations, job log, and so on. BPXBATA2 is specifically intended to provide the capability for APF-authorized z/OS UNIX program to be started in a PSW Key 2 . To insure that the target program receives control PSW Key 2, a PPT entry for BPXBATA2 must be set up that specifies that BPXBATA2 starts up PSW Key 2.

The same restrictions that apply to BPXBATSL apply to BPXBATA2 and BPXBATA8, in addition to, the following:

- The PGM keyword is the only invocation type that is supported. The SH keyword is not supported.
- The interfaces can only be used from started task address spaces.
- The z/OS UNIX program that is the target of the BPXBATA2 and BPXBATA8 job must be marked as an APF-authorized executable file.

Any other usage of the BPXBATA8 and BPXBATA2 interfaces than what is described is not supported and will cause the invoking job to fail.

Format

For **JCL:**
EXEC PGM=BPXBATCH,PARM='SH|PGM program_name'

For **TSO/E:**
BPXBATCH SH|PGM program_name

Description

The BPXBATCH program allows you to submit MVS batch jobs that run shell commands or scripts, or z/OS XL C/C++ executable files. You can invoke BPXBATCH from a JCL job or from TSO/E (as a command, through a CALL command, or from a CLIST or REXX EXEC).

With BPXBATCH, you can allocate the MVS standard file **stdin** only as z/OS UNIX files for passing input. You can allocate the MVS standard files **stdout**, **stderr** or **stdenv** as MVS data sets or z/OS UNIX text files. The **stdenv** file for containing environment variables or the **stderr** and **stdout** files for saving job output can be allocated as SYSOUT, PDSE, PDS or sequential data sets. If you do not allocate them, **stdin**, **stdout**, **stderr**, and **stdenv** default to **/dev/null**. Allocate the standard files using the data definition PATH keyword options, or standard data definition options for MVS data sets, for **stdenv**, **stdout** and **stderr**.

For MVS data sets, use the standard data definition options for MVS data sets.

For JCL jobs, specify PATH keyword options on DD statements:

```
//jobname JOB ...

//stepname EXEC PGM=BPXBATCH,PARM='SH|PGM program_name'

//STDIN   DD  PATH='/stdin-file-pathname',PATHOPTS=(ORDONLY)
//STDOUT  DD  PATH='/stdout-file-pathname',PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//            PATHMODE=SIRWXU
//STDERR  DD  PATH='/stderr-file-pathname',PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//            PATHMODE=SIRWXU
:
```

Your application in the executable file can also allocate **stdin**, **stdout**, **stderr**, and **stdenv** dynamically through the use of SVC 99.

For TSO/E, you specify PATH keyword options on the ALLOCATE command:

```
ALLOCATE FILE(STDIN) PATH('/stdin-file-pathname') PATHOPTS(ORDONLY)
ALLOCATE FILE(STDOUT) PATH('/stdout-file-pathname')
         PATHOPTS(OWRONLY,OCREAT,OTRUNC) PATHMODE(SIRWXU)
ALLOCATE FILE(STDERR) PATH('/stderr-file-pathname')
         PATHOPTS(OWRONLY,OCREAT,OTRUNC) PATHMODE(SIRWXU)

BPXBATCH SH|PGM program_name
```

stdin and **stdenv** must always be allocated as read. **stdout** and **stderr** must always be allocated as write.

As previously stated, a user who wants to perform a local spawn without being concerned about environment setup (that is, without having to set specific environment variables which could be overwritten if they are also set in the user's profile) can use BPXBATSL. BPXBATSL provides users with an alternate entry point into BPXBATCH, and forces a program to run using a local spawn instead of fork/exec as BPXBATCH does. This ultimately allows a program to run faster.

The following example contains DD statements that are accessible to a program that was given control from BPXBATSL:

```
//jobname JOB ...

//stepname EXEC PGM=BPXBATSL,PARM='PGM program_name'
/* The following 2 DDs are still available in the program which gets
/* control from BPXBATSL.
//DD1       DD DSN=MVSDSN.FOR.APPL1,DISP=SHR
//DD2       DD DSN=MVSDSN.FOR.APPL2,DISP=SHR
/* The following DDs are processed by BPXBATSL to create file descriptors
/* for stdin, stdout, stderr
//STDIN   DD  PATH='/stdin-file-pathname',PATHOPTS=(ORDONLY)
//STDOUT  DD  PATH='/stdout-file-pathname',PATHOPTS=(OWRONLY,OCREAT,OTRUNC
//            PATHMODE=SIRWXU
//STDERR  DD  PATH='/stderr-file-pathname',PATHOPTS=(OWRONLY,OCREAT,OTRUNC
//            PATHMODE=SIRWXU
```

Parameters

BPXBATCH accepts one parameter string as input, the combination of SH|PGM and program_name. At least one blank character must separate the parts of the parameter string. The total length of the parameter string will now support up to 32754 characters.

BPXBATCH was first created for use with JCL, which had a maximum parameter length of 100. Now, BPXBATCH can also be called form CLIST, REXX, and TSO. These additional environments do not have the 100 character parameter limit. From a TSO command environment the parameter string itself will now support up to 32754 characters.

Parameters to BPXBATCH can also be supplied via the STDPARM DD up to a limit of 65,536 characters. When the STDPARM DD is allocated BPXBATCH will use the data found in the z/OS UNIX file or MVS data set associated with this DD rather than what is found on the parameter string or in the STDIN DD. An informational message BPXM079I is displayed indicating that this is occurring, as a warning to the user. The STDPARM DD will allow either a z/OS UNIX file, or a MVS SYSIN, PDS or PDSE member or a sequential data set.

If neither SH nor PGM is specified as part of the parameter string, BPXBATCH assumes that the shell is to be started to run the shell script allocated by STDIN.

SH|PGM
Specifies whether BPXBATCH is to run a shell script or command or a z/OS XL C/C++ executable file located in a z/OS UNIX file.

SH Specifies that the shell designated in your TSO/E user ID's security product profile is to be started and is to run shell commands or scripts provided from **stdin** or the specified program_name.

If SH is specified with no program_name information, BPXBATCH attempts to run anything read in from **stdin**.

PGM

Specifies that the program identified by the program_name parameter is invoked directly from BPXBATCH. This is done either via a spawn or a fork and exec. BPXBATCH creates a process for the program to run in and then calls the program. If you specify PGM, you must also specify program_name.

All environment variables read from the stdenv file are set when the program is run if stdenv was allocated. If the HOME and LOGNAME variables are not specified in the stdenv file, or stdenv was not allocated, then HOME and LOGNAME, if possible, are set when the program is run.

Refer to "Usage notes" for more information about environment variable processing.

Restriction: When using PGM, the program_name cannot contain any shell specific functions because they will not be resolved. If shell specific functions must be specified, then SH should be used to avoid possible errors or unpredictable results.

program_name

Specifies the shell command name or the z/OS UNIX path name for the shell script or z/OS XL C/C++ executable file to be run. In addition, program_name can contain option information.

The program_name is interpreted as case-sensitive.

When PGM and program_name are specified and the specified program name does not begin with a slash character (/), BPXBATCH prefixes the user's initial working directory information to the program path name.

Usage notes

1. BPXBATCH is an alias for the program BPXMBATC, which resides in the SYS1.LINKLIB data set.
2. BPXBATCH must be invoked from a user address space running with a program status word (PSW) key of 8.
3. BPXBATCH does not translate characters on the supplied parameter information. You should supply parameter information, including z/OS UNIX path names, using only the POSIX portable character set. For information about the POSIX portable character set, see *z/OS UNIX System Services Programming Tools*.
4. If your BPXBATCH job returns ABEND 4093 reason code 0000001c, you need to expand the region size. For example:

   ```
   //SHELLCMD  EXEC PGM=BPXBATCH,REGION=8M,PARM='SH shell_cmd'
   ```

5. BPXBATCH does not support any ddnames other than stdin, stdout, stderr, stdenv or stdparm . Attempting to allocate or reference any other ddnames will result in enqueue failures or unpredictable results. To use an MVS data set in your batch UNIX application, use "dynamic allocation", such as SVC99 or the TSO ALLOC command. Also, you must remove all "static allocations" (ddnames referring to the MVS data set in question) from all steps in the batch job.
6. If you define an MVS data set for stdout or stderr, consider the following:
   - It must be a sequential data set, a partitioned data set (PDS) member, a partitioned data set extended (PDSE) member, or SYSOUT.

- The data set must have a nonzero logical record length (LRECL) and a defined record format (RECFM); otherwise, BPXBATCH will fail with error message BPXM012I indicating an open failure for the affected ddname.
- If the LRECL of the target STDOUT or STDERR data set is not large enough to hold a line of output, the data will be truncated and message BPXM080I will be put out indicating this has occurred. This can happen for both fixed and variable blocked data sets. For variable block data sets, the first four bytes of each record, record segment, or block make up a descriptor word containing control information. You must allow for these additional 4 bytes in the specified LRECL if you intend to avoid truncation of the output to the STDOUT and STDERR DDs.
- If you use two members of the same partitioned data set for the STDOUT and STDERR ddnames, then you must use a PDSE (not a PDS). Using a PDS instead of a PDSE can result in a 213 abend (and, if running in a batch job, an abnormal end for the job step) or the output not appearing in the members as expected.
- When you specify an MVS data set for either the STDOUT or STDERR ddnames, a child process will be created to run the target z/OS UNIX program. In some cases, the child process will run in a separate address space from the BPXBATCH job. In such cases, the job log messages for the child will not appear in the job log of the BPXBATCH job. To capture the child's job log messages, set the _BPXK_JOBLOG=STDERR environment variable. This will cause the child's job log messages to be written to the STDERR data set specified in the BPXBATCH job.
- In early releases of z/OS, if a MVS data set were specified on stdout or stderr, BPXBATCH ignored the data set and defaulted to **/dev/null**. To remain compatible with this behavior, the current support does the same defaulting if the MVS data set type is not supported (for example, DD Dummy, Terminal, or SYSIN), or if the MVS data set cannot be opened by BPXBATCH. Also, message BPXM081I is displayed that indicates when this default behavior is being taken by BPXBATCH.
- If STDOUT or STDERR are allocated as a PDS or PDSE member and overwriting of the output is expected from multiple runs of the same job or command, the data set should not be allocated with a disposition of NEW but rather as SHR or OLD. If the data set is allocated as NEW, the member will be created on the 1st run, but subsequent runs will cause i/o errors when attempting to write to the member.
- If STDOUT or STDERR are allocated as a sequential data set and appending of the output is expected from multiple runs of the same job or command, the data set should be allocated with a disposition of MOD.
- In general, any I/O errors that occur with an MVS data set defined to the STDOUT or STDERR (or STDPARM or STDENV, described below) ddnames will result in an abend (x13 or x37, for instance) and, if running in a batch job, an abnormal end for the job step, except for an abend B37, which will be ignored. For example: If the user does not have security access to the data set defined to STDOUT, then when BPXBATCH attempts to open the data set, a 913 abend will occur and message IEC150I will provide details about the error.
- To avoid the possibility of a timeout abend when directing STDOUT and STDERR to an MVS data set or to SYSOUT, specify TIME=1440 (NOLIMIT) on the EXEC statement.

7. BPXBATCH now supports a parameter string up to 32754 characters when called from a TSO command environment. Also from both a batch and TSO environment, up to 65,536 characters can now be supplied via the a new input

DD named **stdparm**. When the **stdparm** DD is allocated BPXBATCH will use the data found in the z/OS UNIX file or MVS data set associated with this DD rather that what is found on the parameter string or in the stdin DD. As a warning to the user, an informational message BPXM079I will be displayed indicating that this is occurring.

The stdparm DD will allow either a z/OS UNIX file, or an MVS SYSIN PDS, PDSE or sequential data set. The following are characteristics of the parameter data that can be supplied in the stdparm DD, if a z/OS UNIX file is specified:

- It must be a text file defined with read access only
- Specify one argument per line
- The file cannot have sequence numbers in it.

  Tip: If you use the ISPF editor to create the file, set the sequence numbers off by typing `number off` on the command line before you begin typing data. If sequence numbers already exist, type `UNNUM` to remove them and then type `number off`.

If a MVS data set is specified:

- Specify one argument per line. If the parameter string for an argument spans more than one line of a data set or file, this string will be divided into two or more arguments that are passed to the corresponding shell script or program.
- The maximum length of a single argument supplied to the program is 32,760, which is the same as the maximum LRECL for an unspanned non-VSAM data set.
- The record format of the data set can fixed or variable (unspanned).
- The data set cannot have sequence numbers in it. If you use the ISPF editor to edit the data set, set the sequence numbers off by typing number off on the command line before you begin typing in the data. If sequence numbers already exist, type UNNUM to remove them and set number mode off.
- Trailing blanks are truncated for SYSIN and variable block data sets, but not for fixed block data sets. For a fixed block data set, trailing blanks will be included in the parameter text for a given argument up to the end of the record.

8. BPXBATCH does not close file descriptors other than `0–2`. Other file descriptors that are open and not defined as “marked to be closed” remain open when you call BPXBATCH and BPXBATCH runs the specified script or executable file.
9. BPXBATCH uses write-to-operator (WTO) routing code 11 to write error messages to either the JCL job log or your TSO/E terminal. Your TSO/E user profile must specify WTPMSG so that messages can be displayed at the terminal.
10. BPXBATCH (with the SH parameter) must not be used to run an executable file, shell command, or shell script in the background (by specifying the shell & symbol) unless the shell **nohup** command is also used. If the shell ampersand (&) symbol is used without **nohup**, the results are unpredictable.
11. BPXBATCH, when used with the PGM parameter, sets up environment variables for the program to be run. If the stdenv file is not allocated, the HOME and LOGNAME environment variables are set. If stdenv is allocated, the environment variables read from the file it represents are set, with HOME or LOGNAME or both environment variables added if they are not specified in the stdenv file. The following types of files can be allocated to stdenv:
    - z/OS UNIX text file
    - Sequential format MVS data set (including SYSIN data set)

- Member of a partitioned data set (PDS)
- Member of a partitioned data set extended (PDSE)

Other forms of MVS data sets, such as DUMMY, TERMINAL, or SYSOUT are not supported for stdenv.

The stdenv file consists of one or more records, where *record* is defined as a string terminated with a <newline> character (X'15') in a z/OS UNIX file, or a fixed or variable (nonspanned) format record in an MVS data set. Other MVS record formats are not supported for stdenv. The following rules apply to the specification of environment variables in **stdenv** files:

- Only one environment variable can be specified per record.
- Each environment variable is specified as *variable=value*.
- Environment variable names must begin in column 1, unless names beginning with blanks are used.
- Environment variable records should not be terminated with null characters (X'00'). BPXBATCH automatically appends a null character to the end of each environment variable, and the lengths of environment variables as seen by the program include the null characters.
- Trailing blanks (X'40') are truncated for MVS SYSIN data sets, but are not truncated for any other type of file.
- Be careful that sequence numbers are not present in MVS data sets, because they will be treated as part of the environment variables. ISPF edit users should always set number mode off when creating environment variables, including JCL data sets with environment variables specified as SYSIN.

Some environment variables are release-dependent. If BPXBATCH is executed on a system that does not support the environment variable, you will not get an error message and the variable will be ignored. Use the **uname** shell command to determine the release number of the operating system that BPXBATCH is running on.

Environment variables (including PATH) are established at the start of the executable program, not for BPXBATCH itself. Thus, PATH is not searched to locate the program, but instead is used if the program invokes other executable programs. In the following example, **someprogram** may be found only in the initial working directory defined by the user's profile, not by the PATH environment variable:

```
//jobname JOB ...

//stepname EXEC PGM=BPXBATCH,PARM='PGM someprogram parm1 parm2'

//STDOUT  DD  PATH='/tmp/pgmout',PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//            PATHMODE=SIRWXU
//STDENV  DD  *
PATH=/bin:/u/usr/joeuser
STEPLIB=SYS1.JOE.STEPLIB
/*
```

12. BPXBATCH uses two more environment variables for execution that are specified by STDENV:

    - _BPX_BATCH_UMASK=0755
    - _BPX_BATCH_SPAWN=YES|NO

    _BPX_BATCH_UMASK allows the user the flexibility of modifying the permission bits on newly created files instead of using the default mask (when PGM is specified).

    Note: This variable is overridden by umask (usually set from within `/etc/profile`) if BPXBATCH is invoked with the 'SH' option (SH is the

default). SH causes BPXBATCH to execute a login shell which runs the /etc/profile script (and runs the user's .profile) and which may set the umask before execution of the intended program.

_BPX_BATCH_SPAWN causes BPXBATCH to use SPAWN instead of fork/exec and allows data definitions to be carried over into the spawned process. When _BPX_BATCH_SPAWN is set to YES, spawn will be used. If it is set to NO, which is equivalent to the default behavior, fork/exec will be used to execute the program.

If _BPX_BATCH_SPAWN is set to YES, then you must consider two other environment variables that affect spawn (BPX1SPN):

- _BPX_SHAREAS = YES | NO | REUSE | MUST

  When YES or REUSE, the child process created by spawn will run in the same address space. Failure to meet these conditions will result in a spawn failure when MUST is used. For more detail about these restrictions see the descriptions of the spawn() function and BPX1SPN callable service in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*:
  - The invoker must have an UID of 0 to issue a SH request
  - The child process is not setuid or setgid to a value different from the parent
  - The spawned file name is not an external link or a sticky bit file
  - The parent has enough resources to allow the child process to reside in the same address space
  - The NOSHAREAS extended attribute is not set

  When no, the child and parent run in separate address spaces.
- _BPX_SPAWN_SCRIPT=YES

  Spawn will recognize a header in the first line of a z/OS UNIX file that indicates the file to be executed and its first set of arguments. This header will only be recognized when a z/OS UNIX file is not found in an executable format. The format of the header is as follows:

  ```
  #! Path String
  ```

  where **#!** is the file magic number. The magic number indicates that the first line of a file is a special header that contains the name of the program to be executed and any argument data to be supplied to it.

  When _BPX_SPAWN_SCRIPT=yes, spawn will first recognize the file magic number and will process the file accordingly. If the file magic number is not found in the file's first line, spawn will treat the specified file as a shell script and will invoke the shell to run the shell script.

For more information about spawn, see BPX1SPN in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.

13. When using BPXBATCH with the SH parameter, environment variables specified in the STDENV DD are overridden by those specified in `/etc/profile` and **.profile** (which overrides **/etc/profile)**. This is because SH causes BPXBATCH to execute a login shell which runs the `/etc/profile` script and runs the user's **.profile**.

Files

- SYS1.LINKLIB(BPXMBATC) is the BPXBATCH program location.
- The stdin default is `/dev/null`.
- The stdout default is `/dev/null`.

- The stderr default is the value of **stdout**. If all defaults are accepted, **stderr** is `/dev/null`.
- stdenv default is `/dev/null`.

Return codes

0 Processing successful.

254 Processing unsuccessful. BPXBATCH requires OMVS to be started.

255 Processing unsuccessful. An error message has been issued.

4095 Processing unsuccessful. An error message has been issued.

32000 BPXBATCH invoked the BPX1FRK (fork) callable service. This is usually invoked only by a TSO/E user. One of the following conditions may have resulted:

- BPXBATCH failed to open specified files after the program fork. Files are normally opened and closed prior to a fork. Try running BPXBATCH again.
- The program_name or the shell exited with an exit status of 125.

32512 One of the following conditions may have resulted:

- The PGM keyword was specified for BPXBATCH and no program_name could be found.

  Message BPXM008I was written to the job log or **stderr**.
- The SH keyword was specified for BPXBATCH and either `/bin/login` or the shell did not exist.
- The SH keyword was specified with a program_name value for BPXBATCH and no program_name could be found. The shell exited with an exit status of 127. stdout contains a shell message indicating the program was not found.
- The program_name or the shell exited with an exit status of 127.

other multiples of 256
A return code greater than `255`, unless explicitly documented as a return code from BPXBATCH (`32000` or `32512`), is actually an exit status being returned from the program that was invoked by BPXBATCH. The exit status can be determined by dividing the value of BPXYWAST by `256`.

BPXYWAST
BPXBATCH invoked the BPX1FRK (fork) callable service. This is usually invoked only by a TSO/E user. Processing was successful with wait() status containing a nonzero value. The wait status was mapped by BPXYWAST and returned by BPX1WAT (wait).

No error messages were issued by BPXBATCH.

Using OSHELL to run shell commands and scripts from MVS

You can use the OSHELL REXX exec to run a shell command or shell script from the TSO/E `READY` prompt and display the output to your terminal. This exec uses BPXBATCH to run the shell command or shell script:

```
oshell shell_command
```

For example, to display process information, enter:

```
oshell ps –ej
```

Restriction: With this exec, do not use an & to run a shell command in the background.

Appendix E. BPXCOPY: Copying a sequential or partitioned data set or PDSE member into an HFS file

This topic describes the BPXCOPY program.

BPXCOPY

Related information

BPXCOPY enables you to copy an HFS file, a sequential data set, or a partitioned data set or a PDSE member into a hierarchical file system (HFS) file.

Format

JCL:

```
EXEC PGM=BPXCOPY,PARM='ELEMENT HEADID LINK TYPE PATHMODE SYMLINK
SYMPATH APF | NOAPF PROGCTL | NOPROGCTL SHAREAS | NOSHAREAS UID GID
SHARELIB | NOSHARELIB
```

Description

BPXCOPY copies an HFS file, a sequential data set, or partitioned data set or PDSE member into an HFS file. You can invoke BPXCOPY in several ways:

- From JCL using `EXEC PGM=BPXCOPY`. BPXCOPY does not need the Terminal Monitor Program (TMP) to be started when it is invoked from JCL.
- From LINK, XCTL, ATTACH, a TSO/E CALL command with the asis option, or by a CALL after a LOAD.

BPXCOPY provides similar function to the OPUT command, but differs from OPUT in these ways:

- There is no code page conversion available.
- The specified filename cannot be longer than 8 characters.
- The path name of the directory specified cannot be longer than 255 characters.
- You can define hard links to the file.
- You can define symbolic links to the file.
- You can set the permission access bits of the file.
- You can set the extended attributes of the file.
- You can set the owning UID and GID of the file.
- Do not specify PATHOPTS when using the TSO/E ALLOCATE command or a JCL DD statement. It will be ignored.

A DD statement allocates a data set or file and sets up a ddname. For BPXCOPY:

- The input ddname can specify a MVS data set (either a sequential data set or a member of a partitioned data set or PDSE) or the input ddname can be the full path name of the HFS file. When you invoke BPXCOPY from JCL, you must use SYSUT1 as the input ddname. If BPXCOPY is invoked from LINK, XCTL, or ATTACH, a TSO/E CALL command with the asis option, or by a call after a LOAD, you can specify an alternative ddname.
- The output ddname is associated with the path name of the directory in which the HFS file resides. The absolute path name for the HFS file is this path name combined with the name specified with the ELEMENT parameter. When you invoke BPXCOPY from JCL, you must use SYSUT2 as the output ddname. If

BPXCOPY is invoked from LINK, XCTL, or ATTACH, a TSO/E CALL command with the asis option, or by a CALL after a LOAD, you can specify an alternative ddname.

- The message output ddname is associated with an MVS data set. The default ddname is SYSTSPRT, which typically directs messages to SYSOUT. When you invoke BPXCOPY from JCL, you must use SYSTSPRT as the message output ddname. SYSTSPRT's default LRECL is 137, with a BLKSIZE of 3155. If BPXCOPY is invoked from LINK, XCTL, or ATTACH, a TSO/E CALL command with the asis option, or by a CALL after a LOAD, you can specify an alternative ddname.
- BPXCOPY invokes IKJTSOEV, which will always have an allocation for ddnames SYSTSIN and SYSTSPRT. SYSTSPRT must be allocated correctly as described in the preceding bullet and ensured that it is closed after entry to BPXCOPY. See *z/OS TSO/E Programming Services* for more information about the IKJTSOEV service.

Parameters

You can specify the following keyword parameters with BPXCOPY. The parameters can be separated by any delimiter (space, comma, tab, or comment (/*)).

ELEMENT(element_name)
element_name is a simple 1-to-8-character filename of the output file. The element_name specified is converted to uppercase characters.

The directory path name for the output file is specified with the PATH keyword on a JCL DD statement.

The path name of the output file consists the directory path name appended with the element_name.

This parameter is required.

HEADID('character_string')
An 8-byte character string, enclosed in single quotes, that will appear on the header of each page of output created.

This optional parameter is provided for SMP/E usage, not for a typical user.

LINK('linkname','linkname',...)
The names of hard links to the file. Each linkname is concatenated with the output directory path name. On the JCL DD statement for the directory, the maximum length for a path name (before concatenation) is 255 characters. Path names with a length of up to 1023 characters can be specified only if BPXCOPY is invoked from LINK, XCTL, or ATTACH, a TSO/E CALL command, or by a CALL after a LOAD.

If you specify this parameter, you create one or more hard links to the file when the data is copied into a file. The linkname must be enclosed in single quotes. You can specify up to 64 linknames, and each must be enclosed in single quotes. Specifying LINK is optional.

SYMLINK('linkname','linkname',...)
The names of symbolic links to the file. Each linkname is concatenated with the output directory path name. On the JCL DD statement for the directory, the maximum length for a path name (before concatenation) is 255 characters. Pathnames with a length of up to 1023 characters (after concatenation) can be specified if BPXCOPY is involved from LINK, XCTL, or ATTACH, a TSO/E CALL command, or by a CALL after a LOAD.

If you specify this parameter, you create one or more symbolic links to the file. The linkname must be enclosed in single quotes. You can specify up to 64 linknames, and each must be enclosed in single quotes. Specifying SYMLINK is optional. If you specify SYMLINK, you must also specify SYMPATH.

SYMPATH('path name','pathname',...)
The path names of the file for which the symbolic link is created. Each path name may be an absolute path name (beginning with a slash) or a relative path name (not beginning with a slash). When an absolute path name is used, the symbolic link will be resolved starting at the root directory. When a relative path name is used, the symbolic link will be resolved starting at the parent directory of the symbolic link.

For JCL, the maximum length for a path name is limited by the 100 character limit on the entire PARM string (including other parameters) on the EXEC statement. Path names with a length of up to 1023 characters can be specified if BPXCOPY is invoked from LINK, XCTL, or ATTACH, a TSO/E CALL command, or by a CALL after a LOAD.

Specifying SYMPATH is optional, but if you specify SYMPATH, you must also specify SYMLINK. Each SYMLINK linkname must be matched with a corresponding SYMPATH path name. The first linkname will define a symbolic link to the first path name, the second linkname will define a symbolic link to the second path name, etc. If there are fewer pathnames than linknames, the last path name will be used for the remaining linknames.

PATHMODE (mode_bits)
Changes the access permissions, or *modes,* of the specified file or directory. Modes determine who can read, write, or search a directory. The bits are used to set execution and permission access of the output file. On BPXCOPY, you can specify PATHMODE as an absolute mode; it must consist of four octal numbers separated by commas or blanks.

Absolute modes are four octal numbers specifying the complete list of attributes for the files. Specify attributes by ORing together the bits for each octal number.

```
4,0,0,0   Set-user-ID bit
2,0,0,0   Set-group-ID bit
1,0,0,0   Sticky bit
0,4,0,0   Individual read
0,2,0,0   Individual write
0,1,0,0   Individual execute (or list directory)
0,0,4,0   Group read
0,0,2,0   Group write
0,0,1,0   Group execute
0,0,0,4   Other read
0,0,0,2   Other write
0,0,0,1   Other execute
```

Specifying PATHMODE is optional.

For more information about permission bits, see the **chmod** command.

TYPE (TEXT|BINARY)
The format for the HFS file. The default is BINARY for U-format data sets and TEXT for all others. (U-format means undefined-length records.) Specifying TYPE is optional.

APF|NOAPF
Specifies whether the APF extended attribute is set or unset. When this attribute is set (APF) on an executable program file (load module), it behaves as if loaded from an APF-authorized library. For example, if this program is

exec()ed at the job step level and the program is linked with the AC = 1 attribute, the program will be executed as APF-authorized.

To be able to set APF, you must have at least READ access to the BPX.FILEATTR.APF resource in the FACILITY class.

Specifying APF or NOAPF is optional. If not specified, the attribute will be defined as NOAPF.

PROGCTL|NOPROGCTL
Specifies whether the PROGCTL extended attribute is set or unset. When this is set (PROGCTL) on an executable program file (load module), it causes the program to behave as if an RDEFINE had been done for the load module to the PROGRAM class. When this program is brought into storage, it does not cause the enviroment to be marked dirty.

To be able to set PROGCTL, you must have at least READ access to the BPX.FILEATTR.PROGCTL resource in the FACILITY class.

Specifying PROGCTL or NOPROGCTL is optional. If not specified, the attribute will be defined as NOPROGCTL.

SHAREAS | NOSHAREAS
Specifies whether the SHAREAS extended attribute is set or unset. When this attribute is set (SHAREAS) on an executable program file (load module), the _BPX_SHAREAS environment variable is honored when the file is spawn()ed. When this attribute is not set (NOSHAREAS), the _BPX_SHAREAS environment variable is ignored when the file is spawn()ed.

Specifying SHAREAS or NOSHAREAS is optional. If not specified, the attribute will be defined as SHAREAS.

SHARELIB | NOSHARELIB
Specifies whether the st_ShareLib extended attribute is set or unset in the target file.

Note: In order to use BPXCOPY with this keyword parameter, you must have at least READ access to the BPX.FILEATTR.SHARELIB resource in the FACILITY class.

UID(owner)
Specifies the owner of the file. Owner can be a user name or a numeric user ID (UID). However, if a numeric owner exists as a user name in the user data base, the UID number associated with that user name is used.

Specifying the UID is optional. If it is not specified, the UID of the user running BPXCOPY is used.

Requirements: These requirements must be met when specifying the UID:

- To be able to set the UID of the file, the user must have UID 0 or have at least READ access to the BPX.SUPERUSER resource in the FACILITY class.
- The UID must be known to the system.
- If a mixed case user name is specified, it must be enclosed in single quotes.

GID(group)
Specifies the group owner of the file. group can be a group name or a numeric group ID (GID). However, if a numeric group exists as a group name in the group data base, the GID number associated with that group name is used.

Specifying the GID is optional. If it is not specified, the GID of the directory path name is used.

Requirements: These requirements must be met when specifying the GID:

- To be able to set the GID of the file, the user must have UID 0 or have at least READ access to the BPX.SUPERUSER resource in the FACILITY class.
- If a mixed case user name is specified, it must be enclosed in single quotes.

Return codes

0 Processing successful

12 Processing unsuccessful. An error message has been issued.

Examples

1. JCL and BPXCOPY are used to copy a PDSE member into a directory. These facts are known:
   - The name of the PDSE member is REGEREX.
   - The directory name is **/u/turbo/llib**.
   - Output messages are to be directed to SYSOUT.
   - Type of data: binary.

   ```
   //TEST JOB MSGLEVEL=(1,1)
   //STEP EXEC PGM=BPXCOPY,
   //  PARM='ELEMENT(REGEREX) LINK("../erex") TYPE(BINARY)'
   //SYSUT1   DD DSN=TURBO.LOADLIB(REGEREX),DISP=SHR
   //SYSUT2   DD PATH='/u/turbo/llib'
   //SYSTSPRT DD SYSOUT=*
   ```

   Result: The LINK name is concatenated with the directory name from SYSUT2, yielding **/u/turbo/llib/../erex**. The file system treats this as **/u/turbo/erex**, making this an alias for **/u/turbo/llib/REGEREX**.
2. JCL and BPXCOPY are used to copy a PDS member into a directory. These facts are known:
   - The name of the PDS member is TABLE1.
   - The directory name is **/u/carbon/data**.
   - Output messages are to be directed to SYSOUT.
   - Type of data: text.

   ```
   //TEST JOB MSGLEVEL=(1,1)
   //STEP EXEC PGM=BPXCOPY,
   //  PARM='ELEMENT(TABLE1) TYPE(TEXT) PATHMODE(0,7,6,4)'
   //SYSUT1   DD DSN=CARBON.DATA(TABLE1),DISP=SHR
   //SYSUT2   DD PATH='/u/carbon/data'
   //SYSTSPRT DD SYSOUT=*
   ```

   Result: The file **/u/carbon/data/TABLE1** is created, with read, write, and execute authority for the user; read and write authority for the group; and read authority for other users.
3. A member of an MVS partitioned data set is copied to an HFS file from a program using the LINK macro. These facts are known:
   - The ddname of the source: INDD. INDD can be any sequential data set and is defined by an ALLOCATE command issued outside the program.
   - The ddname of the directory to copy into: OUTDD. OUTDD can be any directory name and is defined by an ALLOCATE command issued outside the program.
   - Three link names—**DATA**, **link1**, and **link2**—for the target file.
   - Output messages are directed to SYSOUT.
   - Type of data: text.

   ```
   *
   COPYEX   CSECT
            STM   14,12,12(13)           Entry linkage
            LR    12,15
   ```

```
         USING COPYEX,12
         LA    10,SAVEAREA
         ST    10,8(13)
         ST    13,SAVEAREA+4
         LR    13,10
*
         LINK  EP=BPXCOPY,PARAM=(OPT_LIST,DD_LIST),VL
*
         L     13,SAVEAREA+4           Exit linkage
         L     14,12(13)
         LM    0,12,20(13)
         BR    14
*
SAVEAREA DS    18F
*
OPT_LIST DC    H'80'                   Length of option string
         DC    CL80'ELEMENT(DATA) HEAD(''0001'') TYPE(TEXT)           X
               LINK('link1'', ''link2'')'
*
DD_LIST  DC    H'72'                   Length of DDNAME list
         DC    XL56'0'
         DC    CL8'INDD'               Logical SYSUT1  input
         DC    CL8'OUTDD'              Logical SYSUT2  output directory
*
         END   COPYEX
```

4. JCL and BPXCOPY are used to copy a HFS file to another HFS file.

```
//TEST JOB MSGLEVEL=(1,1)
//STEP EXEC PGM=BPXCOPY,
//     PARM='ELEMENT(PROGINFO) TYPE(TEXT) PATHMODE(0,7,4,4)'
//SYSUT1        DD  PATH='/u/dept/data/proginfo'
//SYSUT2        DD  PATH='/u/program'
//SYSTSPRT   DD SYSOUT=*
```

   There is no inheritance of file attributes, path mode, links or symbolic links. This information is determined from the input parameter to BPXCOPY, not from the source file.

Appendix F. Localization

Globalization enables you to work in a cultural context that is comfortable for you through locales, character sets, and a number of special environment variables. The process of adapting an internationalized application or program, particular to a language or cultural milieu, is termed *localization*.

A *locale* is the subset of your environment that deals with language and cultural conventions. When specifying a locale, the convention is to use the descriptive locale name. See the section on locale naming conventions in *z/OS XL C/C++ Programming Guide*. It is made up of a number of categories, each of which is associated with an environment variable and controls a specific aspect of the environment. The following list shows the categories and their spheres of influence:

LC_COLLATE
Collating (sorting) order.

LC_CTYPE
Character classification and case conversion.

LC_MESSAGES
Formats of informative and diagnostic messages and interactive responses.

LC_MONETARY
Monetary formatting.

LC_NUMERIC
Numeric, nonmonetary formatting.

LC_TIME
Date and time formats.

LC_SYNTAX
EBCDIC-variant character encodings used by some C functions and utilities.

To give a locale control over a category, set the corresponding variable to the name of the locale. In addition to the environment variables associated with the categories, there are two other variables which are used in conjunction with localization, **LANG** and **LC_ALL**. All of these variables affect the performance of the shell commands. The general effects apply to most commands, but certain commands such as **sort**, with its dependence on **LC_COLLATE**, require special attention to be paid to one or more of the variables. This; this section discusses such cases in the *Localization* topic of the command. The effects of each environment variable is as follows:

LANG
Determines the international language value. Utilities and applications can use the information from the given locale to provide error messages and instructions in that locale's language. If **LC_ALL** variable is not defined, any undefined variable is treated as though it contained the value of **LANG**.

LC_ALL
Overrides the value of **LANG** and the values of any of the other variables starting with **LC_**.

LC_COLLATE
Identifies the locale that controls the collating (sorting) order of characters and determines the behavior of ranges, equivalence classes, and multicharacter collating elements.

LC_CTYPE
Identifies the locale that defines character classes (for example, *alpha, digit, blank*) and their behavior (for example, the mapping of lowercase letters to uppercase letters). This locale also determines the interpretation of sequences of bytes as characters (such as single-byte versus double-byte characters).

LC_MESSAGES
Identifies the locale that controls the processing of affirmative and negative responses. This locale also defines the language and cultural conventions used when writing messages.

LC_MONETARY
Determines the locale that controls monetary-related numeric formatting (for example, currency symbol, decimal point character, and thousands separator).

LC_NUMERIC
Determines the locale that controls numeric formatting (for example, decimal point character and thousands separator).

LC_TIME
Identifies the locale that determines the format of time and date strings.

LC_SYNTAX
Identifies the locale that defines the encodings for the variant characters in the portable character set.

The NLSPATH localization variable specifies where the message catalogs are to be found.

For example,

```
NLSPATH="/system/nlslib/%N.cat"
```

specifies that the z/OS shell is to look for all message catalogs in the directory **/system/nlslib**, where the catalog name is to be constructed from the *name* parameter passed to the z/OS shell with the suffix **.cat**.

Substitution fields consist of a % symbol, followed by a single-letter keyword. These keywords are currently defined:

%N The value of the *name* parameter

%L The value of the **LC_MESSAGES** category, or **LANG**, depending on how the catopen() function that opens this catalog is coded. For more information, see catopen() in *z/OS XL C/C++ Runtime Library Reference*.

%l The *language* element from the **LC_MESSAGES** category

%t The *territory* element from the **LC_MESSAGES** category

%c The *codeset* element from the **LC_MESSAGES** category

Templates defined in **NLSPATH** are separated by colons (:). A leading colon or two adjacent colons (::) are equivalent to specifying **%N**. For example:

```
NLSPATH=":%N.cat:/nlslib/%L/%N.cat"
```

specifies that the z/OS shell should look for the requested message catalog in *name*, *name*.**cat**, and **/nlslib**/*category*/*name*.**cat**, where *category* is the value of the **LC_MESSAGES** or **LANG** category of the current locale.

Do not set the **NLSPATH** variable unless you need to override the default system path. Otherwise the commands might behave unpredictably.

Appendix G. Stub commands

z/OS UNIX has several stub commands. *Stub commands* are those commands that are recognized by z/OS UNIX but whose functions are not supported. They are:

- **cancel**
- **cu**
- **lpstat**

Appendix H. File formats

This information gives more detailed information about the formats of the files used by certain shell commands.

cpio — Format of cpio archives

Related information

You can use the **cpio** command to back up or restore files. The **cpio** command reads and writes either a compact binary format header or an ASCII format header. The **tar** command reads and writes headers in either the original TAR format from UNIX systems or the USTAR format defined by the POSIX 1003.1 standard.

The **pax** command reads and writes headers in any of the **cpio** formats.

Description

A **cpio** archive consists of one or more concatenated member files. Each member file contains a header optionally followed by file contents as indicated in the header. The end of the archive is indicated by another header describing an (empty) file named **TRAILER!!**.

There are two types of **cpio** archives, differing only in the style of the header:

- ASCII archives have totally printable header information; thus, if the files being archived are also ASCII files, the whole archive is ASCII.
- By default, **cpio** writes archives with binary headers. However, binary archive files cannot usually be ported to other operating systems, so you should not use these.

The information in an ASCII archive header is stored in fixed-width, octal (base 8) numbers padded with zeros on the left. Table 42 gives the order and field width for the information in the ASCII header:

Table 42. Archive file: ASCII header

Field width	Field name	Meaning
6	magic	Magic number 070707
6	dev	Device where file resides
6	ino	I-number of file
6	mode	File mode
6	uid	Owner user ID
6	gid	Owner group ID
6	nlink	Number of links to file
6	rdev	Device major/minor for special file
11	mtime	Modify time of file
6	namesize	Length of filename
11	filesize	Length of file

After the header information, *namesize* bytes of path name are stored. *namesize* includes the null byte of the end of the path name. After this, *filesize* bytes of the file contents are recorded.

Binary headers contain the same information in 2-byte (short) and 4-byte (long) integers as follows:

Bytes	Field names
2	magic
2	dev
2	ino
2	mode
2	uid
2	gid
2	nlink
2	rdev
2	mtime
2	namesize
2	filesize

After the header information comes the filename, with *namesize* rounded up to the nearest 2-byte boundary. Then the file contents appear as in the ASCII archive. The byte ordering of the 2- and 4-byte integers in the binary format is machine-dependent and thus portability of this format is not easily guaranteed.

Related information

The **compress**, **cpio**, **pax**, and **tar** commands

---

magic — Format of the /etc/magic file

Related information

Description

The **file** command uses the **/etc/magic** file in its attempt to identify the type of a binary file. Essentially, **/etc/magic** contains templates showing what different types of files look like.

The **magic** file contains lines describing magic numbers, which identify particular types of files. Lines beginning with a > or & character represent continuation lines to a preceding main entry:

> If the **file** command finds a match on the main entry line, these additional patterns are checked. Any pattern that matches is used. This may generate additional output; a single blank separates each matching line's output if any output exists for that line.

If the **file** command finds a match on the main entry line, and a following continuation line begins with this character, that continuation line's pattern must also match, or neither line is used. Output text associated with any line beginning with the & character is ignored.

Each line consists of four fields, separated by one or more tabs:

(a) The first field is a byte offset in the file, consisting of an optional offset operator and a value. In continuation lines, the offset immediately follows a continuation character.

If no offset operator is specified, then the offset value indicates an offset from the beginning of the file.

The * offset operator specifies that the value located at the memory location following the operator be used as the offset. Thus, `*0x3C` indicates that the value contained in `0x3C` should be used as the offset.

The + offset operator specifies an incremental offset, based on the value of the last offset. Thus, `+15` indicates that the offset value is 15 bytes from the last specified offset.

If the byte offset has passed the file length limit, the test will not match.

(b) The second field is the type of the value.

The valid specifiers are listed below:

d Signed decimal

u Unsigned decimal

s String

u and **d** can be followed by an optional unsigned decimal integer that specifies the number of bytes represented by the type. The numbers of bytes supported are refined to the byte length of the C-language type char, short, int,long. u and d can also be followed by an optional size specifiers listed below:

C char

S short

I int

L long

The **C**, **S**, **I**, or **L** specifiers are correspond to the number of bytes in the C-language types char, short, int, or long.

All type specifiers, except for **s**, can be followed by a mask specifier of the form **&number**. The mask value will be bitwise AND 'ed with the value of the input file before the comparison with the value field of the line is made. By default the mask will be interpreted as an unsigned decimal number. With a leading 0x or 0X, the mask will be interpreted as an unsigned hexadecimal number; otherwise, with a leading 0, the mask will be interpreted as an unsigned octal number.

The long format of type specifiers is supported. The valid specifiers, and their interpretation, are listed below:

Specifier	_UNIX03=YES	_UNIX03 is not YES
byte	dC	uC
short	dS	uS
long	dL	uL
string	s	s

(c) The next field is a value, preceded by an optional operator.

If the specifier from the type field is s or string, then interpret the value as a string. Otherwise, interpret it as a number. If the value is a string, then the test will succeed only when a string value exactly matches the bytes from the file. The string value field can contain at most 127 characters per magic line.

If the value is a string, it can contain the following sequences:

- \character

  The backslash-escape sequences as specified in the Base Definitions volume of IEEE Std 1003.1-2001, Table 5-1, Escape Sequences and Associated Actions (\\, \a, \b, \f, \n, \r, \t, \v). In addition, the escape sequence \ (the <backslash> character followed by a <space> character) will be recognized to represent a <space> character.

- \octal

  Octal sequences that can be used to represent characters with specific coded values. An octal sequence consists of a backslash followed by the longest sequence of one, two, or three octal-digit characters (01234567).

By default, any value that is not a string will be interpreted as a signed decimal number. Any such value, with a leading 0x or 0X, will be interpreted as an unsigned hexadecimal number; otherwise, with a leading zero, the value will be interpreted as an unsigned octal number. To maintain compatibility with other systems, numeric values are not subject to bounds checking. Use numeric values that match the specified type.

Operators only apply to nonstring types: `byte`, `short` and `long`. The default operator is = (exact match). The operators are:

= Equal.

! Not equal.

> Greater than.

< Less than.

& All bits in pattern must match.

^ At least one bit in pattern must not match.

x or ? Any value matches (must be the only character in the field). ? is an extension to traditional implementations of **magic**.

(d) The rest of the line is the message string to be printed if the particular file matches the template. Note that the contents of this field is ignored if the line begins with the & continuation character. The fourth field may contain a **printf ()**-type format indicator to output the magic number (see **printf** for more details on format indicators). If the field contains a **printf ()**-type format indicator, the value read from the file will be the argument to **printf**.

Usage notes

1. Characters from a code page other than IBM-1047 should not be added to the **/etc/magic** file (the default **magic** file).
2. Characters from a code page other than IBM-1047 can be used in alternate **magic** files that are specified by the **–m** or **-M** option on the **file** command. These characters should only be used in the third field of the **magic** file template when the field type is `string`. They will only match files containing these characters when the **file** command is invoked in the non-IBM-1047 locale.

Examples

Here are some sample entries:

Characters

```
0   short                0x5AD4                DOS executable
*0x18                    Short                 0x40
>*0x3c                   Short                 0x6584C OS/2 linear
                                               executable
>*0x3C                   Short                 0x454e
>+54byte                 1                     OS/2 format
>+54byte                 2                     Windows format
0   short                0xFDF0                DOS library
0   string               AH                    Halo bitmapped font file
0   short                0x601A                Atara ST contiguous
                                               executable
>14 long                 >0                    - not stripped
0 byte                   0X1F
>1 byte                  0x1E                  Packed file
>1 byte                  0x9D                  Compressed file
```

Related information

The **file** command.

---

pax — Format of pax archives and special header summary files

USTAR archive format

Description

pax uses the USTAR archive format described in the **tar** file format description. For more information about the **tar** file format, see "tar — Format of tar archives" on page 1012.

An example of the special header summary file:

```
#00
#IBMOS390_USTAR_VERS=1
#
# Archive Name: /tmp/spec.pax
#
# This file was created by the IBM z/OS pax or tar utility.
# During the process of creating the archive from which this
# file was extracted, one or more of the source files to be
# stored in the archive was determined to have names or
# attributes that are not supported by the standard USTAR
# format (as described by POSIX.2 IEEE std 1003.2-1992).
# To preserve these files or these characteristics,
# one or more special header files (having the same name as
# this file) were inserted into the archive.  Those files
# are recognized by z/OS pax and tar utilities and are
# used during extraction to restore the files to their
# original state.
## The purpose of this file is to summarize the information
# described by all z/OS special header files stored in
# the archive so that users with versions of pax or tar
# that do not support these special header files can
# manually restore some or all of the files and file
# attributes described by them.  Note that some file
# attributes are specific to z/OS and cannot be restored
```

```
# on other platforms.
#
# The remainder of this file consists of a set of records
# corresponding to each special header file stored in the
# archive.  Each set consists of a record describing the
# path name, one or more reasons explaining why the file or
# attribute could not be stored, and the UNIX command,
# or commands, that would be used to restore the file or
# attribute.  Note that these commands use the path names
# of the file as they existed when archived and may not
# correspond to the current path names on your system.
## path name: level0/longsymlink
# Reason:   1. FSUMF076 target of symbolic link
("level1/level2/level3/level4/level5/level6/level7/level8/
level9/level10/level11/level12/level13/level14/linkbase")
exceeds 100 chars.
# Unix restore commands:
ln -s level1/level2/level3/level4/level5/level6/level7/
level8/level9/level10/level11/level12/level13/level14/
linkbase level0/longsymlink
#
# path name: level0/level1/level2/level3/level4/level5/
level6/level7/level8/level9/level10/level11/level12/
level13/level14/longhardlink
# Reason:   1. FSUMF076 target of hard link ("level0/level1/
level2/level3/level4/level5/level6/level7/level8/level9/
level10/level11/level12/level13/level14/linkbase")
exceeds 100 chars.
# Unix restore commands: ln level0/level1/level2/level3/
level4/level5/level6/level7/level8/level9/level10/level11/
level12/level13/level14/linkbase level0/level1/level2/
level3/level4/level5/level6/level7/level8/level9/level10/
level11/level12/level13/level14/longhardlink
```

Portability

POSIX.2, X/Open Portability Guide.

Related information

The **cpio**, **pax**, and **tar** commands.

pax interchange format

Description

A **pax** archive tape or file produced in the **-x pax** format shall contain a series of blocks. The physical layout of the archive shall be identical to the USTAR format described in “tar — Format of tar archives” on page 1012. Each file archived shall be represented by the following sequence:

- An optional header block with extended header records. This header block is of the form described in “pax header block” on page 1009, with a typeflag value of **x** or **g**. The extended header records, described in “pax extended header” on page 1010, shall be included as the data for this header block.
- A header block that describes the file. Any fields in the preceding optional extended header shall override the associated fields in this header block for this file.
- Zero or more blocks that contain the contents of the file.

At the end of the archive file there shall be two 512-byte blocks filled with binary zeros, interpreted as an end-of-archive indicator.

A schematic of an example archive with global extended header records and two actual files is shown in the following list. In the list, the second file in the archive has no extended header preceding it, presumably because it does not need extended attributes.

USTAR Header [typeflag=g]
Global Extended Header

Global Extended Header Data
Global Extended Header

USTAR Header [typeflag=x]
File 1: Extended Header is included

Extended Header Data
File 1: Extended Header is included

USTAR Header [typeflag=0]
File 1: Extended Header is included

Data for File 1
File 1: Extended Header is included

USTAR Header [typeflag=0]
File 2: No Extended Header is included

Data for File 2
File 2: No Extended Header is included

Block of binary zeroes
End of Archive Indicator

pax header block

Description

The **pax** header block is identical to the USTAR header block described in "tar — Format of tar archives" on page 1012, except that two additional typeflag values are defined:

x Represents extended header records for the following file in the archive (which shall have its own USTAR header block). The format of these extended header records shall be as described in "pax extended header" on page 1010.

g Represents global extended header records for the following files in the archive. The format of these extended header records shall be as described in "pax extended header" on page 1010. Each value shall affect all subsequent files that do not override that value in their own extended header record and until another global extended header record is reached that provides another value for the same field. The typeflag **g** global headers should not be used with interchange media that could suffer partial data loss in transporting the archive.

For both of these types, the size field shall be the size of the extended header records in octets. The other fields in the header block are not meaningful to this version of the **pax** utility. However, if this archive is read by a **pax** utility conforming to the ISOPOSIX-2:1993 standard, the header block fields are used to create a regular file that contains the extended header records as data. Therefore, header block field values should be selected to provide reasonable file access to this regular file.

A further difference from the USTAR header block is that data blocks for files of typeflag 1 (the digit one) (hard link) might be included, which means that the size field may be greater than zero. Archives created by **pax -o linkdata** shall include these data blocks with the hard links.

pax extended header

Description

A **pax** extended header contains values that are inappropriate for the USTAR header block because of limitations in that format: fields requiring a character encoding other than that described in the ISO/IEC646:1991 standard, fields representing file attributes not described in the USTAR header, and fields whose format or length do not fit the requirements of the USTAR header. The values in an extended header add attributes to the following file (or files; see the description of the typeflag **g** header block in "pax header block" on page 1009) or override values in the following header blocks, as indicated in the list of extended header keywords.

An extended header shall consist of one or more records, each constructed as follows:

```
"%d %s=%s\n", <length>, <keyword>, <value>
```

The extended header records shall be encoded according to the ISO/IEC10646-1:2000 standard (UTF-8). The <length> field, <blank>, equals sign, and <newline> shown shall be limited to the portable character set, as encoded in UTF-8. The <keyword> and <value> fields can be any UTF-8 characters. The <length> field shall be the decimal length of the extended header record in octets, including the trailing <newline>.

The field shall be one of the entries from the list in "Extended header keywords" on page 541 or a keyword provided as an implementation extension. Keywords consisting entirely of lowercase letters, digits, and periods are reserved for future standardization. A keyword shall not include an equals sign. In the list of keywords, the notations "files" or "blocks" is used to acknowledge that a keyword affects the following single file after a typeflag **x** extended header, but possibly multiple files after typeflag **g**. Any requirements in the list for **pax** to include a record when in write or copy mode shall apply only when such a record has not already been provided through the use of the **-o** option. When used in copy mode, **pax** shall behave as if an archive had been created with applicable extended header records and then extracted.

If the <value> field is zero length, it shall delete any header block field, previously entered extended header value, or global extended header value of the same name.

If a keyword in an extended header record (or in a **-o** option-argument) overrides or deletes a corresponding field in the USTAR header block, **pax** shall ignore the contents of that header block field.

Unlike the USTAR header block fields, NULLs shall not delimit <value>s; all characters within the <value> field shall be considered data for the field. None of the length limitations of the USTAR header block fields in USTAR Header Block shall apply to the extended header records.

queuedefs — Queue description for at, batch, and cron

Related information

Description

The **queudefs** file describes the characteristics of the queues managed by the clock daemon **cron**. Each line in the file that is not a comment uses the following format to describe a queue:

```
q . [njobj] [nicen] [nwaitw]
```

where the fields are:

q Specifies the name of the queue. Jobs started by **at** default to queue *a*; jobs started by **batch** default to queue *b*, and **crontab** files default to queue *c*. Queue names can be any single-byte character except a space, tab, newline, null, or number sign (#).

njob Specifies the maximum number of jobs that can be run in the queue simultaneously. If more than *njob* jobs are ready to run, **cron** runs the first *njob* jobs immediately, and runs the others as current jobs terminate. The default value is 100.

nice Specifies the nice value (see **nice**) that **cron** assigns to all jobs in the queue that are not run by a user ID with appropriate privileges. The default value is 2.

nwait Specifies the number of seconds that **cron** is to wait before it reschedules a job that was deferred because there were more than *njob* jobs running in that job's queue, or because more than 25 jobs were running in all queues. The default value is 60.

Lines beginning with a number sign (#) are comments, and are ignored.

Examples

Here is a sample **queudefs** file:

```
#
# Sample queuedefs file
#
a.5j3n
b.3j1n90w
```

This file indicates that the *a* queue, for **at** jobs, can have a maximum of five jobs running simultaneously. **crontab** runs the jobs with a **nice** value of 3. Because there is no `nwait` field for this queue, if **cron** cannot run a job because too many other jobs are running, it waits 60 seconds before trying to run it again.

This file also states that the *b* queue, for **batch** jobs, can have a maximum of three jobs running simultaneously. **cron** runs the jobs with a **nice** value of 1. If **cron** cannot run a job because too many other jobs are running, it waits 90 seconds before trying to run it again. All other queues can run up to 100 jobs simultaneously; **cron** runs these jobs with a **nice** value of 2 and, if it cannot run a job because too many other jobs are running, it waits 60 seconds before trying to run it again.

Related information

The **at**, **batch**, and **crontab** commands.

tags — Format of the tags file

Description

When you use the **vi :tag** or **ex :tag** command, or the **ex –t**, **more –5**, **vi –t**, option, that utility looks for a file called **tags** in the current directory. This lets you quickly locate various points of interest in a C program which can span more than one source file. These points of interest are *tags*.

The **tags** file contains tags for function definitions, preprocessor macro definitions, and `typedef` definitions.

For each tag, the **tags** file contains one line in the following form:

tagname sourcefile address

The `tagname` field is the name of the C function, macro, or `typedef`. The `sourcefile` field has the name of the source file containing the tag named **tagname**. The `address` field is an editor address within `sourcefile` to reach the tag definition. This is either a line number in the file or a regular expression (enclosed in ? or / characters) that uniquely matches the line of source code where the tag appears. A tab character separates each field.

For **vi** or **more** to use the **tags** file correctly, it must be sorted by `tagname` using the POSIX locale's collation sequence.

Related information

The **more**, **sort**, and **vi** commands.

tar — Format of tar archives

Description

tar reads and writes headers in either the original TAR format from UNIX systems or the USTAR format defined by the POSIX 1003.1 standard.

The **pax** command reads and writes headers in any of the **tar** formats.

The **tar** command supports both the older UNIX-compatible **tar** formats and the extended USTAR format. The **–X** option needs to be used to enable extended USTAR format. The extended USTAR format allows more information to be stored and supports longer pathnames. There is also a non-portable OS390 format (**–S** option) which also allows storing of additional file attributes and longer pathnames.

A **tar** archive, in either format, consists of one or more blocks, which are used to represent member files. Each block is 512 bytes long; you can use the **–b** option with **tar** to indicate how many of these blocks are read or written (or both) at once.

Each member file consists of a header block, followed by zero or more blocks containing the file contents. The end of the archive is indicated by two blocks filled with binary zeros. Unused space in the header is left as binary zeros.

The header information in a block is stored in a printable ASCII form, so that **tar** archives are easily ported to different environments. If the contents of the files on the archive are all ASCII, the entire archive is ASCII.

Table 43 shows the UNIX format of the header block for a file:

Table 43. Archive file: UNIX-compatible format

Field width	Field Name	Meaning
100	name	Name of file
8	mode	File mode
8	uid	Owner user ID
8	gid	Owner group ID
12	size	Length of file in bytes
12	mtime	Modify time of file
8	chksum	Checksum for header
1	link	Indicator for links
100	linkname	Name of linked file

- A directory is indicated by a trailing / (slash) in its `name`.
- The `link` field is: `1` for a linked file, `2` for a symbolic link, `0` otherwise.

tar determines that the USTAR format is being used by the presence of the null-terminated string USTAR in the `magic` field. All fields before the `magic` field correspond to those of the UNIX format, except that `typeflag` replaces the link field.

Table 44. Archive file: USTAR format

Field width	Field name	Meaning
100	name	Name of file
8	mode	File mode
8	uid	Owner user ID
8	gid	Owner group ID
12	size	Length of file in bytes
12	mtime	Modify time of file
8	chksum	Checksum for header
1	typeflag	Type of file
100	linkname	Name of linked file
6	magic	USTAR indicator
2	version	USTAR version
32	uname	Owner user name
32	gname	Owner group name
8	devmajor	Device major number
8	devminor	Device minor number
155	prefix	Prefix for file name

Description of the header files

In the headers:

- The `name` field contains the name of the archived file. On USTAR format archives, the value of the prefix field, if non-null, is prefixed to the `name` field to allow names longer than 100 characters.
- The `magic`, `uname`, and `gname` fields are null-terminated character strings
- The `name`, `linkname`, and `prefix` fields are null-terminated unless the full field is used to store a name (that is, the last character is not null).

- All other fields are zero-filled octal numbers, in ASCII. Trailing nulls are present for these numbers, except for the `size`, `mtime`, and `version` fields.
- `prefix` is null unless the file name exceeds 100 characters.
- The `size` field is zero if the header describes a link.
- The `chksum` field is a checksum of all the bytes in the header, assuming that the chksum field itself is all blanks.
- For USTAR, the `typeflag` field is a compatible extension of the `link` field of the older **tar** format. The following values are recognized:

  Flag **File Type**

  0 or null
  Regular file

  1 Link to another file already archived

  2 Symbolic link

  3 Character special file

  4 Block special file (not supported)

  5 Directory

  6 FIFO special file

  7 Reserved

  S z/OS extended USTAR special header

  T z/OS extended USTAR special header summary (**S** and **T** are z/OS extensions. See "z/OS-extended USTAR support" on page 548 for more information.)

  A–Z Available for custom usage
- In USTAR format, the `uname` and `gname` fields contain the name of the owner and group of the file, respectively.

Compressed **tar** archives are equivalent to the corresponding archive being passed to a 14-bit **compress** command.

Related information

The **cpio** and **tar** commands

---

utmpx — Format of login accounting files

Description

Login accounting information is stored in two files:
- **/etc/utmpx** holds the current state of each item being accounted
- **/etc/wtmp** maintains the history of changes to each accounting item

Both files are arrays of the following binary records described in the form of a C data structure:

```
#include <sys/types.h>

struct utmpx
 {
   char ut_user[9] ;              /* user login name */
   char ut_id[34] ;               /* unspecified initialization process ID */
   char ut_line[33] ;             /* device name */
```

```
   pid_t ut_pid ;                  /* process id */
   short int ut_type ;             /* type of entry */
   short int ut_version;           /* LE runtime level when boot record is written */
   #ifndef _LP64
     struct timeval     ut_tv;     /* time entry was made */
   #else
     struct __timeval32 ut_tv32;   /* time entry was made */
   #endif
   struct ut_exit_status {
      short ut_e_termination;      /* Process termination status */
      short ut_e_exit ;            /* Process exit status */
     }
   ut_exit ;                       /* The exit status of process markedDEAD_PROCESS. */
   unsigned short ut_reserved1;    /* Reserved for future use */
   char ut_host[1024] ;            /* host name, if remote */
   #ifdef _LP64
      struct timeval      ut_tv;   /* time entry was made */
   #else
      struct __timeval64  ut_tv64; /* time entry was made */
   #endif
 } ;

#define EMPTY         0   /* Unused */
#define RUN_LVL       1   /* Set new run level */
#define BOOT_TIME     2   /* System boot */
#define OLD_TIME      3   /* Time of date change - delta */
#define NEW_TIME      4   /* Time of date change + delta */
#define INIT_PROCESS  5   /* Process started by &[.ETCDIR]/init */
#define LOGIN_PROCESS 6   /* Login process */
#define USER_PROCESS  7   /* User process */
#define DEAD_PROCESS  8   /* Contains exit status */
#define ACCOUNTING    9   /* Other accounting */
```

Files

/etc/utmpx
: Reflects the current state of the accounting entries; for example, who is logged in, when the date was last set, and so on.

/etc/wtmp
: Contains a history of changes to any of the accounting entries.

Related information

The **who** command

uucp — Format of UUCP working files

Description

UUCP uses three kinds of working files when handling UUCP requests, command, data, and execute.

All three files are stored in a subdirectory for each specific site, named after the site's name. For example, because the UUCP spool directory is **/usr/spool/uucp**, then the directory **/usr/spool/uucp/south** is used for all the command, data, and execute files associated with the remote site `south`.

Command Files

Command files are created by the mail routing agents **uucp** and **uux**. On UUCP sites, command files have names such as `C.targetA28B9`, where `target` is the name of the destination site, `A` is the job grade (as set by the **–g** option to **uucp**, and `28B9` is the sequence number or job identification number. (You can use the **–j** option on **uucp** and **uux**, as well as **uustat** to find the job identification number.)

In a command file, each line records one file transfer request. The fields are defined as follows:

type The type field can be one of the following:

- **R** Receive a file from remote to local site.
- **S** Send a file from local to remote site.

source The name of the source file.

destination
The name of the file after the transfer completes, whether to the remote site (S request) or the local site (R request).

Special characters such as the tilde (~) are still present, because they are expanded on the destination site.

sender The login name of the user who issued the command. This is normally your login name, though some programs (such as mail programs) use a different login name for their requests.

options
The command options, which correspond to options of the **uucp** and **uux** commands.

- **C** Use the data file name as the source for the copy; this can only be used with the S request.
- **c** Use the source file name as the source for the copy.
- **d** Create intermediate target directories as required. This is the default.
- **m** Send mail to the user when the transfer is complete.
- **n** Send mail to the user specified by the notification name when the transfer is complete.

datafile
The temporary file to be used if the source file was copied into the spool directory; it is only used with the S request. If **C** is one of the options, the data file is the name of the copy in the destination site's data spool directory. Otherwise, the placeholder name D.0 is used.

file mode
The UNIX-style permission mode of the source file. It is only used with the S request. All files sent have mode 0666, plus whatever execute permissions the original file had. (For an explanation of the modes, see **chmod**.)

notification
The login name of the person to be notified after the job request completes. It is used only with the S request if n is one of the options.

Examples

1. The command

   ```
   uucp –m /memos.001 /memos.002 south!~/
   ```

   copies the files **/memos.001** and **/memos.002** root directory to the public UUCP directory on south. Assuming your user name is eve, a command file containing these lines is created in the UUCP spool directory **/usr/spool/uucp/south**:

```
S /memos.001 ~/memos.001 eve –mcd D.0 0777
S /memos.002 ~/memos.002 eve –mcd D.0 0777
```

2. The command

   ```
   uucp south!~/index ~/
   ```

   generates a command file on your site in the UUCP spool directory **/usr/spool/uucp/south** containing this line:

   ```
   R ~ /index ~/index eve –cd
   ```

Data files

Data files contain data to be transferred to the remote site. They are created by **uucp** if the **–C** option is used, and by **uux** and **mail** programs.

On UUCP sites, data files have names like `D.source9B73001`, where `source` is the name of the site that the data file originated from (the local site for an `S` request, or the remote site for an `R` request), `98B3` is the sequence number, and `001` is the subsequence number, used when a request generates more than one data file.

Data files created by **uucp** contain files to be copied. Data files created by **uux** which contain commands for the remote site become execute files at their destination.

Mail sites typically create two data files, one containing the message and the other containing the command to run the mail routing agent on the remote site.

Examples

UUCP data files contain data to be copied. The contents of **uux** data files and commands that generate remote commands are execute files intended for other sites. For example, a mail message to `north` generates two data files in the UUCP spool directory **/usr/spool/uucp/north**

```
D.north000A001
X.northX000A002
```

These working files are created:

```
D.north000A001    Text of mail message
X.northX000A002   Execute file
```

The execute file contains the **uux** request for the mail routing program to be run on `north`.

Execute files

Execute files are data files containing commands that are created on other sites and copied to your site. The files are treated as execute files when they arrive at your site, where the commands are run by **uuxqt**.

On UUCP sites, execute files are named as:

```
X.remotX28A3003
```

where *remot* is the first five characters of the destination site's name, `X` is the job grade (execute files always have the grade `X`), and `28A3` is the sequence number.

Each execute file contains one command, and the necessary information to run the command. The type of information on each line is identified by the first character in the line. Not all lines are used in all files, and not all UUCP implementations support all of these lines. The first line in an execute file must be a `U` line, and the last line must be a `C` line.

# Indicates a comment. Comments and unrecognized commands are ignored.

C *command*
Requests that *command* be run. *command* is a string that includes the program and arguments. This line must be present and must be the last line in the execute file.

E Processes the command with **execve()**. If the `E` line is present, **uuxqt** runs a **fork()/ecec()** sequence, unless the command contains a shell metacharacter. In that case, **uuxqt** invokes a shell to run the command.

e Processes the command by the POSIX shell. It is intended to handle commands that require special processing. If the `e` line is present, **uuxqt** invokes the defined shell to run the command.

F *filename* **[** *xqtname* **]**
Names *filename*, a file required for the command to be run. This is usually a file that is transferred from the site that **uux** was executed from, but it can also be a file from the local site or some other site. If *filename* is not from the local site, then it is usually a file in the spool directory. Multiple `F` lines are allowed. Any file other than the standard input file requires the *xqtname* argument and is copied to the execution directory as *xqtname*. If the standard input file is not from the local site, it appears in both an **F** command and an **I** command.

I *stdin* Names the file that supplies standard input to the command. If the standard input file is not from the site running the command, the file is also in an **F** command. If there is no standard input file, behavior depends on the site implementation. **uuxqt** rejects the command; some UNIX implementations use **/dev/null** as the standard input. Only one **I** line can be present in an execute file; the corresponding **F** line must precede the file.

N No mail message should be sent, even if the command failed.

n Requests a mail message be sent if the command succeeded. Normally a message is sent only if the command failed.

O *stdout* **[** *site* **]**
Names the standard output file. The optional second argument names the site to which the file should be sent. If there is no second argument, the file should be created on the executing site. Only one **O** line can be present in an execute file; the corresponding **F** line must precede the **O** line.

U *user site*
Names the user who requested the command and the site that the request came from. This line must be present and must be the first line in the execute file.

Z Specifies that a mail message should be sent if the command failed. This is the default for **uuxqt**.

Not all these commands may be implemented at your site. For a list of the commands not supported by **uuxqt**, see **uuxqt**.

Although most execute files are generated on other sites, complex **uux** commands that retrieve files from multiple sites can generate execute commands in the local spool directory, where *local* is the name of your site.

Examples

The following is an example of an execute file to run **rmail** on the site `south`. The data file containing the mail message is `D.south49Z3`. This is an execute file that might be created by the **mailx** command:

```
U eve north
F D.south49Z3
I D.south49Z3
C rmail bob
```

This command originated with user `eve` on `north`. It requests that **rmail** be run with the argument `bob` on the target site. The file **D.south49Z3** is required to run the command and is used as standard input for the command.

Portability

X/Open Portability Guide.

Related information

uucico, **uucp**, **uux**, **uuxqt**

Appendix I. Format of the TZ environment variable

Command format

Format

TZ= *standardHH[:MM[:SS]] [daylight[HH[:MM[:SS:]]] [,startdate[/starttime],enddate[/endtime]]]*

Description

All commands assume that times stored in the file system and returned by the operating system are stored using Universal Time Coordinated (UTC), hereafter referred to as the universal reference time. The mapping from the universal reference time to local time is specified by the TZ (time zone) environment variable.

The value of the TZ environment variable has these fields (two required and three optional):

standard
: An alphabetic abbreviation for the local standard time zone; for example, GMT, EST, MSEZ.

HH[:MM[:SS]]
: The time offset westward from the universal reference time. A leading minus sign (-) means that the local time zone is east of the universal reference time. An offset of this form must follow *standard* and can also optionally follow *daylight*. An optional colon (:) separates hours from optional minutes and seconds.

  If *daylight* is specified without a *daylight* offset, daylight saving time is assumed to be one hour ahead of the standard time.

[daylight]
: The abbreviation for your local daylight saving time zone. If the daylight field is missing, the conversion to daylight saving time is disabled. The number of hours, minutes, and seconds your local daylight saving time is offset from UTC when daylight saving time is in effect. If the daylight saving time abbreviation is specified, and the offset omitted, the offset of one hour is assumed.

[,startdate[/starttime],enddate[/endtime]]
: A rule that identifies the start and end of daylight saving time, specifying when it should be in effect. Both the *startdate* and *enddate* must be present, and must either take the form `J`*n*, *n*, or `M`*m.w.d.*.

  - `J`*n* is the Julian day *n* (1 <= *n* <=365). Leap days are not counted. In all years, including leap years, February 28 is day 59 and March 9 is day 60. It is impossible to implicitly refer to the occasional February 29.
  - *n* is the zero-based Julian day (0 <= *n* <= 365). Leap days are counted, and it is possible to refer to February 29.

    Non-leap year
    January 1
    Day 0

February 28
Day 58
March 1
Day 59
December 31
Day 364

Leap year
January 1
Day 0
February 29
Day 59
March 1
Day 60
December 31
Day 365

- `M`*m.w.d* defines the day (0 <= *d* <= 6) of week *w* (1 <= *w* <= 5) of month *m* (1 <= 12) of the year. Week 5 has the last day (*d*) in month *m*, which may occur in either the fourth or fifth week). Week 1 is the first week in which the *d*th day occurs. Day zero is Sunday.

Neither *starttime* nor *endtime* are required. If they are omitted, their values default to 02:00:00. If this daylight saving time rule is omitted altogether, the values in the rule default to the standard rules for American daylight saving time.

When the TZ variable is not set, time conversions behave as if TZ were set to `TZ=GMT0`.

Portability

This interpretation of the TZ environment variable is a superset of that supported by UNIX System V.

Description

The **locale**, **date** and **touch** commands.

Appendix J. Environment variables

This information contains a partial list of environment variables.

- For the **c89/cc/c++** environment variables, refer to the **c89/cc/c++** command.
- For the **xlc** environment variables, refer to the "xlc — Compiler invocation using a customizable configuration file" on page 870 command.
- For the **mailx** environment variables, refer to the "mailx — Send or receive electronic mail" on page 416 command.
- For the **tcsh** environment variables, refer to the "tcsh — Invoke a C shell" on page 689 command.
- For the **tso** environment variables, refer to the "tso — Run a TSO/E command from the shell" on page 772 command.
- For the **tsocmd** environment variables, refer to the tsocmd command.
- For the **vi** environment variables, refer to the "vi — Use the display-oriented interactive text editor" on page 828 command.

For a list of built-in environment variables, refer to Table 29 on page 624. (Built-in environment variables are predefined variables that are set up with default values when you start the shell.)

A list of commonly used environment variables is in *z/OS UNIX System Services Planning*.

Appendix K. Specifying MVS data set names in the shell environment

Several utilities allow the user to specify an MVS data set name in place of a z/OS UNIX file name. See "Utilities that support MVS data set names" for the current list. This topic describes the syntax for specifying an MVS data set name. Because MVS data set names generally contain single quotation marks and parentheses, which can be misinterpreted by the shell, care needs to be taken to correctly escape these characters.

What follows are general rules for specifying MVS data set names. Consult the description of each utility for more specific instructions or exceptions.

- MVS data sets are distinguished from z/OS UNIX files by preceding them with two slashes (//). For example, to specify the MVS data set name PROGRAM.OUTPUT, enter:

  ```
  //PROGRAM.OUTPUT
  ```

  If the double slashes were not used, the name would be interpreted as the file path name PROGRAM.OUTPUT in the current working directory.
- Unless a utility specifically provides an option to disable uppercasing, the default approach is to make all MVS data set names uppercase before processing. For example, the following are all equivalent methods for specifying the MVS data set PROGRAM.OUTPUT:

  ```
  //program.output
  //ProGram.OutPut
  //PROGRAM.OUTPUT
  ```
- The single quotation mark (') and parentheses (**()**) metacharacters are typically used to specify fully qualified MVS names and PDS/PDSEs, respectively. These characters, however, are metacharacters that will be incorrectly interpreted by the shell. To prevent this situation, they must be escaped. The simplest approach is to place the entire name within double quotation marks ("). Alternatively, these characters can be escaped by preceding each with a backslash (\). For example:

  To specify the fully qualified MVS data set 'SMITH.PROGRAM.OUTPUT':

  ```
  "//'smith.program.output'"
   //\'smith.program.output\'
  ```

  To specify the fully qualified partitioned data set 'SMITH.PROGRAM.SOURCE(FILE1)':

  ```
  "//'smith.program.source(file1)'"
   //\'smith.program.source\(file1\)\'
  ```

  To specify the non-qualified partitioned data set PROGRAM.SOURCE(FILE1):

  ```
  "//program.source(file1)"
   //smith.program.source\(file1\)
  ```

Utilities that support MVS data set names

The following utilities currently support the use of MVS file names. Consult the description for each utility for limitations and exceptions:

- **automount**
- **c89**

- **cp**
- **mv**
- **pax**
- **tar**

Restriction: MVS data sets defined with DSNTYPE=LARGE are not supported.

Appendix L. Controlling text conversion for z/OS UNIX shell commands

This information describes the various methods for controlling text conversion for the z/OS UNIX shell and utilities.

Using automatic code set conversion

Most commands that perform file input and output allow automatic code set conversion of files that are tagged as text with a code set. For example, a file with ISO8859-1 (ASCII) content that is tagged with TXT, ISO8859-1 can be converted to IBM-1047 (EBCDIC) for processing by z/OS UNIX shells and utilities. Automatic conversion is controlled by configuration parameters and environment variables. For more information about automatic conversion, see *z/OS UNIX System Services Planning*.

Restriction: For commands that can specify text conversion (see "Specifying the text conversion" on page 1028, automatic conversion can take place between IBM-1047 and any code sets that Unicode Service supports. For **sh**, automatic conversion is supported with the limitation of the SBCS code pages of the locale and SBCS shell scripts. For **tsch**, automatic conversion is supported with the limitation of the SBCS code page of the locale. For other commands, automatic conversion can only be supported between the IBM-1047 and ISO8859-1 code sets.

Shell redirection and automatic conversion

In the z/OS shell or the tcsh shell, when the shell is redirecting the standard input (stdin), standard output (stdout), or standard error (stderr), the default behavior is no automatic conversion of tagged files and no tagging of files created by the redirection. However, shell variables can be used to control the automatic conversion. For more information about shell redirection and automatic conversion, see Shell variables (shell variables for automatic conversion) and "tcsh shell and environment variables" on page 717 (using tcsh shell variables to control automatic conversion).

You can also use shell variables for commands in a pipeline. For example, they can be used to tag the standard output of each command that is writing to a pipeline or to tag the standard input of each command that is reading from a pipeline.

Disabling automatic conversion

Many commands that perform file input/output, by default, allow automatic conversion of tagged files. Some of these commands can disable automatic conversion using the **-B** option. The explicit use of the **-B** option on the command overrides any automatic conversion as well as any text conversion indicated by the _TEXT_CONV environment variable.

The **-B** option applies to the input text file that is processed by the command. Other files used by the command, such as a file list or configuration information, are not affected by the **-B** option. When a command allows the use of the standard input (stdin) in place of the input text file, the **-B** option will disable automatic conversion of the standard input (stdin) if it is not associated with a terminal.

Following are commands can be used to disable automatic conversion using the **-B** option.

cat	**grep**
cmp	**head**
comm	**more**
cut	**pack**
diff	**paste**
dircmp	**sed**
ed	**strings**
egrep	**tail**
ex	**unexpand**
expand	**uniq**
fgrep	**vi**
file	**wc**

Specifying the text conversion

Some commands that perform file input/output and, by default, allow automatic conversion of tagged files, allow the automatic code set conversion of files that are tagged as text with a code set have the option of specifying the text conversion. These commands use the **filecodeset** and **pgmcodeset** option (**-W** option to specify the text conversion. The explicit use of the **filecodeset** or **pgmcodeset** option (**-W** option on the command will override any automatic conversion, any use of the **–B** option to disable automatic conversion, as well as any text conversion indicated by the _TEXT_CONV environment variable

The **filecodeset** and **pgmcodeset** option (**-W** option) applies to the input text file that is processed by the command. Other files that are used by the command, such as a file list or configuration information, are not affected by the **filecodeset** and **pgmcodeset** option (**-W** option). When a command allows the use of the standard input (stdin) in place of the input text file, the **filecodeset** and **pgmcodeset** option (**-W** option) will be applied to the standard input (stdin) if it is not associated with a terminal.

The coded character set can be specified by using the code set name or by using the numeric coded character set identifier (CCSID). The command `iconv -l` lists existing numeric CCSIDs along with their corresponding code set names.

Note: BPXK_UNICODE_TECHNIQUE, _BPXK_UNICODE_SUB and _BPXK_UNICODE_MAL specifies the Unicode Services actions to take for the translation operation. For more information about those environment variables, see *z/OS UNIX System Services Planning*.

Restriction: Text conversion can take place between **pgmcodeset IBM-1047** and any **filecodeset** that Unicode Service supports.

Following are commands that can specify text conversion using the **filecodeset** or **pgmcodeset** option (**-W** option).

cat
cmp

comm
cut
diff
dircmp
ed
egrep
ex
expand
fgrep
file
grep
head
more
paste
sed
strings
tail
unexpand
uniq
vi
wc

Using the _TEXT_CONV environment variable

Use the _TEXT_CONV environment variable if you know that all input text files for a given set of commands require the same text conversion. It applies to commands that support the **filecodeset** and **pgmcodeset** option (**-W** option) and the **-B** option (disable automatic conversion of tagged files).

Environment variable	Description	Valid values
_TEXT_CONV	Contains text conversion information for commands that support a text conversion specification. Multiple value keywords are separated by a comma. Additional information for value keywords that require it are placed within parentheses immediately after the value. For example: FILECODESET(ISO8859-1)	FILECODESET PGMCODESET DISABLE

Use the _TEXT_CONV environment variable if it is not possible to use the **filecodeset** and **pgmcodeset** option (**-W** option) and the **-B** option (disable automatic conversion of tagged files). If any of those options are specified on a command, the specified command option is used to determine the text conversion. If none of those options are specified on the command, the _TEXT_CONV environment variable is used to determine the text conversion. If none of those options are specified and the environment variable is not set, then automatic code set conversion occurs, if enabled.

The valid value keywords for the _TEXT_CONV environment variable correspond to the **filecodeset** and **pgmcodeset** option (**-W** option) and the **-B** option (disable automatic conversion of tagged files). When a value keyword is included in the _TEXT_CONV environment variable, the behavior of the command will be as if the corresponding option was specified on the command. The corresponding value keywords are as follows:

Command option	Corresponding _TEXT_CONV value keyword
-W filecodeset	FILECODESET
-W pgmcodeset	PGMCODESET
-B	DISABLE

The FILECODESET and PGMCODESET value keywords require a supported coded character set to be specified within parenthesis. Multiple value keywords are separated with a comma. If the DISABLE value keyword is used along with either the FILECODESET or PGMCODESET value keywords, the DISABLE value keyword is ignored.

If the specified coded character set for the FILECODESET or PGMCODESET value keyword is not valid, an error condition will occur for all commands that support the **filecodeset** and **pgmcodeset** option (**-W** option), as if the invalid code set were specified on the command.

If the _TEXT_CONV environment variable is used by a command and it contains a value keyword other than FILECODESET, PGMCODESET, or DISABLE, an error message will be issued and the command ends. If the _TEXT_CONV environment variable is used by a command and it contains a syntax error, an error message will be issued and the command ends.

Some examples of specifying text conversion using the _TEXT_CONV environment variable:

1. To indicate text conversion from the ASCII code set ISO8859-1 to the EBCDIC code set IBM-1047 using the _TEXT_CONV environment variable:
   ```
   export _TEXT_CONV="FILECODESET(ISO8859-1),PGMCODESET(IBM-1047)"
   ```
2. To indicate text conversion from the ASCII code set 819, but allow the default value for PGMCODESET using the _TEXT_CONV environment variable:
   ```
   export _TEXT_CONV="FILECODESET(819)"
   ```
3. To use the _TEXT_CONV environment variable to disable automatic conversion:
   ```
   export _TEXT_CONV="DISABLE"
   ```

Note: When exporting the _TEXT_CONV environment variable, it is very important to understand that all commands that support the corresponding options performs the requested text conversion, regardless of the input text file that is being used. For example, if automatic conversion is enabled and the input file is a tagged file, the automatic conversion is ignored and the text conversion indicated by the _TEXT_CONV environment variable is used. However, if a command specifies any of the corresponding options, that option will override the _TEXT_CONV environment variable.

The coded character set can be specified by using the code set name or by using the numeric coded character set identifier (CCSID). The command `iconv -l` lists existing numeric CCSIDs along with their corresponding code set names.

Note: _BPXK_UNICODE_TECHNIQUE, _BPXK_UNICODE_SUB and _BPXK_UNICODE_MAL specify the Unicode Services actions to take for the translation operation. For more information about those environment variables, see *z/OS UNIX System Services Planning*.

Restriction: Text conversion can take place between **pgmcodeset IBM-1047** and any **filecodeset** that Unicode Service supports.

Following are commands that are affected by the FILECODESET and PGMCODESET value keywords of the _TEXT_CONV environment variable.

cat	**grep**
cmp	**head**
comm	**more**
cut	**paste**
diff	**sed**
dircmp	**strings**
ed	**tail**
egrep	**unexpand**
ex	**uniq**
expand	**vi**
fgrep	**wc**
file	

Following are commands that are affected by the DISABLE value keyword of the _TEXT_CONV environment variable.

cat	**grep**
cmp	**head**
comm	**more**
cut	**pack**
diff	**paste**
dircmp	**sed**
ed	**strings**
egrep	**tail**
ex	**unexpand**
expand	**uniq**
fgrep	**vi**
file	**wc**

Commands that prevent automatic conversion by default

Table 45 lists commands that expect binary data, so they prevent automatic conversion.

Table 45. Commands that disallow automatic conversion by default

Command	Special behavior
cksum	Allows automatic conversion with **–T**.

Table 45. Commands that disallow automatic conversion by default (continued)

Command	Special behavior
compress	• Allows automatic conversion on the file being read. • Disables automatic conversion on the compressed file and allow the automatic tagging of the file as binary. Because file tag information cannot be preserved in the compressed file, you can lose data if translation does not occur on input. If you want translation to occur, change the file tag, or disable automatic conversion with the _BPXK_AUTOCVT environment variable.
dd	• Prevents automatic conversion. • If you specify **conv=ascii**, **conv=ebcdic**, or **conv=ibm**, and the input is tagged as text, **dd** issues a warning message if the file tag does not match the expected output.
gencat	Prevents automatic conversion.
mkcatdefs	Prevents automatic conversion.
od	Allows automatic conversion with **–T**.
sum	Allows automatic conversion with **–T**.
uncompress and **zcat**	• Disables conversion on the compressed file being read. • Allows conversion on the uncompressed file being written. Because the compressed file must always be binary, IBM recommends that you do not provide the option to allow translation of a compressed file on input. However, if you need to do this, you must perform it manually using **iconv**
unpack and **pcat**	Prevents automatic conversion.
uudecode	Prevents automatic conversion.
uuencode	Prevents automatic conversion

Appendix M. Additional dbx documentation

The following topics are **dbx** help texts that are not particular to a specific command. They can be viewed within **dbx** by using the *help* command. You can also view them as man pages, using the traditional **man** syntax, with "dbx" and the topic title in the place of a command name. For example, `man dbxexecution` would display the execution page. Within **dbx** , `help execution` would display the same page.

execution: Controlling execution

The **dbx** utility allows you to set breakpoints (stopping places) in the target program. After entering **dbx**, you can specify which lines or addresses are to be breakpoints and then run the program with **dbx**. When the program reaches a breakpoint, it halts and reports that it has reached a breakpoint. You can then use **dbx** subcommands to examine the state of your program.

For execution controlling commands, see: **run**, **rerun**, **stop**, **status**, **catch**, **ignore**, **cont**, **step**, **next**, and **return** commands.

files: Accessing source files

Accessing source files:

```
/<regular-expression>[/]
?<regular-expression>[?]
```

Search forwards or backwards, respectively, in the current source file for the given regular-expression. Both forms of search wrap around. The previous regular expression is used if no regular expression is given to the current command.

See also: **edit**, **file**, **func**, **list**, and **use** commands.

scope: Scope

When displaying variables and expressions, **dbx** resolves names first using the static scope of the current function. The dynamic scope is used if the name is not defined in the first scope. If static and dynamic searches do not yield a result, an arbitrary symbol is chosen and the system prints the following message:

```
[using <module.variable>]
```

The `<module.variable>` is the name of an identifier qualified with a block name. You can override the name resolution procedure by qualifying an identifier with a block name. Source files are treated as modules named by the file name without the language suffix (such as, the .c suffix on a C language program).

threads: Thread display and control

If execution is stopped for any one thread, the entire process and all other threads in the process also stop. The **dbx** events such as breakpoints are not specific to any one thread. If one thread hits a breakpoint, all threads and the process stop. An automatic way to ensure that other threads do not hit breakpoints set by next(i) or step(i) is to set the variable $hold_next. **dbx** will then hold all threads except the

current thread during those operations, then unhold all threads after the operation is complete. Holding all threads, or holding a thread that may release a mutex will cause the user program to deadlock. Conditional breakpoints can be used to specify breakpoints for any one particular thread by checking the execution state of the thread.

For example:

```
'stop at 42 if $t2==$current'
```

will set a breakpoint at line 42 only for thread two.

For thread display and control, see the **condition**, **mutex**, **readwritelock**, and **thread** commands. For manipulation of thread-oriented **dbx** variables ($c<n>, $t<n>, $l<n>, $current, $hold_next, $cv_events, $mv_events, $tv_events, and $lv_events), see the **assign**, **print**, **set**, and **whatis** commands.

usage: Basic command usage

Basic **dbx** command usage:

run Begin or restart execution of the program

print <exp>
Print the value of the expression

where Print currently active functions (stack trace)

stop at <line>
Set a breakpoint at the line

stop in <proc>
Set a breakpoint when a particular function is called

cont Continue execution

step Single step one line

next Step to next line (skip over calls)

trace <line#>
Trace execution of the line

trace <proc>
Trace calls to the procedure

trace <var>
Trace changes to the variable

trace <exp> at <line#>
Print <exp> when <line> is reached

status Print trace/stop's in effect

delete <number>
Remove trace or stop of given number

whatis <name>
Print the declaration of the name

list <line>, <line>
List source lines

registers
Display register set

quit Exit **dbx**

variables: "Set" variables

The following variables for the **set** subcommand have special meanings:

$asciichars
Any **dbx** operation that displays the value of a character will interpret the binary representation of the character as ASCII.

$asciistrings
Any **dbx** operation that displays the value of a string will interpret the binary representation of the string as ASCII.

$c<n> Condition variables.

$catchbp
Catches breakpoints during the execution of the next command.

$charset="destCodePage,srcCodePage"
Converts character strings before displaying them. The character strings are converted from the code page srcCodePage to destCodePage. The destCodePage must be IBM-1047. The default setting is not to convert the character strings.

$commandedit
Enables the command-line facility.

$current
Defined as a constant with the value of the current thread.

$cv_events
Notifies the user but does not stop when a condition variable event is processed. The following trace information is sent to the user for the different events:

```
(dbx) cont
.
.
cv initialize, object=0x2e04567
cv wait, object=0x2e04567, mutex=0x2d04567, thid=0x0102030405060708
cv unwait, object=0x2e04567, mutex=0x2d04567, thid=0x0102030405060708
cv destroy, object=0x2e04567
.
.
```

$dll_loads
Set by default. **dbx** processes symbolics for DLLs as they are loaded.

$dll_loadstop
Set by default. **dbx** stops the function call that caused the DLL to be loaded. If the DLL was loaded due to a variable reference or an explicit load, **dbx** stops at the source line that caused the DLL to be loaded.

$expandunions
Displays values of each part of variant records or unions.

$expressionexhaustivesearch
Searches all scopes in a user's program to determine and verify the scope for an expression. Selecting this option might degrade performance.

$fl_precison
Determines the precision in bytes of floating-point registers when used in expressions, displays and during assignment. Valid values are 4, 8 or 16.

$fr<n>
Hexadecimal floating-point register.

$frb<n>
Binary floating-point register

$frd<n>
Decimal floating-point register

$hexchars
Prints characters as hexadecimal values.

$hexin
Input is interpreted in hexadecimal format.

Restriction: The **$hexin** variable is only supported in **dbx** command-line mode and does not affect the interpretation of GUI input. If the user of the GUI debugger wants input to be interpreted in hexadecimal format, the input must be prefixed with "0x".

$hexints
Prints integers in hexadecimal format instead of decimal format.

$historypage
Specifies the number of history items to be traversed when using the page up and page down keys.

$history_unique
Prevents consecutive duplicate commands from being saved to the history list.

$historywindow
Specifies the number of commands to display and retain in the history list.

$hold_next
Automatically holds all threads except the current thread during **next**, **nexti**, **step** or **stepi** command execution. If not set, all threads resume execution and might hit the breakpoint set by the **next**, **nexti**, **step**, or **step** command execution.

$l<n> Read/write locks variables.

$listwindow
Specifies the number of lines to list around a function and to list when the **list** subcommand is used without parameters.

$lv_events
Notifies the user but does not stop when a read/write lock object event is processed. The following trace information is sent to the user for the different events:

```
(dbx) cont
.
.
lv initialize, object=0x2d04567
lv wait, object=0x2d04567, thid=0x0102030405060708
lv unwait, object=0x2d04567, thid=0x0102030405060708
lv lock, object=0x2d04567, thid=0x0102030405060708
lv unlock, object=0x2d04567, thid=0x0102030405060708
lv relock, object=0x2d04567, thid=0x0102030405060708
lv unrelock, object=0x2d04567, thid=0x0102030405060708
lv destroy, object=0x2d04567
.
.
```

$m<n>
Specifies mutex variables.

$maxstring
Specifies the maximum number of characters to be displayed when printing a string. String printing stops when $maxstring characters are printed. Set to zero to completely display strings. The default value is zero.

$mv_events
Notifies the user but does not stop when a mutex object event is processed. The following trace information is sent to the user for the different events:

```
(dbx) cont
.
.
mv initialize, object=0x2d04567
mv wait, object=0x2d04567, thid=0x0102030405060708
mv unwait, object=0x2d04567, thid=0x0102030405060708
mv lock, object=0x2d04567, thid=0x0102030405060708
mv unlock, object=0x2d04567, thid=0x0102030405060708
mv relock, object=0x2d04567, thid=0x0102030405060708
mv unrelock, object=0x2d04567, thid=0x0102030405060708
mv destroy, object=0x2d04567
.
.
```

$noargs
Omits arguments from subcommands, such as **where**, **up**, **down**, and **dump**.

$noflbregs
Does not display the binary floating point representation of the floating point registers with the **registers** subcommand.

$nofldregs
Does not display the decimal floating point representation of the floating point registers with the **registers** subcommand.

$noflregs
Does not display the hexadecimal floating point representation of the floating point registers with the **registers** subcommand.

$octin Interprets input in octal format. The **$octin** variable is only supported in **dbx** command-line mode and does not affect the interpretation of GUI input. If the user of the GUI debugger wants input to be interpreted in octal format, the input must be prefixed with `0`.

$octints
Prints integers in octal format.

$pc Program counter register.

$psw First word of the program status word register.

$psw0 First word of the program status word register.

$psw1 Second word of the program status word register.

$r<n> General register.

$r_precision
Sets the amount of precision, in bytes, to use when displaying an integer value. Possible values are 4 and 8.

$repeat
Repeats the previous command if no command was entered.

$showbases
Displays the base class data when a derived class is printed.

$sigblock
Blocks all signals from reaching the program being debugged.

$sticky_debug
Recognizes sticky bit programs and DLLs in the loadmap.

$t<n> Thread variables

$tv_events
Notifies the user but does not stop when a thread object event is processed. Trace information similar to the following example is sent to the user for the different events:

```
(dbx) cont
.
.
IPT create, thid=0x1234567890123456, stack=5200
IPT exit, thid=0x1234567890123456
tv create, thid=0x1234567890123456,  created thid=0x1234567890123422,
           stack=5200
tv created, thid=0x1234567890123456, stack=5200
tv exit, thid=0x1234567890123456
tv wait, thid=0x1234567890123456, joining thid=0x1234567890123422
tv unwait, thid=0x1234567890123456, joined thid=0x1234567890123422
```

$unsafeassign
Turns off strict type checking between the two sides of an **assign** subcommand.

$unsafebounds
Turns off subscript checking on arrays.

$unsafegoto
Turns off the **goto** subcommand destination checking.

Appendix N. Shell commands changed for UNIX03

z/OS UNIX is UNIX95 conformant, with extensions to commands using formats (such as uppercase option letters) to avoid conflicts with subsequent UNIX standards. The specification of new options and changed command behavior by SUSv3 (also known as UNIX03) has resulted in conflicts with IBM's extensions.

The _UNIX03 shell variable was introduced in z/OS 1.8 as a means of controlling whether certain shell commands behave according to Single UNIX Specifications, version 3 (SUSv3). _UNIX03=YES is only needed when an option or behavior conflicts with an existing z/OS implementation, and the SUSv3 behavior is desired. Additional command changes introduced in z/OS 1.9 have behavior conflicts controlled by the _UNIX03 variable. If _UNIX03 is not set (or set to "NO"), the z/OS 1.9 commands will maintain compatibility with prior releases.

Therefore, system programmers should make sure that _UNIX03 is not set in system-wide profiles (or setup scripts), including:

/etc/profile

/etc/csh.cshrc

/etc/csh.login

/etc/rc

Users who want the SUSv3 conformant behavior can set _UNIX03=YES in their own profile files, or in specific scripts or command invocations where it is needed.

Table 46 lists the commands changed for UNIX03. (It is not a complete list of changes to shell commands.) For more detail, see the specific command description.

Table 46. UNIX shell commands and _UNIX03

Command	z/OS release introduced	Affected option or behavior	_UNIX03 =YES	_UNIX03 is unset or not YES
awk	1.9	Stricter rules on a command-line argument being treated as a variable assignment	No effect	No effect
		Handling of break or continue statements outside of a loop	Displays error and halts processing	Displays warning, exits current pattern or function, and continues processing
bc	1.9	**/usr/lib/lib.b** improved cos() and sin() performance	No effect	No effect
cp	1.8	Options added or changed: **-H** | **L** | **P** **-W** *seqparms*	**-P** specifies symbolic link handling	**-P** *params* specifies sequential data set parameters

Table 46. UNIX shell commands and _UNIX03 (continued)

Command	z/OS release introduced	Affected option or behavior	_UNIX03 =YES	_UNIX03 is unset or not YES
cksum	1.10	Output and diagnostic messages	Output defaults to space-separated: `cksum bytecount filename` If a *filename* operand is not specified, the path name and its leading white space is omitted. If a read error occurs, the checksum for that file is not displayed and a diagnostic message is sent to stderr.	Output defaults to tab-separated: `cksum bytecount filename` If a *file* operand is not specified, the path name and its leading tab is omitted. If a read error occurs, **cksum** attempts to display the available checksum to standard output and marks the output line with FSUM6199 [read error].
ed	1.9	Minor changes in subcommands **c**, **i**, **g**, **G**, **v**, **V**, **l** (lowercase L), **s**	**c** and **i** subcommands: accept address 0 as 1 **g**, **G**, **v**, **V** subcommands: unmark changed lines **l** (lowercase L) subcommand writes **$** as **\$** **s** subcommand: % without prior **s** subcommand is an error	**c** and **i** subcommands: reject address 0 **g**, **G**, **v**, **V** subcommands: leave lines marked **l** (lowercase L), subcommand does not escape **$** characters **s** subcommand: % without prior **s** subcommand is accepted
file	1.9	Options added or changed: **-d -M -i** New magic file format **-h** handling of link to a nonexistent file	**-m** *magic* tested before **/etc/magic** magic file (byte, short, long) format are signed **-h** is the default Output separator char is a space	**-m** *magic* tested instead of **/etc/magic** magic file (byte, short, long) format are unsigned **-h** is not the default (The default is to follow symbolic links) Output separator char is a tab
mailx	1.9	Default command-mode subcommand **Followup** command-mode subcommand Honors the TZ environment variable Use tilde (**~**) as the escape character when **escape** variable is unset	Default subcommand is **next** **Followup** overrides the **record** variable	Default subcommand is **print** **Followup** does not override the **record** variable
od	1.9	Output of signed single-byte values	No effect	No effect

Table 46. UNIX shell commands and _UNIX03 (continued)

Command	z/OS release introduced	Affected option or behavior	_UNIX03 =YES	_UNIX03 is unset or not YES
pax	1.8	Options added or changed: **-H** **-x pax** (new format) **-o** *keyword=value* (new keywords) **pax -r** restore of access permission bits, when neither **-p p** or **-p e** is specified	**-o** multiple keyword/value pairs must be separated by commas (with white space allowed before a keyword) Files are restored with permissions **0666** modified by **umask**.	**-o** multiple keyword/value pairs may be separated by commas or spaces Files are restored with **saved permissions** modified by **umask**.
sed	1.9	Subcommand preceded by **!** **s** subcommand with **w** specified **y** subcommand with **\n** in a specified set of characters	One or more **!** characters are allowed **w** and *file* must be separated by blank(s) **\n** is treated as a newline	Only one **!** character is allowed **w***file* is allowed or may be separated by blank(s) **\n** is treated as a character 'n'
sum	1.10	Output and diagnostic messages	Output defaults to space-separated: `checksum bytecount filename` If a *filename* operand is not specified, the path name and its leading white space is omitted. When a read error occurs, the checksum for that file is not displayed and a diagnostic message is sent to stderr.	Output defaults to tab-separated: `checksum bytecount filename` If a *file* operand is not specified, the path name and its leading tab is omitted. When a read error occurs, **sum** attempts to display the available checksum to stdout and marks the output line with FSUM6199 [read error].
tr	1.9	Option added: **-C**	**-c** complements the set of binary values in binary order	**-c** complements the set of characters in LC_COLLATE order (like the new **-C** behavior)
uudecode	1.9	Option added: **-o** *outfile* **/dev/stdout**	No effect	No effect
uuencode	1.9	Option added: **-m** **/dev/stdout**	No effect	No effect

Appendix O. Accessibility

Accessible publications for this product are offered through IBM Knowledge Center (http://www.ibm.com/support/knowledgecenter/SSLTBW/welcome).

If you experience difficulty with the accessibility of any z/OS information, send a detailed message to the "Contact us" web page for z/OS (http://www.ibm.com/systems/z/os/zos/webqs.html) or use the following mailing address.

IBM Corporation
Attention: MHVRCFS Reader Comments
Department H6MA, Building 707
2455 South Road
Poughkeepsie, NY 12601-5400
United States

Accessibility features

Accessibility features help users who have physical disabilities such as restricted mobility or limited vision use software products successfully. The accessibility features in z/OS can help users do the following tasks:

- Run assistive technology such as screen readers and screen magnifier software.
- Operate specific or equivalent features by using the keyboard.
- Customize display attributes such as color, contrast, and font size.

Consult assistive technologies

Assistive technology products such as screen readers function with the user interfaces found in z/OS. Consult the product information for the specific assistive technology product that is used to access z/OS interfaces.

Keyboard navigation of the user interface

You can access z/OS user interfaces with TSO/E or ISPF. The following information describes how to use TSO/E and ISPF, including the use of keyboard shortcuts and function keys (PF keys). Each guide includes the default settings for the PF keys.

- *z/OS TSO/E Primer*
- *z/OS TSO/E User's Guide*
- *z/OS ISPF User's Guide Vol I*

Dotted decimal syntax diagrams

Syntax diagrams are provided in dotted decimal format for users who access IBM Knowledge Center with a screen reader. In dotted decimal format, each syntax element is written on a separate line. If two or more syntax elements are always present together (or always absent together), they can appear on the same line because they are considered a single compound syntax element.

Each line starts with a dotted decimal number; for example, 3 or 3.1 or 3.1.1. To hear these numbers correctly, make sure that the screen reader is set to read out

punctuation. All the syntax elements that have the same dotted decimal number (for example, all the syntax elements that have the number 3.1) are mutually exclusive alternatives. If you hear the lines 3.1 USERID and 3.1 SYSTEMID, your syntax can include either USERID or SYSTEMID, but not both.

The dotted decimal numbering level denotes the level of nesting. For example, if a syntax element with dotted decimal number 3 is followed by a series of syntax elements with dotted decimal number 3.1, all the syntax elements numbered 3.1 are subordinate to the syntax element numbered 3.

Certain words and symbols are used next to the dotted decimal numbers to add information about the syntax elements. Occasionally, these words and symbols might occur at the beginning of the element itself. For ease of identification, if the word or symbol is a part of the syntax element, it is preceded by the backslash (\) character. The * symbol is placed next to a dotted decimal number to indicate that the syntax element repeats. For example, syntax element *FILE with dotted decimal number 3 is given the format 3 * FILE. Format 3* FILE indicates that syntax element FILE repeats. Format 3* * FILE indicates that syntax element * FILE repeats.

Characters such as commas, which are used to separate a string of syntax elements, are shown in the syntax just before the items they separate. These characters can appear on the same line as each item, or on a separate line with the same dotted decimal number as the relevant items. The line can also show another symbol to provide information about the syntax elements. For example, the lines 5.1*, 5.1 LASTRUN, and 5.1 DELETE mean that if you use more than one of the LASTRUN and DELETE syntax elements, the elements must be separated by a comma. If no separator is given, assume that you use a blank to separate each syntax element.

If a syntax element is preceded by the % symbol, it indicates a reference that is defined elsewhere. The string that follows the % symbol is the name of a syntax fragment rather than a literal. For example, the line 2.1 %OP1 means that you must refer to separate syntax fragment OP1.

The following symbols are used next to the dotted decimal numbers.

? indicates an optional syntax element
The question mark (?) symbol indicates an optional syntax element. A dotted decimal number followed by the question mark symbol (?) indicates that all the syntax elements with a corresponding dotted decimal number, and any subordinate syntax elements, are optional. If there is only one syntax element with a dotted decimal number, the ? symbol is displayed on the same line as the syntax element, (for example 5? NOTIFY). If there is more than one syntax element with a dotted decimal number, the ? symbol is displayed on a line by itself, followed by the syntax elements that are optional. For example, if you hear the lines 5 ?, 5 NOTIFY, and 5 UPDATE, you know that the syntax elements NOTIFY and UPDATE are optional. That is, you can choose one or none of them. The ? symbol is equivalent to a bypass line in a railroad diagram.

! indicates a default syntax element
The exclamation mark (!) symbol indicates a default syntax element. A dotted decimal number followed by the ! symbol and a syntax element indicate that the syntax element is the default option for all syntax elements that share the same dotted decimal number. Only one of the syntax elements that share the dotted decimal number can specify the ! symbol. For example, if you hear the lines 2? FILE, 2.1! (KEEP), and 2.1 (DELETE), you know that (KEEP) is the

default option for the FILE keyword. In the example, if you include the FILE keyword, but do not specify an option, the default option KEEP is applied. A default option also applies to the next higher dotted decimal number. In this example, if the FILE keyword is omitted, the default FILE(KEEP) is used. However, if you hear the lines 2? FILE, 2.1, 2.1.1! (KEEP), and 2.1.1 (DELETE), the default option KEEP applies only to the next higher dotted decimal number, 2.1 (which does not have an associated keyword), and does not apply to 2? FILE. Nothing is used if the keyword FILE is omitted.

*** indicates an optional syntax element that is repeatable**

The asterisk or glyph (*) symbol indicates a syntax element that can be repeated zero or more times. A dotted decimal number followed by the * symbol indicates that this syntax element can be used zero or more times; that is, it is optional and can be repeated. For example, if you hear the line 5.1* data area, you know that you can include one data area, more than one data area, or no data area. If you hear the lines 3* , 3 HOST, 3 STATE, you know that you can include HOST, STATE, both together, or nothing.

Notes:

1. If a dotted decimal number has an asterisk (*) next to it and there is only one item with that dotted decimal number, you can repeat that same item more than once.
2. If a dotted decimal number has an asterisk next to it and several items have that dotted decimal number, you can use more than one item from the list, but you cannot use the items more than once each. In the previous example, you can write HOST STATE, but you cannot write HOST HOST.
3. The * symbol is equivalent to a loopback line in a railroad syntax diagram.

+ indicates a syntax element that must be included

The plus (+) symbol indicates a syntax element that must be included at least once. A dotted decimal number followed by the + symbol indicates that the syntax element must be included one or more times. That is, it must be included at least once and can be repeated. For example, if you hear the line 6.1+ data area, you must include at least one data area. If you hear the lines 2+, 2 HOST, and 2 STATE, you know that you must include HOST, STATE, or both. Similar to the * symbol, the + symbol can repeat a particular item if it is the only item with that dotted decimal number. The + symbol, like the * symbol, is equivalent to a loopback line in a railroad syntax diagram.

Notices

This information was developed for products and services offered in the U.S.A. or elsewhere.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-1785
U.S.A

For license inquiries regarding double-byte character set (DBCS) information, contact the IBM Intellectual Property Department in your country or send inquiries, in writing, to:

Intellectual Property Licensing
Legal and Intellectual Property Law
IBM Japan, Ltd.
19-21, Nihonbashi-Hakozakicho, Chuo-ku
Tokyo 103-8510, Japan

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the exchange of information between independently created programs and other programs (including this one) and (ii) the mutual use of the information which has been exchanged, should contact:

Site Counsel
IBM Corporation
2455 South Road
Poughkeepsie, NY 12601-5400
USA

Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

The licensed program described in this information and all licensed material available for it are provided by IBM under terms of the IBM Customer Agreement, IBM International Program License Agreement, or any equivalent agreement between us.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

All statements regarding IBM's future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

If you are viewing this information softcopy, the photographs and color illustrations may not appear.

COPYRIGHT LICENSE:

This information might contain sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs. The sample programs are provided "AS IS", without warranty of any kind. IBM shall not be liable for any damages arising out of your use of the sample programs.

Policy for unsupported hardware

Various z/OS elements, such as DFSMS, HCD, JES2, JES3, and MVS, contain code that supports specific hardware servers or devices. In some cases, this device-related element support remains in the product even after the hardware devices pass their announced End of Service date. z/OS may continue to service element code; however, it will not provide service related to unsupported hardware devices. Software problems related to these devices will not be accepted

for service, and current service activity will cease if a problem is determined to be associated with out-of-support devices. In such cases, fixes will not be issued.

Minimum supported hardware

The minimum supported hardware for z/OS releases identified in z/OS announcements can subsequently change when service for particular servers or devices is withdrawn. Likewise, the levels of other software products supported on a particular release of z/OS are subject to the service support lifecycle of those products. Therefore, z/OS and its product publications (for example, panels, samples, messages, and product documentation) can include references to hardware and software that is no longer supported.

- For information about software support lifecycle, see: IBM Lifecycle Support for z/OS (http://www.ibm.com/software/support/systemsz/lifecycle/)
- For information about currently-supported IBM hardware, contact your IBM representative.

Programming Interface Information

This publication documents intended Programming Interfaces that allow the customer to write programs that use z/OS UNIX System Services (z/OS UNIX).

Standards

In the following statement, the phrase *this text* refers to portions of the system documentation.

Portions of this text are reprinted and reproduced in electronic form in the z/OS, from IEEE Std 1003.1, 2004 Edition, Standard for Information Technology -- Portable Operating System Interface (POSIX), The Open Group Base Specifications Issue 6, copyright 2001-2004 by the Institute of Electrical and Electronics Engineers, Inc., and The Open Group. In the event of any discrepancy between these versions and the original IEEE and The Open Group Standard, the original IEEE and The Open Group Standard is the referee document. The original Standard can be obtained online at http://www.opengroup.org/unix/online.html.

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. If these and other IBM trademarked terms are marked on their first occurrence in this information with a trademark symbol (® or ™), these symbols indicate U.S. registered or common law trademarks owned by IBM at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries. A current list of IBM trademarks is available on the Web at www.ibm.com/legal/copytrade.shtml (http://www.ibm.com/legal/copytrade.shtml).

UNIX is a registered trademark of The Open Group in the United States and other countries.

Acknowledgments

InterOpen Shell and Utilities is a source code product providing POSIX.2 (Shell and Utilities) functions to the z/OS UNIX services offered with MVS. InterOpen/POSIX Shell and Utilities is developed and licensed by Mortice Kern Systems (MKS) Inc. of Waterloo, Ontario, Canada.

Index

Special characters

_BPX_BATCH_SPAWN environment variable
  description of 982
_BPX_BATCH_UMASK environment variable
  description of 982
_BPX_SPAWN_SCRIPT environment variable
  description of 982
  magic number
    #! 982
_BPX_TERMPATH environment variable
  used by chcp 133, 134
_TAG_REDIR_ERR = BIN tcsh environment variable
  description of 730
_TAG_REDIR_ERR = TXT tcsh environment variable
  description of 730
_TAG_REDIR_ERR=BIN environment variable
  description of 628
_TAG_REDIR_ERR=TXT environment variable
  description of 628
_TAG_REDIR_IN shell variable 628
_TAG_REDIR_IN=BIN environment variable
  description of 628
_TAG_REDIR_IN=BIN tcsh environment variable
  description of 730
_TAG_REDIR_IN=TXT environment variable
  description of 628
_TAG_REDIR_IN=TXT tcsh environment variable
  description of 730
_TAG_REDIR_OUT = TXT environment variable
  description of 628
_TAG_REDIR_OUT=BIN environment variable
  description of 628
_TAG_REDIR_OUT=BIN tcsh environment variable
  description of 730
_TAG_REDIR_OUT=TXT tcsh environment variable
  description of 730
_TEXT_CONV environment variable 1029
  used by vi 857
-
  explanation of 1
: (colon) shell command 156
? subcommand for dbx 210
/ subcommand for dbx 211
/bin directory
  setting up special files in the 912
/bin/mail file
  used by calendar 119
/dev/mt/0m file
  used by tar 684
/etc/auto.master file
  used by automount 29
/etc/csh.cshrc
  used by tcsh login 689
/etc/csh.login
  used by tcsh login 689
/etc/inetd.conf file
  used by the inetd daemon 356
/etc/inetd.pid file
  used by the inetd daemon 358
/etc/magic file
  explanation of 1004
  used by file 317
/etc/mailx.rc file
  configuration settings 188
  used by mailx 418, 429, 435
/etc/profile file 631
  used by the login shell 605
/etc/rc file
  used by automount 28
/etc/recover file
  used by exrecover 305
/etc/recover/$LOGNAME/VIn* file
  used by exrecover 305
/etc/recover/$LOGNAME/VIt* file
  used by exrecover 305
/etc/startup.mk file
  used by make 454
/etc/suid_us.profile
  used by sh 631
/etc/utmpx file
  used by who 866
/etc/yylex file
  used by lex 388
/etc/yylex.c file
  used by lex 387
/etc/yyparse.c file
  used by yacc 900
/tmp file
  used by ar 18
  used by fc, history, r 311
/tmp/e* file
  used by ed 286
/tmp/sh* file
  description of 631
/tmp/stm* file
  used by sort 649
/tmp/VIl* file
  used by exrecover 305
/tmp/VIn* file
  used by exrecover 305
/tmp/VIt* file
  used by exrecover 305
/usr/lib file
  used by spell 653
/usr/lib/config file
  used by uucc 804
/usr/lib/cron/at.allow file
  used by cron 188
/usr/lib/cron/at.deny file
  used by cron 188
/usr/lib/cron/cron.allow
  used by cron 189
/usr/lib/cron/cron.deny file
  used by cron 189
/usr/lib/cron/queuedefs file
  used by cron 189
/usr/lib/hash file
  used by spell 652, 653
/usr/lib/hashb file
  used by spell 652, 653
/usr/lib/lib.b file
  used by bc 68
/usr/lib/libl.a file
  used by lex 388
/usr/lib/liblxp.a file
  used by lex 388
/usr/lib/lwords file
  used by spell 652, 653
/usr/lib/uucp file
  used by uucc 804
/usr/lib/uucp/config
  used by uucc 803
  used by uuto 822
/usr/lib/uucp/config file
  used by uucico 806
  used by uucp 804, 809
  used by uulog 815
  used by uuname 816
  used by uupick 817
  used by uustat 821
  used by uux 825
  used by uuxqt 827
/usr/lib/uucp/devices file
  used by uucp 804
/usr/lib/uucp/dialcodes file
  used by uucp 804
/usr/lib/uucp/dialers file
  used by uucp 804
/usr/lib/uucp/permissions file
  used by uucp 804
/usr/lib/uucp/systems file
  used by uucp 804
/usr/man/%L/man¬0–9|/*.book file
  used by man 467
/usr/man/%L/whatis file
  used by man 467
/usr/spool/cron file
  used by cron 188
/usr/spool/cron/atjobs file
  used by cron 188
/usr/spool/cron/crontabs file
  used by cron 188
/usr/spool/cron/log file
  used by cron 188
/usr/spool/cron/pid
  used by cron 188

/usr/spool/locks
used by uucico 806
/usr/spool/uucp
used by uustat 821
/usr/spool/uucp file
used by uulog 815
/usr/spool/uucp spool directory 1015
/usr/spool/uucp/.Sequence file
used by uucp 809
used by uux 825
used by uuxqt 827
/usr/spool/uucp/.Status file
used by uustat 821
/usr/spool/uucp/.STATUS file
used by uucico 806
/usr/spool/uucp/.Xqtdir
used by uuxqt 827
/usr/spool/uucp/.Xqtdir directory 824
/usr/spool/uucp/LOGFILE
used by uulog 815
/usr/spool/uucp/LOGFILE file
used by uucico 805, 806
used by uucp 809
used by uux 825
/usr/spool/uucp/site
used by uuxqt 827
/usr/spool/uucp/site file
used by uux 825
/usr/spool/uucp/south directory 1015
/usr/spool/uucppublic file
used by uucp 809
used by uuto 822
/usr/spool/uucpublic file
used by uupick 817
/usr/spool/uucpublic/receive file
used by uupick 818
/var/man/%L/entry.¬0–9|/*.bookname file
used by man 467
. (dot) script
returning from 580
. (dot) shell command 273
... (ellipsis)
explanation of 2
.dbxinit file
used by dbx 205, 207
.dbxsetup file
used by dbx 205, 207
.exrc file
used by vi 856
.profile file 631
$HOME / .sh_history file
used by fc, history, r 310
$HOME/.exrc file
used by vi 856
$HOME/mbox file
used by mail 417
used by mailx 435
$MAILDIR file
used by mailx 435
$MAILRC file
used by mailx 435
$TMPDIR/pg* file
used by pg 558
[(left bracket) shell command 377
–q options syntax 886
|& shell operator 608
& shell operator 608
#!
magic number 988

Numerics

3270 alarm
controlling the 937, 942, 947
3270 passthrough mode
used to invoke the TSO/E OBROWSE command 506
3270 terminals
specifying the use of DBCS 940

A

a.out file
used by dbx 208
abnormal condition
trapping 770
abnormal interrupt
trapping 770
absolute movement command (for vi) 832
absolute movement commands
list of 832
access control list (ACL)
updating 599
access permission
changing 138
access time
resetting 184
setting, for destination files 172
accessibility 1043
contact IBM 1043
features 1043
ACL primary operators
test shell command 756
action
explanation of 45
address
removing breakpoints from 215
AF_UENT stack
configuring the 165
ALARM function key for OMVS command 942
ALARM option of OMVS command 938
ALARM subcommand of OMVS command 947
alias
creating 11
tracked aliases 347
detecting 787
removing
definitions 787
those specified by the name argument 252
alias shell command 11
alias subcommand for dbx command 211
allnet environment variable
used by mailx 431, 432, 436
alloc tcsh shell command 734
allocate
MVS standard files as z/OS UNIX files
using the BPXBATCH program 982
standard files
using the BPXBATCH command 910
using the BPXBATCH program 982
stdenv as z/OS UNIX files
using the BPXBATCH program 982
stderr as z/OS UNIX files
using the BPXBATCH program 982
stdin as z/OS UNIX files
using the BPXBATCH program 982
stdout as z/OS UNIX files
using the BPXBATCH program 982
ALLOCATE TSO/E command 924
allocating data sets 31
allocating file systems 31
allow
messages 468
amblist shell command 14
ampm shell variable
description of 717
append
user's commands to a file
of given identifiers 237
application program
displaying
list of mutex objects 250
appointment
displaying 118
ar shell command 16
arbitrary-precision arithmetic calculation language
using the 54
archive
copying files from directory 183
creating 183
extracting
components from the 524
contents 183
tapes 682
archive file
cpio format 1003
manipulating 682
reading 523, 682
tar format 1012
writing 523, 682
archive library
creating 16
displaying symbol table 502
maintaining 16
ARGC (built-in variable for awk) 40
args subcommand for the dbx command 212
argument
changing dates for 763
concatenating in the current shell environment 291

argument *(continued)*
evaluating
as an expression 301
in the current shell environment 291
obtaining from a list of parameters 341
printing 562
removing 583
returning from the shell 562
writing to standard output 277
argv shell variable 717
description of 717
arithmetic calculation
calculating to arbitrary precision 54
arithmetic expression
evaluating 385
arrange
items on command line 3
options 1
array element (awk variable) 37
as shell command
options 20
asa shell command 23
ASCII code pages for the terminal
setting, resetting, or querying 133
ASCII to EBCDIC conversion 258
ask environment variable
used by mailx 432
askbcc environment variable
used by mailx 432
asksub environment variable
used by mailx 432
assemble
z/OS C and z/OS C++ source files 79
assign
aliases for dbx subcommands 211
attributes to variables 781
values to variables 212, 781
assign subcommand for dbx command 212
assistive technologies 1043
at shell command 24
submitting jobs to cron 190
attribute of files
listing 407
audit attribute
changing 130
audit flag
changing 130
autocorrect shell variable
description of 717
autoexpand shell variable
description of 718
autolist shell variable
description of 718
autoloaded functions
description of 613
autologout shell variable
description of 718
automatic code set conversion
disabling 1027
shell redirection 1027
using 1027
automatic conversion 713, 756
ls 407
automatic conversion *(continued)*
tcsh shell 730
automatic scrolling
controlling 943, 947, 948
turning off 948
automatic, periodic, and timed events 714
automount
allocating data sets 31
allocating file systems 31
automount facility
configuring the 28
automount shell command 28
AUTOMOVE 920
autoprint environment variable
used by mailx 419, 426, 432
AUTOSCROLL function key for OMVS command 943
AUTOSCROLL function of OMVS command
setting the 938
AUTOSCROLL option of OMVS command 938, 943
AUTOSCROLL subcommand of OMVS command 947
awk shell command 35
action 45
ARGC built-in variable 40
arrays 37
BEGIN 45
built-in arithmetic functions 42
built-in string functions 42
built-in variables
FILENAME 41
FNR 41
NF 41
NR 41
comments 36
conditions 45
END 45
ENVIRON environment 38
examples 47
FILENAME file being read 41
FNR number of records read from file 41
FS field separator string 41
functions 44
getline 41
NF field in current record 41
NR number of records read 41
OFMT output number format 46
OFS output field separator 46
operators 39
ORS output record separator 46
patterns 45
processing programs 35
RLENGTH built-in variable 43
RS record separator character 40
RSTART built-in variable 43
statements 45
SUBSEP 37
SYMTAB symbol table 38
system functions 44
variables 37

B

background job
scheduling 189
backquoting 619
BACKSCR function key for OMVS command 943
BACKSCR subcommand of OMVS command 947
backslash shell variable
description of 718
backup files 682
backward retrieve function of OMVS command 944
bang environment variable
used by mailx 429, 432
basename shell command 52
basic regular expression
explanation of 971, 975
list of commands using 974, 978
meaning of metacharacters used 971, 975
batch environment
running shell scripts and z/OS XL C/C++ applications under MVS 981
batch job
submitting
using the BPXBATCH command 910
using the BPXBATCH program 981
submitting for background processing 670
batch shell command 53
submitting jobs to cron 190
bc shell command 54
built-in functions 65
built-in variables 56
dynamic scoping 64
specifying numbers in different bases 57
between-rule circular dependency 446
bg shell command 70
binary file
decoding 811
encoding for transmission 812
bindkey tcsh sell command 734
blind carbon copy 418
BOTTOM function key for OMVS command 943
BOTTOM subcommand of OMVS command 947
Bourne shell 605
BPXACOPY program
automatic setting of permission bits during installation 993
BPXBATCH program 981
invoked in the OSHELL REXX exec 989
invoking
with OSHELL 955
BPXBATCH TSO/E command 910
BPXBATSL
run program using local spawn 910, 981
BPXCOPY program 991
invoking 991

bpxmtext shell command 71
bpxmtext system REXX command 961
BPXMTEXT TSO command 912
bpxtrace shell command 71, 72
BPXTRACE TSO command 912
BPXWISHISPF environment variable
used by obrowse 506
used by oedit 512
BPXWISHTZ environment variable 914
BPXWPERM environment variable
used by oedit 512
BPXWRFD environment variable
used by tsocmd 777
bracket expression 971, 975
brackets
explanation of 1
break
lines 328
break shell command 77
break up
files 654
text file 192
breakpoint
removing from addresses 215
broadcast message 861
browse
files
with the obrowse shell command 506
files, with BPXBATCH 955
files, with the ISPF shell 912
z/OS UNIX file system files
with the OBROWSE TSO/E command 923
build
argument lists before running a command 895
list of files 956
built-in functions
for the bc shell command 65
built-in shell commands 629
: (colon) 156
[377
alias 11
bg 70
break 77
cd 125
colon (:) 156
description of 613
echo 277
exit 297
false 309
fc 310
getopts 341
hash 347
jobs 370
kill 374
let 385
print 562
pwd 575
read 576
test 756
time 761
times 762
true 771
type 781
typeset 781
built-in shell commands *(continued)*
ulimit 785
umask 789
unalias 787
wait 860
whence 864
built-in variable
for the bc command 56
builtins tcsh shell command 736
byte count
calculating and displaying with the sum command 672
bytes
counting 862
swapping 185

C

C escape sequences 515
c++ 78
c++ shell command 77
c++_64 870
c++_x 870
c89 78
c89_64 870
c89_x 870
c89/cc/c++ environment variable
_ACCEPTABLE_RC 95
_ASUFFIX 96
_ASUFFIX_HOST 96
_CCMODE 96
_CCN_32_RUNOPTS 95
_CCN_64_RUNOPTS 95
_CCN_IPA_WORK_SPACE 95
_CLASSLIB_PREFIX 96
_CLASSVERSION 97
_CLIB_PREFIX 97
_CMEMORY 97
_CMSGS 97
_CNAME 97
_CSUFFIX 98
_CSUFFIX_HOST 98
_CSYSLIB 98
_CVERSION 98
_CXXSUFFIX 98
_CXXSUFFIX_HOST 98
_DAMPLEVEL 99
_DAMPNAME 99
_DCB121M 99
_DCB133M 99
_DCB137 99
_DCB137A 99
_DCB3200 99
_DCB80 100
_DCBF2008 99
_DCBU 99
_DEBUG_FORMAT 100
_ELINES 100
_EXTRA_ARGS 100
_IL6SYSIX 100
_ILCTL 101
_ILMSGS 101
_ILNAME 101
_ILSUFFIX 101
_ILSUFFIX_HOST 101
_ILSYSIX 101
_ILSYSLIB 101
c89/cc/c++ environment variable *(continued)*
_ILXSYSIX 101
_ILXSYSLIB 101
_INCDIRS 101
_INCLIBS 101
_ISUFFIX 102
_ISUFFIX_HOST 102
_IXXSUFFIX 102
_IXXSUFFIX_HOST 102
_L6SYSIX 102
_L6SYSLIB 102
_LIBDIRS 102
_LSYSLIB 102
_LXSYSIX 103
_LXSYSLIB 103
_MEMORY 103
_NEW_DATACLAS 103
_NEW_DSNTYPE 103
_NEW_MGMTCLAS 103
_NEW_SPACE 103
_NEW_STORCLAS 103
_NEW_UNIT 104
_NOCMDOPTS 104
_OPERANDS 104
_OPTIONS 104
_OSUFFIX 104
_OSUFFIX_HOST 104
_OSUFFIX_HOSTQUAL 104
_OSUFFIX_HOSTRULE 104
_PMEMORY 105
_PMSGS 106
_PNAME 106
_PSUFFIX 106
_PSUFFIX_HOST 106
_PSYSIX 106
_PSYSLIB 106
_PVERSION 106
_SLIB_PREFIX 107
_SNAME 107
_SSUFFIX 107
_SSUFFIX_HOST 107
_SSYSLIB 107
_STEPS 107
_SUSRLIB 108
_TMPS 108
_WORK_DATACLAS 108
_WORK_DSNTYPE 108
_WORK_MGMTCLAS 108
_WORK_SPACE 108
_WORK_STORCLAS 108
_WORK_UNIT 109
_XSUFFIX 109
_XSUFFIX_HOST 109
IL6SYSLIB 100
c89/cc/c++ shell command
–W option
compiler, prelinker, IPA linker and link editor options 87
DLL and IPA extensions 87
environment variables 94
options 80
specifying
system and operational information to c89/cc/c++/cxx 94
c99 117, 870

c99 shell command 117
c99_64 870
c99_x 870
cal shell command 118
calculate and display
  checksum for each input file
    with the cksum command 149
    with the sum command 672
  number of bytes in each input file
    with the cksum command 149
    with the sum command 672
calendar file 119
calendar shell command 118
call up
  other systems 196
cancel
  print queue requests 120
cancel shell command 120
captoinfo shell command 120
carriage control
  interpreting 23
case of letters 1
case shell command 611
case subcommand for dbx command 213
catch subcommand for dbx command 214
Caution section
  explanation of 6
cc 78
cc shell command 125, 200
cc_64 870
cc_x 870
cd shell command 125
CDPATH environment variable
  description of 624
  used by cd 126
  used by vi 851, 857
cdpath shell variable
  description of 718
ceebldtx shell command 128
change
  crontab entries 189
  dates for arguments 763
  dbx command prompts 235
  file access times 763
  file modification times 763
  files
    using diff output 518
  functions 222
  group owners 135
  groups 497
  groups of directories 143
  groups of files 143
  mount mode 957
  next line to be displayed 229
  owners of directories 143
  owners of files 143
  priorities of running processes 579
  program counter address 223
  root directory 144
  source files 222
  terminal characteristics 765
  user ID
    connected with sessions 667
  working directories 125
change ACLs
  setfacl 599
character
  escaping 614
  translating 767
character class expression 972, 976
character conversion table
  specifying the 938
character special files
  creating 915
characters
  converting from one code set to another 352
  counting 862
chaudit shell command 130
chcp shell command 133
check
  conditions 756
  for spelling errors 652
  path names 522
checksum
  calculating and displaying
    with the sum command 672
chgrp shell command 135
child process
  waiting for it to end 860
child process time
  displaying time accumulated 762
child shell environment 629
chlabel shell command 137
chmod shell command 138
chmount
  change file system mount attributes 141
chmount shell command 141
chown shell command 143
chroot shell command 144
chtag shell command 146
circular dependencies 446
cksum shell command 149
clear breakpoints at addresses 215
clear shell command 151
clear subcommand for dbx command 214
cleari subcommand for dbx command 215
clock daemon (cron) 186
clone output streams 755
close 621
  file descriptors 295
  shell sessions 943, 947
  standard output (stdout) 622
CLOSE function of OMVS command 943
CLOSE subcommand of OMVS command 947
cmd environment variable
  used by mailx 424, 432
cmp shell command 152
code set
  converting characters to another code set 352
col shell command 155
collation sequence 972, 976
collect
  debugging information 940
colon (:) shell command 156
COLUMNS environment variable 624
  description of 624
  used by ed 286
  used by ls 412
  used by more 479
  used by pg 556, 558
  used by ps 574
  used by sed 593
  used by shedit 634
  used by vi 857
COLUMNS tcsh environment variable
  description of 729
comand shell variable
  description of 718
comm shell command 157
command
  aliases
    creating or displaying 11
  built-in 629
  changing prompts, for dbx 235
  constructing
    in the current shell environment 291
    with templates 895
  conventions 1
  creating aliases 11
  descriptions
    reading 1
  displaying 310
    aliases 11
    elapsed time 761
    suppressing command numbers 311
  editing 310, 633
  executing 144
  interpreting names 864
  names
    interpreting 864
  numbers
    suppressing 311
  options
    setting 595
    unsetting 595
  passing to shell for execution 245
  processing history lists 310
  prompts, changing for dbx 235
  reading descriptions 1
  reentering 310
  remote execution
    displaying information about 814
  running
    after constructing an argument list 895
    at a different priority 499
    at a specified time 24
    from the shell 772, 777
    simple 160
    using the OMVS interface 772, 777
    using the TSO/E service routine 772, 777
    when system is not busy 53
  setting options 595
  specifying command lines for another command 295
  substituting 619
  suppressing numbers 311

command *(continued)*
sysvar 674
template 895
TSO/E
ALLOCATE 924
BPXBATCH 910
ISHELL 912
MKDIR 914
MKNOD 915
MOUNT 916
OBROWSE 923
OCOPY 924
OEDIT 928
OGET 929
OGETX 933
OMVS 937
OPUT 949
OPUTX 952
OSHELL 955
OSTEPLIB 956
UNMOUNT 957
unsetting options 595
command aliases
displaying 11
command interpreter 437
command line
specifying for another command 295
command mode 418, 828
command shell command 160
command substitution 619
commands
nonfunctional
cancel 120
cu 196
lpstat 406
running
on remote sites 823
communicate
with other users 867
compare
directories
with the dircmp command 270
with the ISHELL command 912
with the OSHELL command 955
files
with the cmp command 152
with the diff command 263
with the ISHELL command 912
with the OSHELL command 955
terminfo database entries 358
compile
link-edit object file 79
terminfo database entries 760
UUCP configuration files 803
z/OS C and z/OS C++ source file 79
compiler
yacc 899
complete shell variable
description of 718
component directory 523
component file 523
definition of 681
compress
files
using Huffman coding 512
using Lempel-Ziv compression 161
compress *(continued)*
spaces into tabs 791
compress shell command 161
concatenate
arguments in the current shell environment 291
corresponding or subsequent lines of files 515
files 122
lines 515
lines of input files 515
regular expressions 974, 978
condition
explanation of 45
testing for 756
trapping abnormal 770
condition subcommand for dbx command 215
condition variable
displaying list of 215
conditional expression 453
confighfs shell command 163
configstk shell command 165
configstrm shell command 167
configuration file for xlc 877
default name 882
configuration files
/usr/lib/config
used by uucc 804
Devices 803
Dialcodes 803
Dialers 803
Permissions 803
reading and compiling contents of UUCP 803
Systems 803
configuration variable
writing values to standard output 334
configure
AF_UEINT stacks 165
automount facility, the 28
connect to
other systems 196
connecting to
remote systems, with the uucico daemon 805
console log
saving messages in 402
construct
argument lists before running a command 895
commands in the current shell environment 291
cont subcommand of for command 216
contact
z/OS 1043
context diff file 519
context-dependent movement commands (for vi) 834
continuation prompt 626
continue shell command 168
control
3270 alarms 937, 938, 942, 947
automatic scrolling 943, 947, 948
AUTOSCROLL function of OMVS command 938
control *(continued)*
display of function key settings 944
control character
processing 155
CONTROL function of OMVS command 943
control operator 612
conv environment variable
used by mailx 417, 436
conventions for command descriptions 1
conversion buffer 260
convert
characters from one code set to another 352
files 257
from ASCII to EBCDIC 258
from EBCDIC to ASCII 258
from lowercase to uppercase 259
from uppercase to lowercase 259
from variable to fixed records 258
source definitions for locale categories 400
CONVERT option of OMVS command 938
copy
archive files, with the tar command 682
data read from standard input to standard output 767
data sets into files, with BPXCOPY 991
data with format conversion 257
file descriptors 295
files
between UUCP systems 806
from one directory to another 183
selectively 196
to MVS partitioned data set 933
to target named by the last argument on command line 170
to users on remote systems 821
with BPXBATCH 955
with data conversion 257
with the ISPF shell 912
in/out file archive 183
MVS data sets
members into z/OS UNIX file system directories 952
members into z/OS UNIX file system files 949
to another member or file 924
standard input to each output file 755
z/OS UNIX file system
directories to MVS partitioned data set 933
files into MVS data sets 929
files to another member or file 924
copy mode 524
copytree REXX sample 169
correct shell variable
description of 718
count
bytes 862
characters 862
lines 862

count *(continued)*
newlines 862
words 862
cp shell command 170
cpio archive
reading and writing 183
cpio archive format 1003
cpio shell command 183
CPU time 762
create
aliases for dbx subcommands 211
archives 183
character special files 915
command aliases 11
crontab entries 189
directories
for each named directory argument 471
with the MKDIR command 914
FIFO special files 472
hard link 390
libraries 453
library archives 16
link to files 391
message catalogs 331
tag files 194
tracked aliases 347
create executable files 79
cron
submitting jobs to 190
cron daemon 190
crontab
changing entries 189
creating entries 189
editing entries 190
obtaining output of entries 190
crontab shell command 189
submitting jobs to cron 190
crt environment variable
used by mailx 424, 432
csplit shell command 191
ctags shell command 194
cu shell command 196
current appointment
displaying 118
current mail message 420
current operating system
displaying name of the 789
current position pointer 829
current users
displaying information about 865
current working directory
changing to previous working directory 125
displaying path name of the 575
setting to value of the HOME environment variable 126
customize
settings for function keys 942
cwd shell variable
description of 718
cxx 78
cxx_64 870
cxx_x 870

D

daemons
cron 186
exrecover 304
inetd 355
uucico 805
uucpd 810
uuxqt 826
dash
explanation of 1
data
displaying after uncompressing 903
manipulating 35
reading 257
refreshing 944
removing from executable files 659
transferring to remote sites 1017
writing 257
data file 1017
data set
copying
between two files 924
BPXCOPY program, with the 991
data set names
specifying in the shell 1025
database
joining two 372
date
displaying the 200
date shell command 200
Daylight savings time
used in the TZ environment variable 1022
DBCS mode
specifying 940
DBCS option of OMVS command 940
dbgld shell command
examples 204
exit values 205
options 203
restrictions 204
dbx debug program
defining values for variables 240
searching for source files 254
dbx shell command 205
creating aliases for subcommands 211
displaying synopsis of 224
reading subcommands from file 246
subcommands
? 210
/ 211
alias 211
args 212
assign 212
case 213
catch 214
clear 214
cleari 215
condition 215
cont 216
delete 217
detach 217
display memory 218
down 220
dump 221
edit 221
dbx shell command *(continued)*
subcommands *(continued)*
file 222
func 222
goto 223
gotoi 223
help 224
history 224
ignore 225
list 225
listfiles 226
listi 227
map 228
move 229
multproc 229
next 231
nexti 232
object 232
onload 233
print 235
prompt 235
quit 236
record 237
registers 238
rerun 239
return 239
run 240
set 240
sh 245
skip 245
source 246
status 246
step 247
stepi 247
stop 248
stopi 249
trace 251
tracei 252
unalias 252
unset 253
up 253
use 254
whatis 254
where 255
whereis 256
which 257
dbx shell command prompt
changing 235
dd shell command 257
deactivate
function key 944
dead.letter file
used by mail 415
used by mailx 427
DEBUG option of OMVS command 940
debug programs
changing interpretation of symbols 213
with the dbx command 205
debug session
enabling or disabling multiprocess 229
ending 236
debugger
using the 205
debugging information
collecting 940

debugging information *(continued)*
writing 940
decode
files packed by using Hoffman coding 800
Huffman-packed files 554
transmitted binary files 811
default
function key 945
define
local environments 400
values for dbx variables 240
delay program execution 641
delete
alias definitions 787
aliases 252
arguments 583
attributes of variables and functions 801
breakpoints at addresses 215
directories 584
directory entries 583, 797
information from executable files 659
stops
from programs 217
from source lines 214
traces from program 217
trailing part of file names 272
values of variables and functions 801
variables 253
delete subcommand of the for command 217
Description section
explanation of 3
destination file
setting
destination time 172
modification time 172
detach subcommand for dbx command 217
detect
aliases 787
spelling errors 652
dextract shell variable
description of 718
df
in a sysplex 263
df shell command 261
diff output
used when changing files 518
diff shell command 264
dircmp shell command 270
directory
/usr/spool/uucp 1015
/usr/spool/uucp/.Xqtdir 824
/usr/spool/uucp/south 1015
changing
access permission of 138
audit attributes 130
audit flags 130
group owners 135
modes 138
owners and groups 143
comparing 270
with the ISHELL command 912
with the OSHELL command 955
copying files 183
directory *(continued)*
creating
for each named directory argument 471
with BPXBATCH 955
with the ISPF shell 912
with the MKDIR command 914
deleting, with BPXBATCH 955
deleting, with the ISPF shell 912
listing files in a
with ISHELL 912
with OSHELL 955
moving files to a different 485
naming, with BPXBATCH 955
naming, with the ISPF shell 912
removing
entries 583, 797
with the rmdir command 584
searching 254
setting owners and groups 143
setting up special files in the /bin 912
directory (UUCP)
searching public 816
directory substitution 615
dirname shell command 272
dirsfile shell variable
description of 718
dirstack shell variable
description of 718
disable multiprocess debugging 229
display 227
active stop subcommands 246
active trace subcommands 246
aliases for dbx subcommands 211
amount of free space on file system 261
appointments 118
arguments
of programs 212
attributes and contents of a symbolic link 955
attributes and contents of symbolic links 912
calendar 118
changing next line to be displayed 229
command aliases 11
commands
suppressing command numbers 311
with the fc command 310
commands in history list 224
compressed files 554
crontab entries 190
current appointments 118
currently exported variables 300
data after uncompressing 903
dates 200
DBCS characters 9
declaration of program components 254
differences between two files 264
elapsed time for a command 761
environment variables 290, 595
errnojr_value 128, 288
extended attributes for files 307
display *(continued)*
file attributes 912, 955
files 122
page by page 475
files interactively 555
first part of files 348
for month or year 118
formatted information from object and executable files 14
information about
open files, sockets, and pipes 904
information about current users 865
information about locales 395
information about the OMVS command 947
input files 555
instructions in program 227
last part of files 676
lines common to two files 157
list of active condition variables 215
list of active mutex objects 230, 250
list of active program and functions 255
list of active read/write lock objects 236
list of files
of module 226
list of functions associated with a program file 227
list of UUCP systems 815
load characteristics of program 228
log information about UUCP events 814
login information 865
memory 218
message catalogs 274
messages from message catalogs 275
names of
current operating systems 789
shell variables 595
variables in procedures 221
path name of working directories 575
piped files 555
process IDs 330
process status 567
processors 761
qualifications
of given identifiers 257
of symbols 256
specified number of lines in source files 225
status of pending UUCP transfers 818
status of print queues 406
strings in a binary file 656
synopsis of dbx commands 224
system time accumulated by commands 762
terminal options 660
times 200
unprintable characters 123
user time accumulated by the shell 762
values of
floating-point registers 238
general-purpose registers 238

display *(continued)*
values of *(continued)*
instruction registers 238
program status words (PSW) 238
shell variables 595
system control registers 238
variables in procedures 221
values of environment variables 563
Display
static system symbols 674
display ACL entries
getfacl 338
display memory subcommand for dbx command 218
DISPLAY tcsh environment variable
description of 729
display-oriented text editor
vi 828
displaying
man pages 464
displays
errnojr_value 128, 288
DLL (dynamic link library)
description of 88
link-editing 88
dot (.) script
returning from 580
dot (.) shell command 273
dot environment variable
used by mailx 433
double-byte character set 940
displaying characters 9
locales
switching 9
strings 8
using the 7
double-byte characters
converting 352
double-spacing 559
down subcommand for dbx command 220
dspcat shell command 274
dspmsg shell command 275
du shell command 276
dump file to standard output 507
dump subcommand for dbx command 221
dunique shell variable
description of 718
duplicate output stream 755
dynamic link library (DLL)
description of 88
link-editing 88
dynamic scoping
used in the bc shell command 64

E

EBCDIC to ASCII. conversion 258
ECHO function key for OMVS command 943
ECHO option of OMVS command 941
echo shell command 277
echo shell variable
description of 718
ECHO subcommand of OMVS command 947
echo_style shell variable
description of 719
ed shell command 278
ed text editor
using the 278
ed.hup file
used by ed 286
edcmtext shell command 288
edit
commands 310
crontab entries 190
files
with the oedit shell command 511
files, with BPXBATCH 955
files, with the ISPF shell 912
message catalogs 331
z/OS UNIX files
with the OEDIT TSO/E command 928
edit shell variable
description of 719
edit subcommand for dbx command 221
editing subcommands
starting 588
editor
invoking 221
editor environment variable
used by mailx 422, 427
EDITOR environment variable
description of 624
used by crontab 191
used by shedit 634
editor initialization 856
EDITOR tcsh environment variable
description of 729
egrep shell command 343
electronic mail
sending and receiving 416
elif shell subcommand 611
ellipsis
explanation of 2
ellipsis shell variable
description of 719
else shell subcommand 611
emacs
enabling, with the EDITOR environment variable 624
enable multiprocess debugging 229
encode
binary files for transmission 812
files
using Huffman coding 512
end
dbx debugging sessions 236
jobs 374
processes 374
shell sessions 944, 948
shells 297
end of file 676
ENDPASSTHROUGH option of OMVS command 941
ENV environment variable
description of 624
used by sh 606, 607
used by vi 857
env shell command 290
environment
defining local 400
environment variable 1029
_ACCEPTABLE_RC
used by c89/cc/c++ 95
_ASUFFIX
used by c89/cc/c++ 96
_ASUFFIX_HOST
used by c89/cc/c++ 96
_BPX_BATCH_SPAWN
description of 982
_BPX_BATCH_UMASK
description of 982
_BPX_SPAWN_SCRIPT
description of 982
_BPX_TERMPATH
used by chcp 133, 134
_CCMODE
used by c89/cc/c++ 96
_CCN_32_RUNOPTS
used by c89/cc/c++ 95
_CCN_64_RUNOPTS
used by c89/cc/c++ 95
_CCN_IPA_WORK_SPACE
used by c89/cc/c++ 95
_CLASSLIB_PREFIX
used by c89/cc/c++ 96
_CLASSVERSION
used by c89/cc/c++ 97
_CLIB_PREFIX
used by c89/cc/c++ 97
_CMEMORY
used by c89/cc/c++ 97
_CMSGS
used by c89/cc/c++ 97
_CNAME
used by c89/cc/c++ 97
_CSUFFIX
used by c89/cc/c++ 98
_CSYSLIB
used by c89/cc/c++ 98
_CVERSION
used by c89/cc/c++ 98
_CXXSUFFIX
used by c89/cc/c++ 98
_CXXSUFFIX_HOST
used by c89/cc/c++ 98
_DAMPLEVEL
used by c89/cc/c++ 99
_DAMPNAME
used by c89/cc/c++ 99
_DCB121M
used by c89/cc/c++ 99
_DCB133M
used by c89/cc/c++ 99
_DCB137
used by c89/cc/c++ 99
_DCB137A
used by c89/cc/c++ 99
_DCB3200
used by c89/cc/c++ 99
_DCB80
used by c89/cc/c++ 100
_DCBF2008
used by c89/cc/c++ 99
_DCBU
used by c89/cc/c++ 99

environment variable *(continued)*
_DEBUG_FORMAT
used by c89/cc/c++ 100
_ELINES
used by c89/cc/c++ 100
_EXTRA_ARGS
used by c89/cc/c++ 100
_IL6SYSIX
used by c89/cc 100
_IL6SYSLIB
used by c89/cc 100
_ILCTL
used by c89/cc 101
_ILMSGS
used by c89/cc 101
_ILNAME
used by c89/cc/c++ 101
_ILSUFFIX
used by c89/cc 101
_ILSUFFIX_HOST
used by c89/cc 101
_ILSYSIX
used by c89/cc/c++ 101
_ILSYSLIB
used by c89/cc/c++ 101
_ILXSYSIX
used by c89/cc/c++ 101
_ILXSYSLIB
used by c89/cc/c++ 101
_INCDIRS
used by c89/cc/c++ 101
_INCLIBS
used by c89/cc/c++ 101
_ISUFFIX
used by c89/cc/c++ 102
_ISUFFIX_HOST
used by c89/cc/c++ 102
_IXXSUFFIX
used by c89/cc/c++ 102
_L6SYSIX
used by c89/cc/c++ 102
_L6SYSLIB
used by c89/cc/c++ 102
_LD_ACCEPTABLE_RC
used by ld 379
_LD_ASUFFIX
used by ld 379
_LD_ASUFFIX_HOST
used by ld 380
_LD_DAMPLEVEL
used by ld 380
_LD_DAMPNAME
used by ld 380
_LD_DCB80
used by ld 380
_LD_DCBU
used by ld 380
_LD_DEBUG_DUMP
used by ld 380
_LD_DEBUG_TRACE
used by ld 380
_LD_ENTRY_POINT
used by ld 381
_LD_EXTRA_SYMBOL
used by ld 381
_LD_LIBDIRS
used by ld 381

environment variable *(continued)*
_LD_NEW_DATACLAS
used by ld 381
_LD_NEW_DSNTYPE
used by ld 381
_LD_NEW_MGMTCLAS
used by ld 381
_LD_NEW_SPACE
used by ld 381
_LD_NEW_STORCLAS
used by ld 381
_LD_NEW_UNIT
used by ld 381
_LD_OPERANDS
used by ld 381
_LD_OPTIONS
used by ld 382
_LD_ORDER
used by ld 381
_LD_OSUFFIX
aused by ld 382
_LD_OSUFFIX_HOST
used by ld 382
_LD_SYSIX
used by ld 382
_LD_SYSLIB
used by ld 382
_LD_XSUFFIXHOST
used by ld 382
_LD_XSUFFUX
used by ld 382
_LIBDIRS
used by c89/cc/c++ 102
_LSYSLIB
used by c89/cc/c++ 102
_LXSYSIX
used by c89/cc/c++ 103
_LXSYSLIB
used by c89/cc/c++ 103
_MEMORY
used by c89/cc/c++ 103
_NEW_DATACLAS
used by c89/cc/c++ 103
_NEW_DSNTYPE
used by c89/cc/c++ 103
_NEW_MGMTCLAS
used by c89/cc/c++ 103
_NEW_SPACE
used by c89/cc/c++ 103
_NEW_STORCLAS
used by c89/cc/c++ 103
_NEW_UNIT
used by c89/cc/c++ 104
_NOCMDOPTS
used by c89/cc/c++ 104
_OPERANDS
used by c89/cc/c++ 104
_OPTIONS
used by c89/cc/c++ 104
_OSUFFIX
used by c89/cc/c++ 104
_OSUFFIX_HOST
used by c89/cc/c++ 104
_OSUFFIX_HOSTQUAL
used by c89/cc/c++ 104
_OSUFFIX_HOSTRULE
used by c89/cc/c++ 104

environment variable *(continued)*
_PLIB_PREFIX
used by c89/cc/c++ 105
_PMEMORY
used by c89/cc/c++ 105
_PMSGS
used by c89/cc/c++ 106
_PNAME
used by c89/cc/c++ 106
_PSUFFIX
used by c89/cc/c++ 106
_PSUFFIX_HOST
used by c89/cc/c++ 106
_PSYSIX
used by c89/cc/c++ 106
_PSYSLIB
used by c89/cc/c++ 106
_PVERSION
used by c89/cc/c++ 106
_SLIB_PREFIX
used by c89/cc/c++ 107
_SNAME
used by c89/cc/c++ 107
_SSUFFIX
used by c89/cc/c++ 107
_SSUFFIX_HOST
used by c89/cc/c++ 107
_SSYSLIB
used by c89/cc/c++ 107
_STEPS
used by c89/cc/c++ 107
_SUSRLIB
used by c89/cc/c++ 108
_TAG_REDIR_ERR=BIN
description of 628
_TAG_REDIR_ERR=TXT
description of 628
_TAG_REDIR_IN=BIN
description of 628
_TAG_REDIR_IN=TXT
description of 628
_TAG_REDIR_OUT=BIN
description of 628
_TAG_REDIR_OUT=TXT
description of 628
_TEXT_CONV
used by vi 857
_TMPS
used by c89/cc/c++ 108
_WORK_DATACLAS
used by c89/cc/c++ 108
_WORK_DSNTYPE
used by c89/cc/c++ 108
_WORK_MGMTCLAS
used by c89/cc/c++ 108
_WORK_SPACE
used by c89/cc/c++ 108
_WORK_STORCLAS
used by c89/cc/c++ 108
_WORK_UNIT
used by c89/cc/c++ 109
_XSUFFIX
used by c89/cc/c++ 109
_XSUFFIX_HOST
used by c89/cc/c++ 109
allnet
used by mailx 431, 432, 436

environment variable *(continued)*
append
used by mailx 425
ask
used by mailx 432
askbcc
used by mailx 432
asksub
used by mailx 432
autoprint
used by mailx 419, 426, 432
bang
used by mailx 429, 432
BPXWISHISPF
used by obrowse 506
used by oedit 512
BPXWPERM
used by oedit 512
BPXWRFD
used by tsocmd 777
CDPATH
description of 624
used by cd 126
used by vi 851, 857
cmd
used by mailx 424, 432
COLUMNS
description of 624
used by ed 286
used by ls 412
used by more 479
used by pg 556, 558
used by ps 574
used by sed 593
used by shedit 634
used by vi 857
conv
used by mailx 417, 436
crt
used by mailx 424, 432
description of 624
displaying 290, 595
displaying the value of a 563
dot
used by mailx 433
editor
used by mailx 427
EDITOR
description of 624
used by crontab 191
used by shedit 634
ENV
description of 606, 624
used by sh 607
used by vi 857
ERRNO
description of 624
escape
used by mailx 427, 433
EXINIT
used by vi 856, 857
FCEDIT
description of 624
used by fc, history, r 311
flipr
used by mailx 425, 433

environment variable *(continued)*
folder
used by mailx 422, 425, 433
FPATH
description of 624
header
used by mailx 433
HISTFILE
description of 624
used by fc, history, r 310, 311
HISTSIZE
description of 624
used by fc, history, r 310, 311
hold
used by mailx 419, 433
HOME
description of 625
used by cd 126
used by crontab 190, 191
used by mail 415
used by mailx 430
used by vi 851, 856, 857
IFS
description of 625
used by read 576, 577
used by sh 607
ignore
used by mailx 417, 433
ignoreeof
used by mailx 433
indent
used by mailx 433
indentprefix
used by mailx 428, 433
keep
used by mailx 433
keepsave
used by mailx 419, 433
LANG
description of 625
LIBPATH
description of 625
used by c89/cc/c++ 89
LINENO
description of 625
LINES
description of 625
used by more 479
used by pg 556, 558
used by vi 854
LOCPATH
description of 625
LOGNAME
description of 625
used by crontab 190, 191
used by logname 404
used by mailx 430
LPDEST
used by lp 405, 406
MAIL
used by mailx 430
MAILCHECK
description of 625
MAILDIR
used by mailx 430
MAILER
used by calendar 119

environment variable *(continued)*
MAILPATH
description of 625
MAILRC
used by mailx 430
mailserv
used by mailx 433, 436
MAKEFLAGS
used by make 452, 454
MAKESTARTUP
used by make 437, 452, 454
MANPAGER
used by man 466, 468
MANPATH
description of 625
used by man 466, 468
MBOX
description of 625
metoo
used by mailx 433
MORE
used by more 479
NLSPATH
description of 625
OLDPWD
description of 625
used by cd 126
onehop
used by mailx 434, 436
OPTARG
used by getopts 342
OPTIND
used by getopts 342
outfolder
used by mailx 434
page
used by mailx 424, 434
pager
used by mailx 424
PAGER
used by man 466
PATH
description of 626
used by crontab 190, 191
used by vi 857
PPID
description of 626
PRINTER
used by lp 405, 406
prompt
used by mailx 434
PS1
description of 626
PS2
description of 626
used by read 577
PS3
description of 626
PS4
description of 626
PWD
description of 626
used by cd 126
quiet
used by mailx 434
RANDOM
description of 626

environment variable *(continued)*
record
used by mailx 417, 423, 425, 434
REPLY
used by read 576, 577
replyall
used by mailx 434, 436
save
used by mailx 434
screen
used by mailx 423, 434
SECONDS
description of 626
sendmail
used by mailx 434, 436
sendwait
used by mailx 434, 436
setting 290
SHELL
description of 626
used by at 27
used by awk 53
used by crontab 190
used by ed 286
used by mailx 425
used by make 454
used by vi 848, 857
showto
used by mailx 434
sign
used by mailx 427, 434
Sign
used by mailx 435
STEPLIB
description of 627
SYSEXEC
used by tso 774
used by tsocmd 777
SYSPROC
used by tso 774
used by tsocmd 777
TERM
used by at 151
used by more 479
used by talk 680, 681
used by touch 766
used by vi 830, 854, 857
terminfo 362
TERMINFO
used by talk 680, 766
used by vi 857
TMOUT
description of 627
TMP
used by exrecover 305
TMP_VI
used by vi 857
TMPDIR
description of 627
used by ar 18
used by ed 286
used by man 466
used by pg 558
used by sort 649
used by vi 857
toplines
used by mailx 426, 435
environment variable *(continued)*
TSOALLOC
used by tso 774
used by tsocmd 778
tsoout
used by tso 774
TSOPREFIX
used by tso 774
TSOPROFILE
used by tso 774
used by tsocmd 778
TZ 1021
description of 627
used by at 27
used by cron 187
used by crontab 191
used by date 202
used by locale 399
used by ls 412
used by mail 415
used by pr 561
used by touch 764
used by uulog 814
used by uustat 820
used by mailx 422
used to specify system and operational information to c89/cc/c++/cxx 94
used to specify system and operational information to xlc/xlC 872
VISUAL
description of 627
used by mailx 426, 428
used by shedit 634
environment variables
partial list 1023
Environment Variables section
explanation of 4
equivalence class 972, 976
ERRNO environment variable
description of 624
errnojr_value
displaying 128, 288
escape character
displaying current settings 948
specifying the 942
turning off display for settings 948
escape environment variable
used by mailx 427, 433
ESCAPE option of OMVS command 942
escape sequences 614
escaping characters 614
eval shell command 291
evaluate
arguments as expression 301
arguments in the current shell environment 291
arithmetic expression 385
shell expressions 156
ex command
regular expressions 854
special characters 849
ex mode
commands issued from 840
current position pointer 829
entering 840
ex mode *(continued)*
starting session in 828
ex shell command 292
creating tag files for the 194
ex text editor
using the 292
Examples section
explanation of 3
exception condition
trapping 770
exec shell command 295
executable
reentrant 115
executable file
creating 79
displaying symbol table 502
execute
commands on remote sites 823
execute files 1017
exhaustive mode 256
EXINIT environment variable
used by vi 856, 857
exit code
returning a nonzero 309
exit shell command 297
exit shell subcommand 631
exit status
returning values of 0 771
Exit Values section
explanation of 6
expand
compressed data written by Lempel-Ziv compression 790
tabs to spaces 298
expand shell command 298
export
aliases 12
environment variables 300
export shell command 300
expr operators 302
expr shell command 301
expression 971, 975
bracket 971, 975
character class 972, 976
evaluating 301, 385
handling, for the dbx command 207
printing tracing information 251
expression values
printing 235
exrecover shell daemon 304
extattr shell command
extended attributes
setting, resetting, and displaying 307
extended ACL entries 410
extended attributes
APF | NOAPF 993
PROGCTL|NOPROGCTL 994
SHAREAS | NOSHAREAS 994
SHARELIB | NOSHARELIB 994
extended regular expression
explanation of 971, 975
list of commands using 974, 978
external link
identifying 407, 410
ln 393

extract
components from archives 524
contents of archive files 183

F

false shell command 309
fc shell command 310
FCEDIT environment variable
description of 624
used by fc, history, r 311
fg shell command 312
fgrep shell command 343
Fibonacci sequence 630
field (awk variable) 37
FIFO special files
creating 472, 474
fignore shell variable
description of 719
file
allocating
using the BPXBATCH program 982
backing up
archive files 682
backup 682
binary
decoding transmitted 811
encoding for transmission 812
browsing, with BPXBATCH 955
browsing, with the ISPF shell 912
calculating and displaying 149
byte counts 672
checksum 672
changing
access permission of 138
access times 763
audit attributes 130
audit flags 130
group owners 135
groups 143
modes 138
modification times 763
owners 143
source 222
using diff output 518
comparing two 264
with the cmp command 152
with the diff command 263
with the ISHELL command 912
with the OSHELL command 955
with the sum command 672
compressed
displaying 554
compressing
using Lempel-Ziv compression 161
concatenating lines into standard output 515
converting 257
from ASCII to EBCDIC 258
from EBCDIC to ASCII 258
copying
archive files 682
between sites 806
between two files 924
file *(continued)*
copying *(continued)*
to target named by the last argument on command line 170
to users on remote systems 821
with BPXBATCH 955
with data conversion 257
with the ISPF shell 912
creating
character special files for file systems 915
directories for 914
FIFO special 474
links to 391
with BPXBATCH 955
with the ISPF shell 912
deleting
information from 659
with BPXBATCH 955
with the ISPF shell 912
displaying 227
attributes of 912, 955
compressed 554
first part 348
interactively 555
last part of the 676
lines common to two files 157
page by page 475
specified number of lines in source 225
dumping to standard output 507
editing
with the oedit shell command 511
with the OEDIT TSO/E command 928
editing, with BPXBATCH 955
editing, with the ISPF shell 912
expanding compressed files 790
formatting in paginated form 559
instructions in a source 227
lines
numbering 500
list of
building, with the OSTEPLIB command 956
listing
attributes 407
names 407
maintaining
interdependent 436
program-generated 436
manipulating repeated lines 794
merging corresponding or subsequent lines of files 515
misspelled words
looking for 652
moving 485
naming, with BPXBATCH 955
naming, with the ISPF shell 912
object
displaying symbol table of an 502
output tags
used by ctags 195
used by uptime 803
passing small amounts to 278
processing 35
reading dbx subcommands from 246
file *(continued)*
removing
information from 659
renaming 485
running
object files, with previous arguments 239
with the ISHELL command 912
with the OSHELL command 955
searching
backward for patterns 210
for specified patterns 343
for text strings 912, 955
forward for patterns 211
sending
paginated files to printer 559
to other users 867
setting
destination time 172
groups 143
modification time 172
owners 143
showing differences between two 264
sorting
in topological order 779
splitting 654
summarizing use of space 276
text
comparing two 263
concatenating 122
counting items in 862
displaying 122
finding information in 35
finding strings in 971, 975
retrieving information from 35
splitting 192
transfers
displaying information about 814
uncompressing
Huffman-coded 554
words
looking for misspelled 652
file cache
managing 328
file descriptor
closing 295
copying 295
opening 295
file formats
magic 1004
queuedefs 1011
tags 1012
tar 1012
utmpx 1014
file hierarchy
copying, with copytree 169
file mode creation mask
setting or returning 786
file name
deleting trailing parts 272
expanding on command line 278
generation 622
file owner
group
GID(group) 994
UID(owner) 994

file recovery daemon for vi (exrecover) 304
file shell command 313
  using the magic file 1004
file space
  summarizing use of 276
file subcommand for dbx command 222
file system
  unmounting from the shell 798
file system recovery
  TSO MOUNT 922
file systems
  browsing files in the
    with the obrowse shell command 506
  hierarchical
    unmounting 959
  TFS
    mounting 921
    unmounting 959
file tag 713, 756
  automount 28
  ls 407
  MOUNT TSO/E command 916
  tcsh shell 730
file tag information
  changing 146
file tags
  changing 146
file transfer
  daemon for (uucico) 805
  requests
    processing, with the uucico daemon 805
file type
  determining the 313
file-creation permission-code mask
  setting or returning 786
filec shell variable
  description of 719
FILENAME built-in variable for awk 41
files 317
  /bin/mail
    used by calendar 119
  /dev/mt/0m
    used by tar 684
  /etc/auto/master
    used by automount 29
  /etc/csh.cshrc
    used by tcsh login 689
  /etc/csh.login
    used by tcsh login 689
  /etc/inetd.conf
    used by the inetd daemon 356
  /etc/inetd.pid
    used by the inetd daemon 358
  /etc/magic
    used by file 317
  /etc/mailx.rc
    configuration settings 188
    used by mailx 418, 429, 435
  /etc/profile 631
    used by the login shell 605
  /etc/rc
    used by automount 28
  /etc/recover
    used by exrecover 305
files *(continued)*
  /etc/recover/$LOGNAME/VIn*
    used by exrecover 305
  /etc/recover/$LOGNAME/VIt*
    used by exrecover 305
  /etc/startup.mk
    used by make 454
  /etc/suid_us.profile
    used by sh 631
  /etc/utmpx
    used by who 866
  /etc/yylex
    used by lex 388
  /etc/yylex.c
    used by lex 387
  /etc/yyparse.c
    used by yacc 900
  /tmp
    used by ar 18
    used by fc, history, r 311
  /tmp/e*
    used by ed 286
  /tmp/sh*
    description of 631
  /tmp/stm*
    used by sort 649
  /tmp/VIl*
    used by exrecover 305
  /tmp/VIn*
    used by exrecover 305
  /tmp/VIt*
    used by exrecover 305
  /usr/lib
    used by spell 653
  /usr/lib/config
    used by uucc 804
  /usr/lib/cron/at.allow
    used by cron 188
  /usr/lib/cron/at.deny file
    used by cron 188
  /usr/lib/cron/cron.allow
    used by cron 189
  /usr/lib/cron/cron.deny
    used by cron 189
  /usr/lib/cron/queuedefs
    used by cron 189
  /usr/lib/hash
    used by spell 652, 653
  /usr/lib/hashb
    used by spell 652, 653
  /usr/lib/lib.b
    used by bc 68
  /usr/lib/libl.a
    used by lex 388
  /usr/lib/liblxp.a
    used by lex 388
  /usr/lib/lwords
    used by spell 652, 653
  /usr/lib/uucp
    used by uucc 804
  /usr/lib/uucp/config
    used by uucc 803, 804
    used by uucico 806
    used by uucp 809
    used by uulog 815
    used by uuname 816
    used by uupick 817
files *(continued)*
  /usr/lib/uucp/config *(continued)*
    used by uustat 821
    used by uuto 822
    used by uux 825
    used by uuxqt 827
  /usr/lib/uucp/devices
    used by uucc 804
  /usr/lib/uucp/dialcodes
    used by uucc 804
  /usr/lib/uucp/dialers
    used by uucc 804
  /usr/lib/uucp/permissions
    used by uucc 804
  /usr/lib/uucp/systems
    used by uucc 804
  /usr/man/%L/man¬0–9|/*.book
    used by man 467
  /usr/man/%L/whatis
    used by man 467
  /usr/spool/.Sequence
    used by uucp 809
  /usr/spool/cron
    used by cron 188
  /usr/spool/cron/atjobs
    used by cron 188
  /usr/spool/cron/crontabs
    used by cron 188
  /usr/spool/cron/log
    used by cron 188
  /usr/spool/cron/pid
    used by cron 188
  /usr/spool/locks
    used by uucico 806
  /usr/spool/uucp
    used by uulog 815
    used by uustat 821
  /usr/spool/uucp/.Sequence
    used by uux 825
    used by uuxqt 827
  /usr/spool/uucp/.Status
    used by uucico 806
    used by uustat 821
  /usr/spool/uucp/.Xqtdir
    used by uuxqt 827
  /usr/spool/uucp/LOGFILE 806
    used by uucico 805, 806
    used by uucp 809
    used by uulog 815
    used by uux 825
  /usr/spool/uucp/site
    used by uux 825
    used by uuxqt 827
  /usr/spool/uucppublic
    used by uucp 809
    used by uuto 822
  /usr/spool/uucpublic
    used by uupick 817
  /usr/spool/uucpublic/receive
    used by uupick 818
  /var/man/%L/entry.¬0–9|/*.bookname
    used by man 467
  .dbxinit
    used by dbx 205, 207
  .dbxsetup
    used by dbx 205, 207

files *(continued)*
.exrc
used by vi 856
.profile 631
$HOME / .sh_history
used by fc, history, r 310
$HOME/.exrc
used by vi 856
$HOME/mbox
used by mailx 435
used by make 417
$MAILRC
used by mailx 435
$TMPDIR/pg*
used by pg 558
a.out
used by dbx 208
calendar 119
dead.letter
used by mail 415
used by mailx 427
ed.hup
used by ed 286
extended attributes
displaying 307
HOME/.profile
used by tcsh login 689
used by the login shell 605
l.output
used by lex 387, 388
lex.yy.c
used by lex 388
liby.a
used by yacc 900
libyxp.a
used by yacc 900
MAILDIR
used by mailx 435
mailrc
used by mailx 429
MapName
used by automount 30
mbox
used by mail 415
used by mailx 418
pk$*
used by unpack 801
queuedefs
used by cron 186
remove old 642
rsh
used by the sh command 605
sh_history 631
terminfo.src
used by tic 760
y.output
used by yacc 900
y.tab.c
used by yacc 900
y.tab.h
used by yacc 900
Files section
description of 5
filter
numbering lines in a file 500
passing small amounts to 278
filter out
repeated lines in a file 794
find 971, 975
group affiliation of invoking processes 354
identical lines within files 157
patterns, using regular expressions 971, 975
spelling errors 652
strings, using regular expressions 971, 975
user identity of invoking processes 354
find shell command 320
fixed records
converting from variable records 258
fixed to variable-record conversion 259
flag options syntax 887
flipr environment variable
used by mailx 425, 433
FLOAT
C/C++ programs 82
floating-point numbers 82
select format of floating-point numbers 82
floating-point registers
displaying values of 238
FNR built-in variable for awk 41
fold shell command 328
folder environment variable
used by mailx 422, 425, 433
for loop
exiting from, in a shell script 77
for shell subcommand 607
format files in paginated form 559
Format section
explanation of 1
forward retrieve function of OMVS command 943
FPATH environment variable
description of 624
fpath search 613
free space
displaying amount of 261
fullword
definition of, for vi 834
func subcommand for dbx command 222
function
changing 222
explanation of 63
listing 255
moving down the stack 220
moving up the stack 253
printing tracing information for 251
unsetting values and attributes of 801
function key
customizing settings for 942
deactivating 944
displaying current settings 948
list of defaults 945
setting
controlling display of 944
setting up
to control display of the function key settings 944
function key *(continued)*
setting up *(continued)*
to enter subcommand mode 945
to enter TSO/E command mode 945
to return from subcommand mode to shell 944
to scroll data backward 945
turning off display of 948
function shell subcommand 613
fuser shell command 330
FWDRETR function key for OMVS command 943
FWDRETR option of OMVS command 943

G

gencat shell command 331
preprocessing message source files for 469
general-purpose registers
displaying values of 238
generate
file names 622
programs for lexical tasks 387
generate source dependency information
makedepend 457
get
configuration values 334
contents of archive files 183
messages 468
getconf shell command 334
getfacl shell command 338
getopts shell command 340
gid shell variable
description of 719
glob characters 622
glob patterns 622
globalization
explanation of 997
gmacs 597
enabling, with the EDITOR environment variable 624
GMT (Greenwich Mean time)
used by the TZ environment variable 1021
GONUMBER
C/C++ programs 83
debugging 83
improved performance 83
gotoi subcommand for dbx command 223
Greenwich Mean Time (GMT)
used by the TZ environment variable 1021
grep shell command 343
group
changing 497
setting 912
group affiliation
finding 354
returning 354
group owner
changing 135
setting 135

group recipe
explanation of 437
group shell variable
description of 719
GROUP tcsh environment variable
description of 729

H

HALFSCR function key for OMVS command 943
HALFSCR subcommand of OMVS command 947
hangup 632
hash shell command 347
head shell command 348
header environment variable
used by mailx 433
header line 418
HELP function key for OMVS command 943
help information
refreshing 944
scrolling
backward 943, 947
forward 943, 945, 947, 949
half a screen forward 943, 947
help subcommand for dbx command 224
HELP subcommand of OMVS command 947
here-document 621
HFS
invoking
vfs_pfsctl HFS functions 163
hide
data entered on the shell command line 944, 948
OMVS command input area 943, 947
HIDE function key for OMVS command 944
HIDE subcommand of OMVS command 948
histchars shell variable
description of 719
histdup shell variable
description of 720
HISTFILE environment variable
description of 624
used by fc, history, r 310, 311
histfile shell variable
description of 720
histlit shell variable
description of 720
history
editing 633
history file
processing 310
truncating the 310
history list
displaying commands in a 224
processing for commands 310
history shell variable
description of 720
history storage file (sh_history) 631
history subcommand for dbx command 224
HISTSIZE environment variable
description of 624
used by fc, history, r 310, 311
hold buffer 588
hold environment variable
used by mailx 419, 433
home directory 625
HOME environment variable
description of 625
used by cd 126
used by crontab 190, 191
used by mail 415
used by mailx 430
used by vi 851, 856, 857
home shell variable
description of 720
HOME tcsh environment variable
description of 729
HOME/.profile file
used by tcsh login 689
used by the login shell 605
HOST tcsh environment variable
description of 729
HOSTTYPE tcsh environment variable
description of 729
HPATH tcsh environment variable
description of 729
Huffman coding
compressing files with 800
uncompressing files 554
hyphen
explanation of 1

I

iconv shell command 352
id shell command 354
identifier
displaying qualifications of 257
identifier (awk variable) 37
identify shell names 781
if shell subcommand 607
IFS environment variable
description of 625
used by read 576, 577
used by sh 607
ignore environment variable
used by mailx 417, 433
ignore subcommand for dbx command 225
ignoreeof shell variable
description of 720
ignoreof environment variable
used by mailx 433
illegal byte sequence
in DBCS strings 8
implicitcd shell variable
description of 720
improved debugging
GONUMBER 83
improved performance
XPLINK 90
in shell subcommand 611, 612
in/out file archives
copying 183
indent environment variable
used by mailx 433
indentprefix environment variable
used by mailx 428, 433
inetd daemon 355
handling of requests by uucpd 810
inference rules
used by make 447
infocmp shell command 358
input
passing small amounts to filter or file 278
input file
concatenating lines 515
displaying 555
printing 405
input mode 418
inputmode shell variable
description of 720
insert mode 828
instruction
displaying 227
running 247
instruction register
displaying values of 238
interactive shell 606, 690
Interactive System Productivity Facility 923
interactive text editor (vi) 828
intercept
abnormal conditions and interrupts 770
signals 770
interdependent file
maintaining 436
internal field separator 625
Interprocedural Analysis (IPA) optimization
explanation of 89
interprocess communication facility status
reporting the 364
interrupt
trapping abnormal 770
invalid byte sequence
in DBCS strings 8
invoke
BPXBATCH
with OSHELL 955
editor 221
HFS functions 163
shell 604
TSO/E command mode 949
utilities, ignoring the SIGHUP signal 505
z/OS shell 937
invokes
vfs_pfsctl HFS functions 163
IPA
enabling 87, 461
explanation of 87, 461
IPA (Interprocedural Analysis) optimization
explanation of 89
ipcrm shell command 362
ipcs shell command 364
ISHELL TSO command 912

ISPF (Interactive System Productivity Facility)
  browsing files
    with the obrowse shell command 506
    with the OBROWSE TSO/E command 923
  editing files
    with the oedit shell command 511
    with the OEDIT TSO/E command 928
  entering TSO/E commands from 909
  invoking the shell
    with ISHELL 912
italic typeface
  explanation of 1, 2

J

JCL (job control language)
  example of, using the BPXCOPY program 995
job
  ending 374
  moving
    from background to foreground 312
    to background 70
  restarting a suspended 312
  returning list of, in current session 370
  running in background 70
  scheduling background 189
  waiting for it to end 860
jobs shell command 370
join shell command 372
join two databases 372

K

keep environment variable
  used by mailx 433
keepsave environment variable
  used by mailx 419, 433
key
  sorting 648
keyboard
  navigation 1043
  PF keys 1043
  shortcut keys 1043
kill shell command 374

L

l.output file
  used by lex 387, 388
LALR(1) grammar
  converting 899
LANG environment variable 4, 997
  description of 625
LANG tcsh environment variable
  description of 729
large format data set
  restriction in z/OS UNIX 11
LC_ALL environment variable 4, 997
LC_COLLATE environment variable 997
LC_CTYPE environment variable 997
LC_CTYPE tcsh environment variable
  description of 729
LC_MESSAGES environment variable 4, 997
LC_MONETARY environment variable 997
LC_NUMERIC environment variable 997
LC_SYNTAX environment variable 997
LC_TIME environment variable 997
ld environment variable
  _LD_ACCEPTABLE_RC 379
  _LD_ASUFFIX 379
  _LD_ASUFFIX_HOST 380
  _LD_DAMPLEVEL 380
  _LD_DAMPNAME 380
  _LD_DCB80 380
  _LD_DCBU 380
  _LD_DEBUG_DUMP 380
  _LD_DEBUG_TRACE 380
  _LD_ENTRY_POINT 381
  _LD_EXTRA_SYMBOL 381
  _LD_LIBDIRS 381
  _LD_NEW_DATACLAS 381
  _LD_NEW_DSNTYPE 381
  _LD_NEW_MGMTCLAS 381
  _LD_NEW_SPACE 381
  _LD_NEW_STORCLAS 381
  _LD_NEW_UNIT 381
  _LD_OPERANDS 381
  _LD_OPTIONS 382
  _LD_ORDER 381
  _LD_OSUFFIX 382
  _LD_OSUFFIX_HOST 382
  _LD_SYSIX 382
  _LD_SYSLIB 382
  _LD_XSUFFIX 382
  _LD_XSUFFIXHOST 382
ld shell command 377
  environment variables 379
  specifying 379
ld utility
  starting the 377
Lempel-Ziv compression 185, 538
  compressing data with 161
  uncompressing data 790
let shell command 385
lex shell command 387
lex.yy.c file 388
lexical analyzer 387
lexical syntax
  reading description of 387
lexical tasks
  generating programs for 387
LIBPATH environment variable
  description of 625
  used by c89/cc/c++ 89
library
  creating 16
  maintaining 16
  making 453
library of objects
  displaying symbol table 502
liby.a file
  used by yacc 900
libyxp.a file
  used by yacc 900
Limits section
  explanation of 6
line
  breaking into shorter lines 328
  changing next line to be displayed 229
  numbering, in a file 500
  reading from standard input 576
line editor (ex) 828
LINENO environment variable
  description of 625
lines
  counting 862
LINES environment variable
  description of 625
  used by more 479
  used by pg 556, 558
  used by vi 854
LINES option of OMVS command 942
LINES tcsh environment variable
  description of 729
link
  creating, for files 391
link shell command 390
link-edit
  z/OS C and z/OS C++ object files 79
links
  creating 390
list
  active procedures and functions 255
  file attributes 407
  file names 407
  files in directories
    with ISHELL 912
    with OSHELL 955
  instructions in program 227
  process IDs 330
  variables and their attributes 781
list mode 524
list subcommand for dbx command 225
listfiles subcommand for the dbx command 226
listflags shell variable
  description of 720
listfuncs subcommand for dbx command 227
listi subcommand for dbx command 227
listjobs shell variable
  description of 720
listlinks shell variable
  description of 720
listmax shell variable
  description of 721
listmaxrows shell variable
  description of 721
ln shell command 391
load characteristics
  displaying 228
local environment
  defining 400
local spawn
  BPXBATSL 910, 981
locale 4, 387

locale *(continued)*
converting source definitions for categories 400
displaying information about 395
giving it control over a category 997
switching 9
locale shell command 395
localedef shell command 400
localization
categories of 997
explanation of 997
Localization section
explanation of 4
LOCPATH environment variable
description of 625
log information
displaying about UUCP events 814
log messages 402
logger shell command 402
logging in 605, 689
login accounting information
storing 1014
login information
displaying 865
login name
returning 404
login password and password phrase
changing the 514
login shell
description of 605, 689
system profile for the 631
truncating history files 310
user profile for the 631
loginsh shell variable 721
LOGNAME environment variable
description of 625
used by crontab 190, 191
used by logname 404
used by mailx 430
logname shell command 404
logout shell variable
description of 721
loop
exiting from, in a shell script 77
skipping to the next iteration of a 168
lowercase
converting to uppercase 259
lowercase letters 1
lp shell command 405
LPDEST environment variable
used by lp 405, 406
lpstat shell command 406
ls
in a sysplex 412
ls shell command 407

M

MACHTYPE tcsh environment variable
description of 729
macro definitions 442
macro modifiers 443
magic file format 1004
used by the file command 314
magic number
#! 988
mail
reading 413
sending 413
sending and receiving 416
MAIL environment variable
used by mailx 430
mail shell command 413
mail shell variable
description of 721
MAILCHECK environment variable
description of 625
MAILDIR environment variable
used by mailx 430
MAILER environment variable
used by calendar 119
MAILPATH environment variable
description of 625
MAILRC environment variable
used by mailx 430
mailrc file
used by mailx 429
mailserv environment variable
used by mailx 433, 436
mailx environment variable
used by mailx 425
mailx shell command 416
maintain
library archives 16
program-generated and interdependent files 436
make
directories
for each named directory argument 471
with the MKDIR command 914
FIFO special files 472
libraries 453
make shell command 436
conditional expression 453
makedepend
generate source dependency information 457
makedepend shell command 457
makefile 441
contents of 442
MAKEFLAGS environment variable
used by make 452, 454
MAKESTARTUP environment variable
used by make 437, 452, 454
man page
displaying 464
man shell command 464
manage
file caches 328
manipulate
dates 35
repeated lines 794
tar archive files 682
MANPAGER environment variable
used by man 466, 468
MANPATH environment variable
description of 625
used by man 466, 468
map subcommand for dbx command 228
MapName file
used by automount 30
mark name 833
master mode 805
match
strings of text in text file 971, 975
matchbeep shell variable
description of 721
matching strings
searching for 343
MBOX environment variable
description of 625
mbox file
used by mail 415
used by mailx 418
memory
displaying 218
merge
corresponding or subsequent lines of files 515
mesg shell command 468
message
allowing 468
broadcasting a 861
header line 418
logging 402
receiving 468
refusing 468
sending to other users 867
message catalog
creating 331
displaying 274
displaying messages from 275
editing 331
modifying 331
piping from mkcatdefs to gencat 585
message queue
removing 362
message source file
preprocessing 469
metacharacter
used in regular expressions 971, 975
metarules 447
metoo environment variable
used by mailx 433
mkcatdefs shell command 469
mkdir shell command 471
MKDIR TSO/E command 914
mkfifo shell command 472
MKNOD TSO/E command 915
mode
changing 138
command 418
input 418
modification time
setting for destination files 172
modify
message catalogs 331
MORE environment variable
used by more 479
more shell command 475
creating tag files for the 194
mount
a file system 481
z/OS UNIX file system 912, 917
mount attributes
changing
from the shell 141

mount mode
changing the 957
mount shell command 481
MOUNT TSO/E command 916
move
current function down the stack 220
current function up the stack 253
files 485
jobs from background to foreground 312
positional parameters 640
move subcommand for dbx command 229
movement commands (for vi) 832
MsgFile.h
mkcatdef output file 469
multihop name 807
multinode name 807
multiple volume support 185, 537
multiprocess debugging
enabling or disabling 229
multproc subcommand for dbx command 229
mutex object
display list of 250
displaying list of 230
mutex subcommand for dbx command 230
mv shell command 485
MVS (Multiple Virtual Storage)
batch environment
running shell scripts and z/OS XL C/C++ applications under 981
copying
data sets into z/OS UNIX file system directories 952
data sets into z/OS UNIX file system files 949
data sets to another member or file 924
sequential data sets into z/OS UNIX file system directories 952
sequential data sets into z/OS UNIX file system files 949
z/OS UNIX file system files to MVS data sets 929

N

name of files
listing 407
name, user
displaying your 867
named pipe 474
national language system report 715
navigation
keyboard 1043
newgrp shell command 497
newline
counting 862
next subcommand for dbx command 231
nexti subcommand for dbx command 232
NEXTSESS function key for OMVS command 944
NEXTSESS subcommand of OMVS command 948
NF built-in variable for awk 41
nice shell command 499
nickname
creating 11
nl shell command 500
NLSPATH environment variable 4
description of 625
nm shell command 502
NO function key for OMVS command 944
NOALARM function key for OMVS command 942
NOALARM option of OMVS command 938
NOALARM subcommand of OMVS command 948
NOAUTOMOVE 920
NOAUTOSCROLL function key for OMVS command 943
NOAUTOSCROLL option of OMVS command 938
NOAUTOSCROLL subcommand of OMVS command 948
nobeep shell variable
description of 721
noclobber shell variable
description of 721
NODBCS option of OMVS command 940
NOECHO function key for OMVS command 943
NOECHO option of OMVS command 941
NOECHO subcommand of OMVS command 948
nogob shell variable
description of 721
NOHIDE function key for OMVS command 944
NOHIDE subcommand of OMVS command 948
nohup shell command 505
nokanji shell variable
description of 721
nonfunctional commands 196
cancel 120
lpstat 406
nonomatch shell variable
description of 721
nonsupported commands
cu 196
nonzero exit code
returning 309
NOPFSHOW function key for OMVS command 944
NOPFSHOW option of OMVS command 946
NOPFSHOW subcommand of OMVS command 948
NOREBIND tcsh environment variable
description of 729
NOSHAREAS option of OMVS command 946, 947
nostat shell variable
description of 721
Notices 1047
notify shell variable
description of 722
NR built-in variable for awk 41
null command 156
number
lines in a file 500

O

object file
displaying the symbol table of an 502
loading for execution 232
managing 436
running with previous arguments 239
object library
displaying symbol table 502
object manipulator commands (for vi) 836
list of 837
object subcommand for dbx command 232
obrowse shell command 506
OBROWSE TSO/E command 923
obtain
crontab entries 189
obtain options and their arguments 341
OCOPY TSO/E command 924
octal dump 507
od shell command 507
oedit shell command 511
OEDIT TSO/E command 928
OGET TSO/E command 929
OGETX TSO/E command 933
OLDPWD environment variable
description of 625
used by cd 126
OMVS command
list of subcommands 947
OMVS command input area
hiding 947
hiding or unhiding 943
unhiding 948
OMVS interface
running commands from the shell using the 772, 777
onehop environment variable
used by mailx 434, 436
online reference manual
printing entries 464
searching for entries 464
onload subcommand for dbx command 233
open file descriptors 295
open files
displaying
zlsof system REXX command 961
zlsof TSO command 960
OPEN function key for OMVS command 944
OPEN subcommand of OMVS command 948
operator
control 612
description of 612

operator *(continued)*
redirection 612
OPTARG environment variable
used by getopts 342
OPTIND environment variable
used by getopts 342
optional features 79
options
explanation of 1
obtaining from a list of parameters 341
order of 1
Options section
explanation of 3
OPUT TSO/E command 949
OPUTX TSO/E command 952
order of items on command line 3
order of options 1
OSHELL REXX exec 989
OSHELL TSO command 955
OSTYPE tcsh environment variable
description of 729
outfolder environment variable
used by mailx 434
output file
copying standard input to each 755
output stream
cloning 755
output tags file
used by ctags 195
used by uptime 803
output, formatted
writing 564
overlay commands 295
owd shell variable
description of 722

P

pack shell command 512
page environment variable
used by mailx 424, 434
pager environment variable
used by mailx 424
PAGER environment variable
used by man 466
paginated file
formatting 559
printing 559
parallel processing
OpenMP environment variables 873
parameter
positional
description of 615
setting 595
shifting 640
unsetting 595
special
description of 615
parameter substitution 615, 715
parent process
returning to the 297
parse
utility options 341
partitioned data set (PDS) 933
partitioned data set extended (PDSE) 933
pass
command to shell for execution 245
small amounts of input to filter or file 278
passwd shell command 514
password and password phrase
changing the 514
paste shell command 515
patch shell command 518
PATH environment variable
description of 626
used by crontab 190, 191
used by vi 857
path name
checking for validity and portability 522
displaying 575
returning
directory components of 272
nondirectory components of 52
path search 613
path shell variable
description of 722
PATH tcsh environment variable
description of 729
pathchk shell command 522
pattern
finding, using regular expressions 971, 975
rules for 611
searching 343
backward for a 210
forward for a 211
pattern buffer 588
pax file format 1007
pax shell command 523
pcat shell command 554
PDS (partitioned data set)
copying
members from MVS to files 952
members to files 949
z/OS UNIX file system directories or file to a 933
PDSE (partitioned data set extended)
copying
members from MVS to files 952
members to files 949
z/OS UNIX file system directories or files to a 933
performance
C/C++ programs
FLOAT 82
XPLINK 90
permission bits
of files, setting 993
permissions 410
PF keys
showing at the bottom of the screen 946
PFSHOW function key for OMVS command 944
PFSHOW option of OMVS command 946
PFSHOW subcommand of OMVS command 948
pg shell command 555
pipe
creating 607
output from mkcatdefs to gencat 585
piped file
displaying 555
pipeline 607
pipes
displaying
zlsof system REXX command 961
zlsof TSO command 960
pk$* file
used by unpack 801
placeholder information in commands 2
Portability section
explanation of 6
positional parameter 640
POSIX.1 standard parameter names 334
POSIX.2 standard parameter names 336
PPID environment variable
description of 626
pr shell command 559
preprocess
message source files 469
prevent changes to values of the name argument 578
PREVSESS function key for OMVS command 944
PREVSESS subcommand of OMVS command 948
print
arguments 562
expression values 235
formatted output 564
writing 564
input files 405
paginated files 559
sections of online reference manuals 464
terminal entries in the terminfo database 120
terminfo database entries 358
tracing information 251
print queue
requests
canceling 120
displaying status of 406
print shell command 562
print subcommand of for command 235
printenv shell command 563
printer
sending files to 405
PRINTER environment variable
used by lp 405, 406
printexitvalue shell variable
description of 722
printf shell command 564
priorities of running processes
changing 579
priority
running commands at a different 499
procedure
listing 255
printing tracing information for 251
process
changing priorities of running 579
displaying
status of 567

process *(continued)*
displaying *(continued)*
time accumulated 762
ending 374
returning
file-creation permission-code masks 786
status of 567
sending signals to 374
setting
file-creation permission-code masks 786
resource limits 785
process IDs
displaying 330
process list
returning 370
processing
awk programs 35
command history list 310
processor
displaying 761
processor time 762
program
continuing execution 216
from stopping point 245
continuing execution without dbx control 217
debugging 205
delaying execution of 641
deleting stops and traces from 217
displaying
declarations of components 254
instructions 227
load characteristics 228
generating, for lexical tasks 387
managing 436
printing tracing information 251
running
object files 240
program instructions 247
source lines 247
to next instruction 232
to next source line 231
until return is reached 239
with previous arguments 239
stopping
at a specific location 249
when certain conditions are met 248
writing printouts created by 23
program counter address
changing 223
program file
displaying
list of functions 227
program-generated file
maintaining 436
prompt
continuation 626
string 626
prompt environment variable
used by mailx 434
prompt shell variable
description of 725
prompt subcommand of for command 235
prompt2 shell variable
description of 722
prompt3 shell variable
description of 722
promptchars shell variable
description of 722
ps shell command 567
PS1 environment variable
description of 626
PS2 environment variable
description of 626
used by read 577
PS3 environment variable
description of 626
PS4 environment variable
description of 626
public directories (UUCP)
searching 816
pushdsilent shell variable
description of 722
pushdtohome shell variable
description of 722
PWD environment variable
description of 626
used by cd 126
pwd shell command 575
PWD tcsh environment variable
description of 729

Q

query
ASCII/EBCDIC code pages for the terminal 133
STREAM physical file system 167
queuedefs file
used by cron 186
queuedefs file format 1011
quick mode 256
quiet environment variable
used by mailx 434
quiet mode
turning on 830
quit
sessions
ending 944
shell sessions 944, 948, 949
QUIT function key for OMVS command 944
QUIT subcommand of OMVS command 948
quit subcommand of the for command 236
QUITALL function key for OMVS command 944
QUITALL option of OMVS command 949
QUITALL subcommand of OMVS command 948
quoting 614

R

RACF (Resource Access Control Facility) 11
RANDOM environment variable
description of 626
read
archive files 523, 682
contents of UUCP configuration files 803
cpio archives 183
data 257
dbx subcommands from file 246
description of lexical syntax 387
electronic mail 416
lines from standard input 576
mail 413
read mode 524
read shell command 576
read/write lock objects
displaying list of 236
readonly shell command 578
readonly variable
used by vi 829, 848
readwritelock subcommand for dbx command 236
reason_code text
displaying
bpxmtext shell command 71
bpxmtext system REXX command 961
BPXMTEXT TSO command 912
receive
electronic mail 416
messages 468
recexact shell variable
description of 722
recipe line
explanation of 437
recipes 442
explanation of 441
recognize_only_executables shell variable
description of 722
record environment variable
used by mailx 417, 423, 425, 434
record separator character 40
record subcommand for the dbx command 237
recovery daemon
for vi 304
redirection 3, 620
redirection operator 612
reenter commands 310
reentrancy 115
reference manual
online
printing entries 464
searching for entries 464
refresh
data 944
help information 944
REFRESH function key for OMVS command 944
refuse
messages 468
regexp 971, 975
registers subcommand for dbx 238
regular expression
composition of 971, 975
concatenating to form a larger regular expression 974, 978

regular expression *(continued)*
examples 974, 978
explanation of 971, 975
features that apply to z/OS shell commands 974, 978
matching 343
supported by awk 38
used in ex 854
used to find patterns in files 971, 975
used when finding strings in files 971, 975
Related Information section
explanation of 6
remote site
running commands on 823
transferring data to 1017
remote system
copying files to users on 821
remote systems
connecting to, with the uucico daemon 805
REMOTEHOST tcsh environment variable
description of 730
remount
specified file systems 957
remove
alias definitions 787
aliases 252
arguments 583
attributes of shell variables 801
attributes of variables and functions 801
breakpoints at addresses 215
crontab entries 190
directories 584
directory entries 583, 797
duplicate files 794
files 583, 797
information from executable files 659
message queues 362
old files 642
reverse line feeds 155
semaphore sets 362
shared memory identifiers 362
stops from programs 214, 217
traces from program 217
trailing part of file names 272
values of variables and functions 801
variables 253
remove ACLs
setfacl 599
rename files 485
renice shell command 579
REPLY environment variable
used by read 576, 577
replyall environment variable
used by mailx 434, 436
report
interprocess communication facility status 364
repeated lines in a file 794
request (file transfer)
processing, with the uucico daemon 805
rerun subcommand for dbx command 239
reset
ASCII/EBCDIC code pages for the terminal 133
reset access time 184
Resource Access Control Facility (RACF) 11
restart suspended jobs 312
restricted shell 605, 606
restriction in z/OS UNIX
large format data set 11
retrieve
saved input lines by going backward 944
saved input lines by going forward 943
RETRIEVE function key for OMVS command 944
return
arguments from the shell 562
directory components of path names 272
file mode creation masks 786
from . (dot) scripts 580
from shell functions 580
from subcommand mode to shell session 949
group affiliation of invoking processes 354
list of jobs in current session 370
login names 404
nonzero exit codes 309
path name of working directories 575
process status 567
to shell mode from TSO/3270 passthrough mode 941
to the parent process 297
to TSO/E 297
user ID of person who entered commands 404
user identity of invoking processes 354
RETURN function key for OMVS command 944
return shell command 580
return subcommand for dbx command 239
return values of 0 771
reverse line feed
removing the 155
REXX
OSHELL 989
REXX system commands 961
RLENGTH (awk built-in variable) 43
rlogin requests
handling 355
rlogind program 356, 581
rm shell command 583
rmdir shell command 584
rmstar shell variable
description of 722
root directory
changing 144
root file system
setting up directories for the 912
rprompt shell variable
description of 722
rsh file
description of 605
RSTART (awk built-in variable_ 43
run
commands
after building an argument list 895
at a different priority 499
at a specified time 24
at specified dates and times 186
on remote sites 823
when system is not busy 53
with the exec command 295
debug programs 205
executable files
with the BPXBATCH program 981
files, with the ISHELL command 912
files, with the OSHELL command 955
object files with previous arguments 239
program instructions 247
programs 240
shell scripts
with the BPXBATCH program 981
source lines 223, 247
run subcommand for dbx 240
runcat shell command 585
running processes
changing priorities of 579
runtime macros 444

S

save environment variable
used by mailx 434
save messages 402
saved input line
retrieving by going backward 944
retrieving by going forward 943
savedirs shell variable
description of 722
savehist shell variable
description of 723
SBCS mode
specifying the 940
scale value 56
sched tcsh shell variable
description of 723
schedule
background jobs 189
screen editor (vi) 828
screen environment variable
used by mailx 423, 434
script shell command 586
scroll
automatic
controlling 943, 947, 948
data 949
data backward 943, 945, 947
data forward 943, 947
data half a screen forward 943, 947
help information backward 943, 947
help information forward 943, 945

scroll *(continued)*
help information half a screen forward 943
SCROLL function key for OMVS command 945
SCROLL subcommand of OMVS command 949
scrolling commands (for vi) 831
search
backward for patterns 210
directories 254
files for text strings 912, 955
for strings 343
forward for patterns 211
public UUCP directories 816
search path 613
search rules 613
SECONDS environment variable
description of 626
sections
meaning of, in command descriptions 1
sed noninteractive stream editor
starting the 588
sed shell command 588
select format of floating-point numbers
FLOAT 82
select loop
exiting from, in a shell script 77
select shell subcommand 611
semaphore set
removing 362
send
electronic mail 416
files to printer 405
mail 413
messages
to other users 867
paginated files to printer 559
signals to processes 374
sending comments to IBM xv
sendmail environment variable
used by mailx 434, 436
sendwait environment variable
used by mailx 434, 436
sequential data set
copying to files 949, 952
serviceability
C/C++ programs
GONUMBER 83
session
specifying number to be started 946
starting
in ex mode 828
in vi mode 828
switching
to the next higher-numbered one 944, 948
to the previous (lower-numbered) session 944, 948
SESSION option of OMVS command 946
session, returning list of jobs in 370
set
ASCII/EBCDIC code pages for the terminal 133
command options 595
set *(continued)*
commands to be run at a specified time 24
export attributes for variables 300
file mode creation masks 786
positional parameters 595
priorities of running processes 579
process limits 785
STREAM physical file system 167
terminal options 660
terminal tab stops 674
set ACLs
setfacl 599
set option variables 850
set shell command 595
set subcommand for dbx command 240
set up
directories for the root file system 912
existing groups 912
existing users 912
setfacl shell command 599
sh shell command 604
rsh file 605
sh subcommand for dbx command 245
sh_history file 631
SHAREAS option of OMVS command 946
shared file system
changing file system mount attributes 141
displaying amount of free space 261
mounting a file system 481
using df 263
using ls 412
shared memory identifier
removing 362
shedit shell command 633
shell
access to, giving users 955
alias command, and the 11
archive 630
arguments
evaluating 291
returning 562
arrays 623
command lines 11
command syntax 606
commands 607
running from TSO/E sessions 910, 989
running from TSO/E sessions, with OSHELL 989
using extended regular expressions 971, 975
using regular expressions 971, 975
comments 607
displaying variables 781
editing
interactive 633
ending 297
entering TSO/E commands from 909
evaluating
arguments 291
expressions 156
execution environment 628
shell *(continued)*
removing aliases from 787
expressions
evaluating 156
functions
returning from 580
giving TSO/E users access to 955
identifying names 781
invoking 604
keywords 11
program
running in a separate address space 946
running in the TSO/E address space 946
removing attributes of shell variables 801
reserved word commands 608
returning
arguments from 562
functions 580
running
programs in a separate address space 946
programs in a TSO/E address space 946
TSO/E commands from the 772, 777
scripts
exits from loops in a 77
running from TSO/E sessions, with BPXBATCH 910
running from TSO/E sessions, with OSHELL 989
running, with the . (dot) command 273
running, with the BPXBATCH program 981
skipping to the next iteration of a loop 168
sessions 944
closing 943, 947
ending 948
returning from subcommand mode 949
starting 944, 948
variables
displaying 781
removing attributes of 801
rules for 623
z/OS UNIX
giving TSO/E users access to 955
shell command
chmount 141
mount 481
skulker 642
unmount 798
shell command line
hiding data so secure data can be entered 944, 948
SHELL environment variable
description of 626
used by at 27
used by awk 53
used by crontab 190
used by ed 286
used by mailx 425

SHELL environment variable *(continued)*
used by make 454
used by vi 848, 857
shell mode
returning to, from TSO/3270
passthrough mode 941
shell pre-defined aliases
integer 362
shell predefined aliases
autoload 28
functions 329
history 351
stop 655
suspend 673
shell redirection
automatic code set conversion 1027
shell tcsh shell variable
description of 723
shell variable
displaying
names of 595
values of 595
shift out
used in DBCS strings 8
shift positional parameters 640
shift shell command 640
SHLVL tcsh environment variable
description of 730
shlvl tcsh shell variable
description of 723
short circuit evaluation 39
shortcut keys 1043
show
amount of free space on file system 261
arguments
of programs 212
attributes and contents of a symbolic link 955
attributes and contents of symbolic links 912
currently exported variables 300
declaration of program components 254
differences between two files 264
elapsed time for a command 761
environment variables 290
file attributes 912, 955
first part of files 348
information about locales 395
instructions in program 227
lines common to two files 157
list of active program and functions 255
list of files
of module 226
memory 218
names of
shell variables 595
variables in procedures 221
path name of working directories 575
process status 567
processors 761
qualifications
of given identifiers 257
of symbols 256
show *(continued)*
status of print queues 406
system time accumulated by commands 762
terminal names 780
user time accumulated by the shell 762
values of
shell variables 595
variables in procedures 221
showto environment variable
used by mailx 434
SIGHUP signal
ignored when utility is invoked 505
sign environment variable
used by mailx 427, 434
Sign environment variable
used by mailx 435
signal
intercepting 770
sending to processes 374
trapping
starting 214
stopping 225
signal handling 715
simple command 612
single-byte character set (SBCS)
when you must use 7
single-byte characters
converting 352
site
transferring data to remote 1017
skip subcommand for dbx 245
skip to the next iteration of a loop in a shell script 168
skulker shell command 642
slave mode 805
sleep shell command 641
socket
identifying file types 410
sockets
displaying
zlsof system REXX command 961
zlsof TSO command 960
sort
files
in topological order 779
sort shell command 646
sort-merge utility
starting the 646
sorted files
locating 157
sorting keys 648
sound
3270 alarms 937, 942, 947
source definitions
converting for locale categories 400
source dependency information
makedepend 457
source file
changing 222
displaying
instructions in a 227
specific number of lines 225
managing 436
source line
printing tracing information for 251
source line *(continued)*
removing stops from 214
running 223, 247
specifying 223
source subcommand for dbx 246
SourceFile
mkcatdefs message file 469
space
compressing into tabs 791
expanding tabs to 298
special built-in commands 629
special built-in shell commands
. (dot) 273
break 77
colon. 156
continue 168
dot (.) 273
eval 291
exec 295
export 300
readonly 578
return 580
set 595
shell 297
shift 640
trap 770
unset 801
special file
creating a FIFO 474
manipulating 913, 956
special parameter
description of 615
special target directives 438
specify
character conversion tables 938
command lines for another command 295
escape characters 942
number of sessions to be started 946
source lines 223
that OMVS operate in DBCS mode 940
that OMVS operate in SBCS mode 940
that PF keys be shown at the bottom of the screen 946
z/OS UNIX character conversion table 938
spell shell command 651
spelling errors
looking for 652
split
files 654
text file 192
split shell command 654
spool directory
/usr/spool/uucp 1015
standard environment variables (stdenv)
allocating as files for passing input
using the BPXBATCH command 910
using the BPXBATCH program 982
standard error (stderr)
allocating as files for passing input
using the BPXBATCH command 910

standard error (stderr) *(continued)*
allocating as files for passing input *(continued)*
using the BPXBATCH program 982
standard input (stdin)
allocating as files for passing input 910
using the BPXBATCH command 910
using the BPXBATCH program 982
closing 621
copying
data read from 767
to each output file 755
explanation of 3
reading 122
reading lines from 576
standard output (stdout)
allocating as files for passing input
using the BPXBATCH command 910
using the BPXBATCH program 982
closing 622
copying standard output to each 755
dumping file to 507
explanation of 3
reading lines from 576
sending paginated files to 559
writing
arguments to 277, 564
configuration values to 334
start
ld utility 377
pending UUCP transfers 818
sessions
in ex mode 828
in vi mode 828
shell sessions 944, 948
sort-merge utility 646
statement
explanation of 45
status
displaying 567
of pending UUCP transfers 818
of print queues
displaying 406
status reporting 714
status subcommand for dbx command 246
status tcsh shell variable
description of 723
stdenv (standard environment variables)
allocating as files for passing input 910
using the BPXBATCH command 910
using the BPXBATCH program 982
stderr (standard error)
allocating as files for passing input
using the BPXBATCH command 910
using the BPXBATCH program 982
stdin (standard input)
allocating as files for passing input
using the BPXBATCH command 910
using the BPXBATCH program 982
closing 621
copying
data read from 767
standard output to each 755
explanation of 3
reading 122
reading lines from 576
stdout (standard output)
allocating as files for passing input
using the BPXBATCH command 910
using the BPXBATCH program 982
closing 622
copying standard input to each 755
dumping file to 507
explanation of 3
sending paginated files to 559
writing
arguments to 277
configuration values to 334
writing arguments to 564
step subcommand for dbx command 247
stepi subcommand for dbx command 247
STEPLIB environment variable
description of 627
stop
dbx debug session 236
pending UUCP transfers 818
program at a specific location 249
program execution 248
removing from program 217
removing from source lines 214
shell 297
stop subcommand for dbx command 248
displaying 246
stopi subcommand for dbx command 249
STREAM physical file system
set and query
configstrm shell command 167
string
displaying in a binary file 656
finding, in text files 971, 975
searching for 343
strings shell command 656
strip shell command 659
stty shell command 660
stub commands
cancel 120
cu 196
explanation of 1001
lpstat 406
su shell command 667
SUBCOMMAND function key for OMVS command 945
subcommand mode
setting up
function key to enter 945
setting up function key to return from 944
submit
batch jobs
using the BPXBATCH command 910
z/OS batch jobs that run shell commands
using the BPXBATCH command 910
submit shell command 670
subscript-in-array condition 38
substitute
commands 619
directories 615
suffix 935
sum shell command 672
summarize
use of file space 276
summary of changes xvii
Summary of changes xvii
suppress command numbers 311
suspend program execution 641
swap bytes 185
switch
locales 9
to the next higher-numbered session 944, 948
to the previous (lower-numbered) session 944, 948
symbol
changing interpretation of 213
displaying qualifications of 256
symbol table
displaying the 502
symbol table used in awk 38
symbolic link
displaying attributes and contents of 912, 955
ln 393
symbolic links
SYMLINK
linkname 992
SYMPATH 993
symlinks tcsh shell variable
description of 727
SYMTAB symbol table 38
synopsis of dbx commands
displaying 224
syntax
explanation of 1
syntax, lexical
reading description of 387
SYSEXEC environment variable
used by tso 774
used by tsocmd 777
sysplex
moving file systems in a sysplex 919
unmounting a file system 798
SYSPROC environment variable
used by tso 774
used by tsocmd 777
SYSROOT 959
dummy file system 921

system
calling up 196
connection to 196
system control registers
displaying values of 238
system files 757
System REXX commands
bpxmtext 961
zlsof 961
sysvar shell command 674

T

tab
compressing from spaces 791
expanding to spaces 298
tab stop
setting 674
tabs shell command 674
tag files
creating 194
tags file format 1012
tail shell command 676
talk
to another user 680
talk shell command 680
tape archive 682
tar archive files
manipulating 682
tar file format 1012
tar shell command 682
target 438
tcsh
built-in commands 716
command execution 708
command syntax 699
signal handling 715
tcsh environment variable
_TAG_REDIR_ERR=BIN
description of 730
_TAG_REDIR_ERR=TXT
description of 730
_TAG_REDIR_IN=BIN
description of 730
_TAG_REDIR_IN=TXT
description of 730
_TAG_REDIR_OU =TXT
description of 730
_TAG_REDIR_OUT=BIN
description of 730
COLUMNS
description of 729
DISPLAY
description of 729
EDITOR
description of 729
GROUP
description of 729
HOME
description of 729
HOST
description of 729
HOSTTYPE
description of 729
HPATH
description of 729
tcsh environment variable *(continued)*
LANG
description of 729
LC_CTYPE
description of 729
LINES
description of 729
MACHTYPE
description of 729
NOREBIND
description of 729
OSTYPE
description of 729
PATH
description of 729
PWD
description of 729
REMOTEHOST
description of 730
SHLVL
description of 730
TERM
description of 730
USER
description of 730
VENDOR
description of 730
VISUAL
description of 730
tcsh files 731
tcsh shell
@ (at) shell command 733
alias shell command 11
automatic, periodic, and timed events 714
bg shell command 70
break shell command 77
cd shell command 125
colon (:) shell command 156
echo shell command 277
editing 691
command-line editor 691, 692, 694
eval shell command 291
exec shell command 295
exit shell command 297
fg shell command 312
history shell command 351
jobs shell command 371
kill shell command 374
ls–F shell command 746
National language system report 715
newgrp shell command 498
nice shell command 499
nohup shell command 505
printenv shell command 564
problems and limitations 731
set shell command 596
status reporting 714
stop shell command 655
substitutions 700
suspend shell command 673
time shell command 761
umask shell command 787
unalias shell command 788
unset shell command 802
wait shell command 860
tcsh shell command 689
alloc 734
bindkey 734
builtins 736
tcsh shell variable
ampm
description of 717
argv
description of 717
autocorrect
description of 717
autoexpand
description of 718
autolist
description of 718
autologout
description of 718
backslash
description of 718
cdpath
description of 718
command
description of 718
complete
description of 718
correct
description of 718
cwd
description of 718
dextract
description of 718
dirsfile
description of 718
dirstack
description of 718
dunique
description of 718
echo
description of 718
echo_style
description of 719
edit
description of 719
fignore
description of 719
filec
description of 719
gid
description of 719
group
description of 719
histchars
description of 719
histdup
description of 720
histfile
description of 720
histlit
description of 720
history
description of 720
home
description of 720
ignoreeof
description of 720
implicitcd
description of 720

tcsh shell variable *(continued)*
inputmode
description of 720
listflags
description of 720
listjobs
description of 720
listlinks
description of 720
listmax
description of 721
listmaxrows
description of 721
loginsh
description of 721
logout
description of 721
mail
description of 721
matchbeep
description of 721
nobeep
description of 721
noclobber
description of 721
noglob
description of 721
nokanji
description of 721
nonomatch
description of 721
nostat
description of 721
notify
description of 722
owd
description of 722
path
description of 722
printexitvalue
description of 722
prompt
description of 725
prompt2
description of 722
prompt3
description of 722
promptchars
description of 722
pushdsilent
description of 722
pushdtohome
description of 722
recexact
description of 722
recognize_only_executables
description of 722
rmstar
description of 722
rprompt
description of 722
savedirs
description of 722
savehist
description of 723
sched
description of 723
tcsh shell variable *(continued)*
shell
description of 723
shlvl
description of 723
status
description of 723
symlinks
description of 727
tcsh
description of 719, 723
term
description of 723
time
description of 728
tperiod
description of 723
tty
description of 723
uid
description of 723
user
description of 723
verbose
description of 723
version
description of 724
visiblebell
description of 724
watch
description of 725
who
description of 725
wordchars
description of 725
tcsh tcsh shell variable
description of 723
tee shell command 755
template for commands 895
temporary files
/tmp/sh*
description of 631
remove 642
TERM environment variable
used by at 151
used by more 479
used by talk 680, 681
used by touch 766
used by vi 830, 854, 857
TERM tcsh environment variable
description of 730
term tcsh shell variable
description of 723
terminal
changing characteristics of 765
sending messages to a 867
setting, resetting, or querying ASCII/EBCDIC code pages 133
terminal entry
printing 120
terminal name
displaying 780
terminal options
displaying 660
setting 660
terminal tab stop
setting 674
terminfo database
printing terminal entries in the 120
terminfo database entries
comparing 358
compiling 760
printing 358
TERMINFO environment variable
used by talk 680, 766
used by vi 857
terminfo.src file
used by tic 760
test condition 756
test shell command 756
text conversion
specifying 1028
text editor
ex 292
using the ed 278
vi 828
text file
comparing two 263, 264
concatenating 122
counting items in 862
displaying 122
finding information in 35
finding strings in 971, 975
retrieving information from 35
showing differences between two 264
splitting 192
text insertion commands (for vi) 838
TFS file systems
unmounting 959
then shell subcommand 611
then statement
using null shell statement 156
thread
displaying information about 250
thread subcommand for dbx command 250
tic shell command 760
time
displaying 200
time program 761
time sharing option extensions 909
time shell command 761
time tcsh shell variable
description of 728
time zone
setting 1021
times shell command 762
TMOUT environment variable
description of 627
TMP environment variable
used by exrecover 305
TMP_VI environment variable
used by exrecover 304
used by vi 857
TMPDIR environment variable
description of 627
used by ar 18
used by ed 286
used by exrecover 305
used by man 466
used by pg 558
used by sort 649
used by vi 857

token
description of 612
TOP function key for OMVS command 945
TOP subcommand of OMVS command 949
toplines environment variable
used by mailx 426, 435
topological sort 779
touch shell command 763
tperiod tcsh shell variable
description of 723
tput shell command 765
tr shell command 767
trace
removing from program 217
trace subcommand for dbx command 251
displaying 246
tracei subcommand for dbx command 252
tracing
activating 72
BPXTRACE TSO command 912
deactivating 72
BPXTRACE TSO command 912
turning on 252
tracing information
printing 251
tracked alias 614
creating a 347
transfers, UUCP
displaying status of pending 818
translate characters 767
trap
abnormal conditions and interrupts 770
signals
starting 214
stopping 225
trap shell command 770
true shell command 771
TSO function key for OMVS command 945
TSO MOUNT
file system recovery 922
tso shell command 772
TSO subcommand of OMVS command 949
TSO/3270 passthrough mode
returning to shell mode 941
TSO/E (Time Sharing Option Extensions)
command mode
invoking the 949
commands
ISHELL 912
MKDIR 914
MKNOD 915
MOUNT 916
OBROWSE 923
OCOPY 924
OEDIT 928
OGET 929
OGETX 933
OMVS 937
OPUT 949
OPUTX 952
TSO/E (Time Sharing Option Extensions) *(continued)*
commands *(continued)*
OSHELL 955
OSTEPLIB 956
UNMOUNT 957
entering commands from 909
giving users access to z/OS UNIX and shell 955
invoking BPXBATCH from the 955
returning to the 297
running
commands from the shell using the 772, 777
setting up function key to enter mode 945
TSOALLOC environment variable
used by tso 774
used by tsocmd 778
tsocmd shell command 777
tsoout environment variable
used by tso 774
TSOPREFIX environment variable
used by tso 774
TSOPROFILE environment variable
used by tso 774
used by tsocmd 778
tsort shell command 779
tty shell command 780
tty tcsh shell variable
description of 723
turn off
automatic scrolling 948
type shell command 781
typeset shell command 781
TZ environment variable
description of 627
setting time zones with 1021
used by at 27
used by cron 187
used by crontab 191
used by date 202
used by locale 399
used by ls 412
used by mail 415
used by pr 561
used by touch 764
used by uulog 814
used by uustat 820

U

uid tcsh shell variable
description of 723
ulimit shell command 785
umask shell command 786
unalias shell command 787
unalias subcommand for dbx command 252
uname shell command 789
uncompress
data 903
Huffman-coded files 554
uncompress shell command 790
undo change 284
unexpand shell command 791
unhide
data entered on the shell command line 948
OMVS command input area 943, 948
uniq shell command 794
unique lines 794
Universal Time Coordinated (UTC)
used by the TZ environment variable 1021
UNIX C shell 689
unlink shell command 797
unmount
a file system 798
TFS file systems 959
z/OS UNIX file system 912, 959
UNMOUNT 920
unmount shell command 798
UNMOUNT TSO/E command 957
unpack shell command 800
unprintable characters
displaying 123
unset
attributes of variables and functions 801
command options 595
positional parameters 595
values of variables and functions 801
unset shell command 801
unset subcommand for dbx command 253
until loop
exiting from, in a shell script 77
until shell subcommand 612
up subcommand for dbx command 253
update
data 944
uppercase
converting to lowercase 259
uppercase letters 1
uptime shell command 803
Usage Notes section
explanation of 6
use subcommand for dbx command 254
user
sending messages to a 867
setting up 912
talking to another user 680
user ID
changing to superuser 667
user ID (UID)
returning 404
setting to owner 143
user identity
finding 354
returning 354
user interface
ISPF 1043
TSO/E 1043
user name
displaying your 867
USER tcsh environment variable
description of 730
user tcsh shell variable
description of 723
users
displaying information about current 865

usrspooluucp spool 1015
usrspooluucpsouth 1015
usrspooluucpxq 824
usrspooluucpxq/usr/spool/uucp/ 824
UTC (Universal Time Coordinated)
used by the TZ environment variable 1021
utility
invoking, while ignoring the SIGHUP signal 505
parsing options 341
utmpx file format 1014
uucc shell command 803
uucico daemon 805
UUCP
configuration file
/usr/lib/uucp/config 806
reading contents of 803
copying files between systems 806
debug file
/usr/spool/uucp/LOGFILE 806
displaying
list of systems 815
status of transfers 818
events
displaying 814
lock file
/usr/spool/locks 806
searching public directories 816
spool directory (/usr/spool/uucp) 1015
status file
/usr/spool/uucp/.Status 806
transfers
displaying status of 818
starting or stopping 818
validating requests by the uucpd program 810
working files
command 1015
data 1015
execute 1015
UUCP file transfer daemon 805
uucp shell command 806
processing file transfer requests 805
uucpd daemon
handling of uucp requests 810
uudecode shell command 811
uuencode shell command 812
uulog shell command 814
uuname shell command 815
uupick shell command 816
uustat shell command 818
uuto shell command 821
uux shell command 823
processing file transfer requests 805
uuxqt daemon 826
uuxqt shell command
/usr/spool/uucp/.Xqtdir directory 824

V

value
defining, for dbx variables 240
displaying, for registers 238
variable
assigning
attributes and variables to 781
values to 212
attributes 782
bc command, for the 56
built-in, for the bc shell command 56
condition
displaying list of 215
deleting 253
description of 615
displaying
currently exported variables 300
list of 781
names of variables in procedures 221
values of variables in procedures 221
environment
displaying 290
listing their attributes 781
parameters used by shell 615, 715
printing tracing information 251
readonly
used by vi 829, 848
setting export attributes 300
unsetting values and attributes of 801
used in awk 37
variable records
converting to fixed records 258
variable to fixed-record conversion 258
VENDOR tcsh environment variable
description of 730
verbose tcsh shell variable
description of 723
version tcsh shell variable
description of 724
vi command
command mode 828
editor initialization 856
entering ex command mode 840
file recovery daemon for 304
fullword
definition of 834
insert mode 828
insert mode commands 840
set option variables 850
starting sessions in vi mode 828
word
definition of 834
vi file recovery daemon 304
vi mode
absolute movement commands 832
list of 832
context-dependent movement commands 834
current position pointer 829
display conventions 829
object manipulator commands 836
list of 837
scrolling commands 831, 832
starting session in 828
text insertion commands 838
vi shell command
creating tag files for the 194
visiblebell tcsh shell variable
description of 724
VISUAL environment variable
description of 627
used by mailx 426, 428
used by shedit 634
VISUAL tcsh environment variable
description of 730

W

wait
for child process to end 860
for jobs to end 860
wait shell command 860
wall shell command 861
watch tcsh shell variable
description of 725
wc shell command 862
whatis subcommand for dbx command 254
whence shell command 864
where subcommand for dbx command 255
whereis subcommand for the dbx command 256
which subcommand for the dbx command 257
while loop
exiting from, in a shell script 77
while shell subcommand 607, 612
who shell command 865
who tcsh shell variable
description of 725
whoami shell command 867
wildcard characters 622
within-rule circular dependency 446
word
counting 862
definition of, for vi 834
description of 612
wordchars tcsh shell variable
description of 725
words
misspelled
looking for 652
working directory
changing
to directory 125
to previous working directory 125
displaying path name of the 575
setting to value of the HOME environment variable 126
working files
format of UUCP 1015
WRAPDEBUG option of OMVS command 947
write
archive files 523, 682
arguments to standard output 277
configuration values to standard output 334
cpio archives 183
data 257
debugging information 940
formatted output 564

write *(continued)*
to other users 867
write mode 524
write shell command 867

X

xargs shell command 895
xlc 870
xlC 870
xlC shell command 895
xlc_64 870
xlC_64 870
xlc_x 870
xlC_x 870
xlc/xlC shell command
environment variables 872
specifying
system and operational information to xlc/xlC 872
xlc++ 870
xlc++ shell command 895
xlc++_64 870
xlc++_x 870
XPLINK
C/C++ programs 90
extra performance linkages 90
improved performance 90
xtrace 782

Y

y.output file
used by yacc 900
y.tab.c file
used by yacck 900
y.tab.h file
used by yacc 900
yacc compiler
using the 899
yacc shell command 899
YYDEBUG option 900

Z

z/OS C and z/OS C++ source files
using the c89 command to compile, assemble, and link-edit 79
z/OS shell
invoking the 937
z/OS UNIX file system 923
browsing files in the 923
copying
between two files 924
data sets into MVS data sets 929
directories to PDS or PDSE 933
files to PDS or PDSE 933
MVS data set members 949, 952
creating 912
mounting 912, 917
unmounting 912, 959
z/OS UNIX shell commands
changed for UNIX03 1039
z/OS UNIX System Services
giving TSO/E users access to 955
z/OS UNIX System Services *(continued)*
managing functions with the ISPF shell
with ISHELL 912
setting up functions with the ISPF shell
with ISHELL 912
zcat shell command 903
zlsof shell command 904
zlsof system REXX command 961
zlsof TSO command 960

Product Number: 5650-ZOS

Printed in USA

SA23-2280-01