IBM Workload Scheduler for z/OS

Managing the Workload

Version 9.3 SPE (Revised January 2019)

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Note
Before using this information and the product it supports, read the information in "Notices" on page 859.

This edition applies to version 9, release 3, modification level 0 of IBM Workload Scheduler for z/OS (program number 5698-T08) and to all subsequent releases and modifications until otherwise indicated in new editions.

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About this publication

IBM Workload Scheduler for z/OS Managing the Workload was created by combining what used to be two separate publications:

- *Planning and Scheduling the Workload*

  Describes organizing when your workload runs, and the dependencies between parts of the workload. The terms *planning* and *scheduling* are used interchangeably and describe these activities.
- *Controlling and Monitoring the Workload*

  Describes managing the workload when it becomes part of a plan and is run with real dates and times.

The term *scheduler*, when used in this publication, refers to IBM Workload Scheduler for z/OS. The term DB2®, when used in this publication, also includes references to DATABASE 2 and DB2 Universal Database™.

What is new in this release

For information about the new and changed functions in this release, see *Tivoli® Workload Automation: Overview*.

Who should read this publication

This publication is intended for those involved in planning, scheduling, monitoring, or managing the work in the production department of a computer installation. You do not need to know any programming languages to use this publication. However, you must know the work that you will automate using IBM Workload Scheduler for z/OS, how that work is broken down into jobs and what the dependencies between them are.

To make the most of IBM Workload Scheduler for z/OS, work together with the system programmer who installs and customizes IBM Workload Scheduler for z/OS. Work closely with the job preparation and operations staff that control the work with IBM Workload Scheduler for z/OS; their tasks will change considerably when IBM Workload Scheduler for z/OS controls your work, so consider their new tasks, which are described in *Managing the Workload*.

Accessibility

Accessibility features help users with a physical disability, such as restricted mobility or limited vision, to use software products successfully.

With this product, you can use assistive technologies to hear and navigate the interface. You can also use the keyboard instead of the mouse to operate all features of the graphical user interface.

For full information, see the Accessibility Appendix in the *IBM Workload Scheduler User's Guide and Reference*.

Technical training

Cloud & Smarter Infrastructure provides technical training.

For Cloud & Smarter Infrastructure technical training information, see: http://www.ibm.com/software/tivoli/education

Support information

IBM provides several ways for you to obtain support when you encounter a problem.

If you have a problem with your IBM software, you want to resolve it quickly. IBM provides the following ways for you to obtain the support you need:

- Searching knowledge bases: You can search across a large collection of known problems and workarounds, Technotes, and other information.
- Obtaining fixes: You can locate the latest fixes that are already available for your product.
- Contacting IBM Software Support: If you still cannot solve your problem, and you need to work with someone from IBM, you can use a variety of ways to contact IBM Software Support.

For more information about these three ways of resolving problems, see the appendix about support information in *IBM Workload Scheduler: Troubleshooting Guide*.

Conventions used in this publication

Conventions used in this publication.

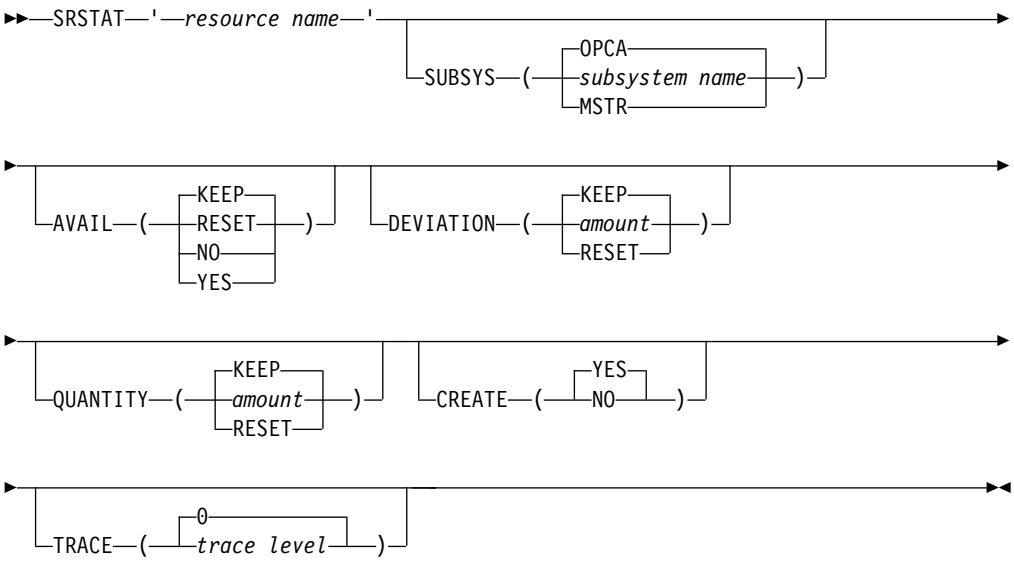
The publication uses several typeface conventions for special terms and actions. Technical changes to the text are indicated by a vertical line to the left of the change. These conventions have the following meanings:

Information type	Style convention	Example
Commands	All capital letters	CREATE
References in the text to fields on panels	All capital letters	QUANTITY
File and directory names, input you should type in panel fields	Monospace	`MYAPPLICATION`
First time new term introduced, publication titles	Italics	*Application*

How to read syntax diagrams

Syntax diagrams help to show syntax in a graphical way.

Throughout this publication, syntax is described in diagrams like the one shown here, which describes the SRSTAT TSO command:



The symbols have these meanings:

The statement begins here.

The statement is continued on the next line.

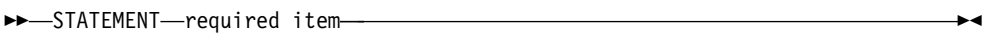
The statement is continued from a previous line.

The statement ends here.

Read the syntax diagrams from left to right and from top to bottom, following the path of the line.

These are the conventions used in the diagrams:

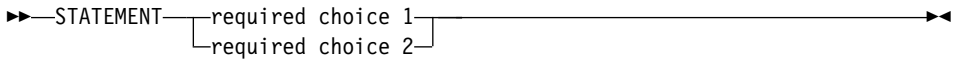
- Required items appear on the horizontal line (main path):



- Optional items appear below the main path:

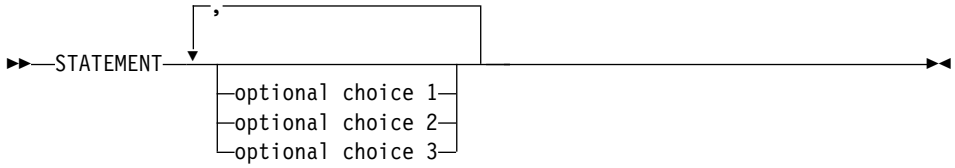
- An arrow returning to the left above the item indicates an item that you can repeat. If a separator is required between items, it is shown on the repeat arrow.

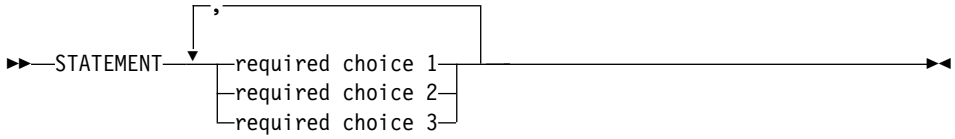
- If you can choose from two or more items, they appear vertically in a stack.
  - If you must choose one of the items, one item of the stack appears on the main path:



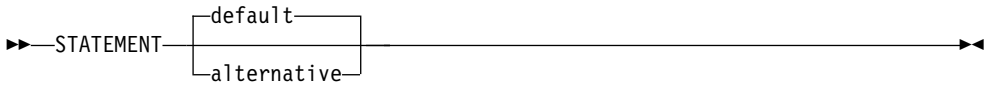
– If choosing one of the items is optional, the entire stack appears below the main path:

– A repeat arrow above a stack indicates that you can make more than one choice from the stacked items:

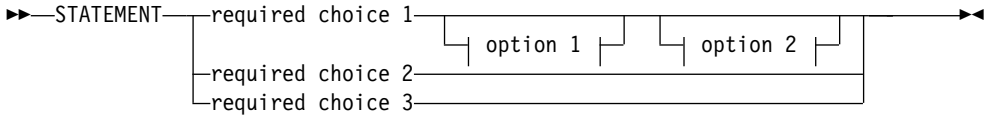




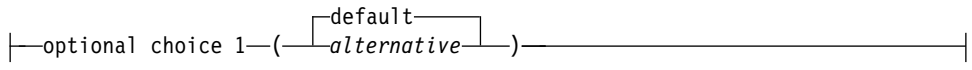
- Parameters that are above the main line are default parameters:



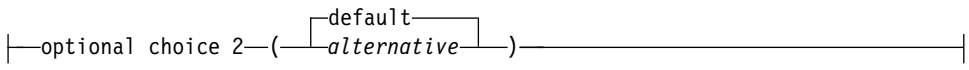
- Keywords appear in uppercase (for example, STATEMENT).
- Parentheses and commas must be entered as part of the command syntax, as shown.
- For complex commands, the item attributes might not fit on one horizontal line. If that line cannot be split, the attributes appear at the bottom of the syntax diagram:



option 1



option 2



Part 1. Planning and scheduling

Learn how to organize your workload while it runs, and the dependencies among its parts.

Chapter 1. What is the scheduler?

This chapter gives a description of IBM Workload Scheduler for z/OS and introduces its terminology. Read this chapter if you are new to IBM Workload Scheduler for z/OS.

One system in your complex is designated as the controlling system: it runs the *controller*. From this system, you can automatically plan, control, and monitor your entire production workload. All the systems in your complex must run the *tracker*. The tracker acts as the communication link between the system that it runs on and the controller.

How the scheduler works

If you do not have an automated planning system such as IBM Workload Scheduler for z/OS, you submit jobs on request, or according to run sheets. If they fail, you correct the error and resubmit them, perhaps after running recovery jobs. The jobs depend on many conditions, such as:

- Hardware, such as tape drives.
- Online systems, such as Customer Information Control System (CICS®). Often a system must be shut down before a batch job can run.
- Operating system resources, such as job entry subsystem (JES) initiators, that you need to run a job of the correct class.
- Other jobs. You cannot run the job to print pay slips until the payroll tax deduction program has completed successfully.
- Job parameters that you must change each run.
- The time of day.
- The day of the week or year. Some jobs must be run on Friday. There are sometimes complex rules that specify what you do when the normal day is a holiday.

When you run jobs and started tasks under IBM Workload Scheduler for z/OS, these dependencies are defined in IBM Workload Scheduler for z/OS databases by someone in your enterprise who is IBM Workload Scheduler for z/OS administrator. The administrator defines your workload to IBM Workload Scheduler for z/OS like this:

1. Creates one or more calendars with the holidays that you take.
2. Defines applications, which are sets of jobs and other steps such as job preparation and print processing. Applications can themselves be grouped into application groups.
3. Creates a long-term plan (LTP). This lists all occurrences of the applications that will run in a long period of typically a few months and the dependencies among them.
4. Creates a current plan (CP). This is a detailed plan, typically for one day, that lists the applications that will run and the operations in each application. An operation can be a computer job, but it can also be any other operation that you want to control with IBM Workload Scheduler for z/OS, such as printing and job preparation.

You work mostly with the current plan. It is created by a batch job, usually at a fixed time each day. The current plan is really a data set of IBM Workload Scheduler for z/OS, which is continually updated by events on the processors, but you can have a printed plan, which is a report that is produced when the current plan is created.

Strictly speaking, the current plan is created only once and the daily planning process is called *extending* the plan. Extension is a better term than creation, because the old current plan is also part of the new current plan. Look at the long-term plan in Figure 1.

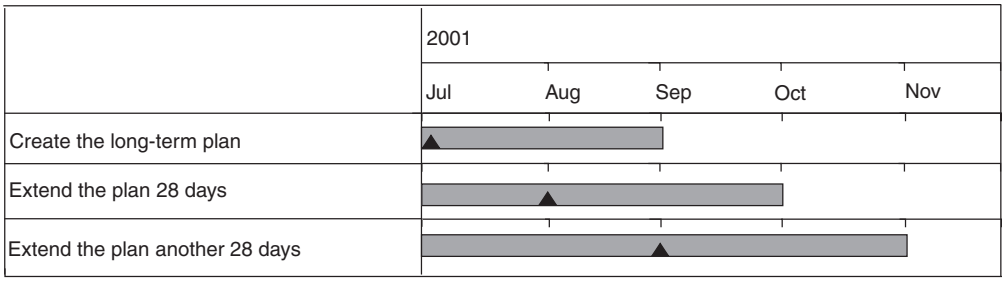


Figure 1. A rolling long-term plan

The current plan should always stretch for some hours or days into the future. Extend the current plan at regular intervals, using the EXTEND option of the DAILY PLANNING menu. You can extend the current plan to a fixed date and time, or you can extend it by a period of hours and minutes.

Figure 2 shows a 48-hour current plan. The initial current plan lasts 48 hours: every morning, the current plan is extended by a further 24 hours.

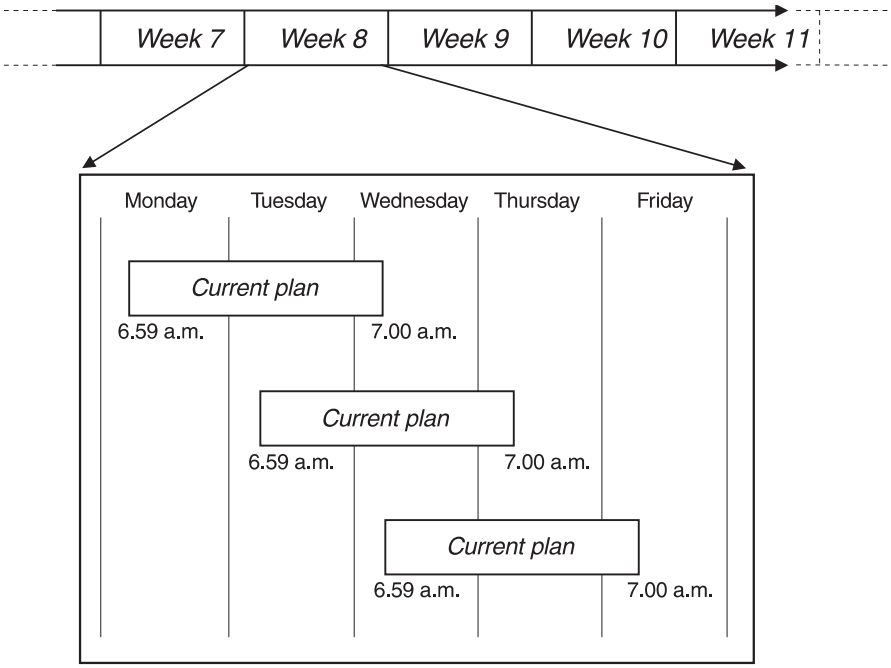


Figure 2. Extending the current plan

Input is taken from both the long-term plan and from the present current plan. The planning performed on Tuesday for the day's work considers the actual situation (both completed and outstanding work) as reflected in the current plan.

The extended current plan always keeps uncompleted application occurrences, but the current plan will usually be about 48 hours long, extended by 24 hours every 24 hours.

How does the Scheduler keep track of jobs?

The scheduler submits jobs to the operating system. The code supplied by the scheduler in the operating system (in the case of a z/OS® tracker, this code is in JES and System Management Facilities [SMF] exits) tells IBM Workload Scheduler for z/OS when the jobs have finished and also *how* they have finished (IBM Workload Scheduler for z/OS looks at abend and return codes and can also look for certain error messages in the job log that do not always give rise to nonzero return codes).

The scheduler calculates the latest time that a job can be started before it is in danger of missing its deadline. The scheduler continually adjusts its estimate of how long a job takes, taking the actual run times into account.

When a job or other operation is running late, IBM Workload Scheduler for z/OS can issue alerts. An alert can be a message to the operator console, but it can also trigger other events.

Can you define a dependency for the job?

When managing the workload in the plan, you can control job processing using dependencies. Dependencies can be of the following types:

Normal
It is a relationship between two jobs or between a job and an application stating that one job or application, named *successor*, can run only when the other job or application, named *predecessor*, is completed. Normal dependencies can be *internal* or *external*:

Internal dependency
The relationship links jobs belonging to the same application.

External dependency
The relationship links:

- Jobs belonging to different applications
- A job to an application
- An application to a job

For detailed information, see "Specifying dependencies" on page 175.

Conditional
It is a relationship between one job, named *conditional successor*, and one or more jobs or job steps, named *conditional predecessors*, stating that the conditional successor can run only when a specific combination of conditional predecessors status and return code values occurs.

For detailed information, see Chapter 22, "Conditioning the processing of operations," on page 421.

Cross It is a dependency of a local job from another job running in a different scheduling environment. It indicates that a local job cannot start until the remote job is completed. Cross dependencies helps you to integrate the

workload running on different engines. They can be both IBM Workload Scheduler for z/OS engines (controller) and IBM Workload Scheduler engines (master domain manager).

For detailed information, see Chapter 23, "Defining and managing cross dependencies," on page 451.

How does the scheduler help with job preparation?

The scheduler helps in two ways:

- Runtime variables can often be automatically substituted, even if they vary from run to run. Many such variables are related to the date, and IBM Workload Scheduler for z/OS can build a string in the format required by a program.
- When jobs need manual job preparation, the administrator specifies a job setup operation as a predecessor for the job operation. The scheduler does not submit the job until you have finished preparing the job statements.

  Do not edit and submit the job outside IBM Workload Scheduler for z/OS. Instead, use the READY LIST panel to edit the job: IBM Workload Scheduler for z/OS submits the job for you when you have prepared the job (and when other dependencies have been met).

How can the scheduler help you recover jobs?

The scheduler supports automatic recovery by having its own job statements that take effect when a job fails: these job statements look like comments to z/OS and JES.

For jobs tracked on a z/OS system, IBM Workload Scheduler for z/OS also notices when the catalog has been updated by a job and is able to undo the catalog updates (step by step, if required) to the point before the job ran, for all data sets allocated with job control language (JCL) DD statements. This facility is called restart and cleanup. For example, when a job creates a data set, a rerun often fails because the data set already exists. With cleanup active for the job, IBM Workload Scheduler for z/OS uncatalogs and deletes the data set before resubmitting the job.

Can the scheduler help with online systems?

An online system, such as a CICS system, is a job or started task, so it can be started like any other operation defined to IBM Workload Scheduler for z/OS.

Many batch applications cannot start until the online system shuts down. One advantage of defining an online system to IBM Workload Scheduler for z/OS is that a batch application can be made dependent on the online system and IBM Workload Scheduler for z/OS can start the batch application automatically (assuming other dependencies are met) when the online system ends.

The scheduler administrator can specify that IBM Workload Scheduler for z/OS issues a message when an operation deadline passes before the operation is complete. This is called a *DEADLINE WTO*. If a DEADLINE WTO is specified for the operation representing an online system on a z/OS system, IBM Workload Scheduler for z/OS sends a write-to-operator (WTO) message to the operator console when the online system must shut down. This message can trigger events in NetView®, such as the broadcasting of a "Closing in 5 minutes" message to online users and the initiation of the shutdown transaction 5 minutes later.

Can you run jobs outside the scheduler?

Jobs fall into four categories:

1. Jobs that are in the current plan and are submitted by IBM Workload Scheduler for z/OS.

   These are scheduled jobs, or jobs that you have added to the current plan using the MODIFY CURRENT PLAN (MCP) panel.
2. Jobs that are in the current plan, but are not submitted by IBM Workload Scheduler for z/OS.

   These are usually jobs that are generated and submitted by some other subsystem, such as CICS. The scheduler can track these jobs and take account of the resources that they use. It is also possible for other subsystems to submit held jobs and for IBM Workload Scheduler for z/OS to release them when all dependencies are met.
3. Jobs that are not submitted by IBM Workload Scheduler for z/OS, but trigger events in IBM Workload Scheduler for z/OS.

   These jobs are specified with event-triggered tracking (ETT). Refer to "Adding occurrences by event-triggered tracking" on page 478 for more details.
4. Jobs that are completely ignored by IBM Workload Scheduler for z/OS controller.

One disadvantage of having jobs outside IBM Workload Scheduler for z/OS (categories 3 and 4) is that IBM Workload Scheduler for z/OS cannot take account of the resources that they use. The scheduler can schedule and control its jobs to avoid contention for resources (such as tapes, data sets, and JES initiators), but if other jobs use these resources, IBM Workload Scheduler for z/OS might submit its jobs when a resource is unavailable.

Finding out about the scheduler

If you are new to IBM Workload Scheduler for z/OS, the number of pages in its library can be daunting, but you do not need to read it all. Start with this book, using the index and the table of contents to find help for the task that you have to do.

Do

- Read the reports that are produced when the current plan is extended.
- Use the panels, especially the panels mentioned in this book (READY LIST, QUERY CURRENT PLAN, and MODIFY CURRENT PLAN), to find out more about IBM Workload Scheduler for z/OS and your application and workstation definitions.
- Press PF1 for help in the panels when you need additional information.
- Suggest improvements to your administrator if jobs do not run smoothly or if you very often have to make changes through the panels.
- Tell the administrator about any tasks that you often do and you think could be automated by IBM Workload Scheduler for z/OS.
- Use *Getting Started* for a quick introduction to IBM Workload Scheduler for z/OS.

Do not

- Run IBM Workload Scheduler for z/OS-controlled jobs (or their associated job preparation tasks) outside IBM Workload Scheduler for z/OS, except where this is planned.
- Attempt to get work going by changing the status of jobs or by using the EXECUTE command. If a job is not being submitted, there must be a reason: use

IBM Workload Scheduler for z/OS panels to find the reason and resolve the dependency. Changing the status of an operation and using the EXECUTE command are for exceptional occasions.

Chapter 2. A user scenario

This scenario introduces you to IBM Workload Scheduler for z/OS by describing the steps that you would take to run a payroll system under the control of IBM Workload Scheduler for z/OS.

If you are the scheduling administrator, responsible for automating applications that are run manually, you must:

1. Design the automation of the work.

   Your work is more than a collection of jobs: you have people who know how to edit JCL and when to run jobs, documentation that describes your jobs and procedures, and people on call who decide what action to take when jobs fail at night.

   Successful design takes into account all procedures, including manual processes. IBM Workload Scheduler for z/OS can reduce manual work and can handle the exceptions as well as the routine.
2. Specify your data processing environment to IBM Workload Scheduler for z/OS.
3. Create your calendar and any necessary periods. Periods are special units of time such as semesters and tax years.
4. Specify the jobs and started tasks. In this step you must specify:
   a. How jobs are grouped
   b. When jobs will run, using the calendar and periods created earlier
   c. Which jobs they depend on
   d. Which resources they need, such as data sets, tape drives, and initiators
   e. How the JCL is processed before each job is submitted
   f. Which actions IBM Workload Scheduler for z/OS must take if any job fails.
5. Build the high-level schedule, which is called the long-term plan (LTP). The long-term plan typically lasts a few months, and is extended once a week.
6. Build the low-level schedule, which is called the current plan (CP). The CP typically lasts one day, and is extended a few hours before it expires.

When you finish this scenario, you should understand the main building blocks of IBM Workload Scheduler for z/OS and how they fit together.

You can work through the scenario using your IBM Workload Scheduler for z/OS system. By performing the steps in the scenario, you cannot corrupt any programs, though you might want to re-create your databases before you specify your own systems.

Implementing a payroll system

To help you understand IBM Workload Scheduler for z/OS and plan the definition of your systems to IBM Workload Scheduler for z/OS, this book bases its examples on a fictional corporation, Paymore Incorporated, that has a system running z/OS, and is converting its applications to run under the control of IBM Workload Scheduler for z/OS. It first converts the payroll system.

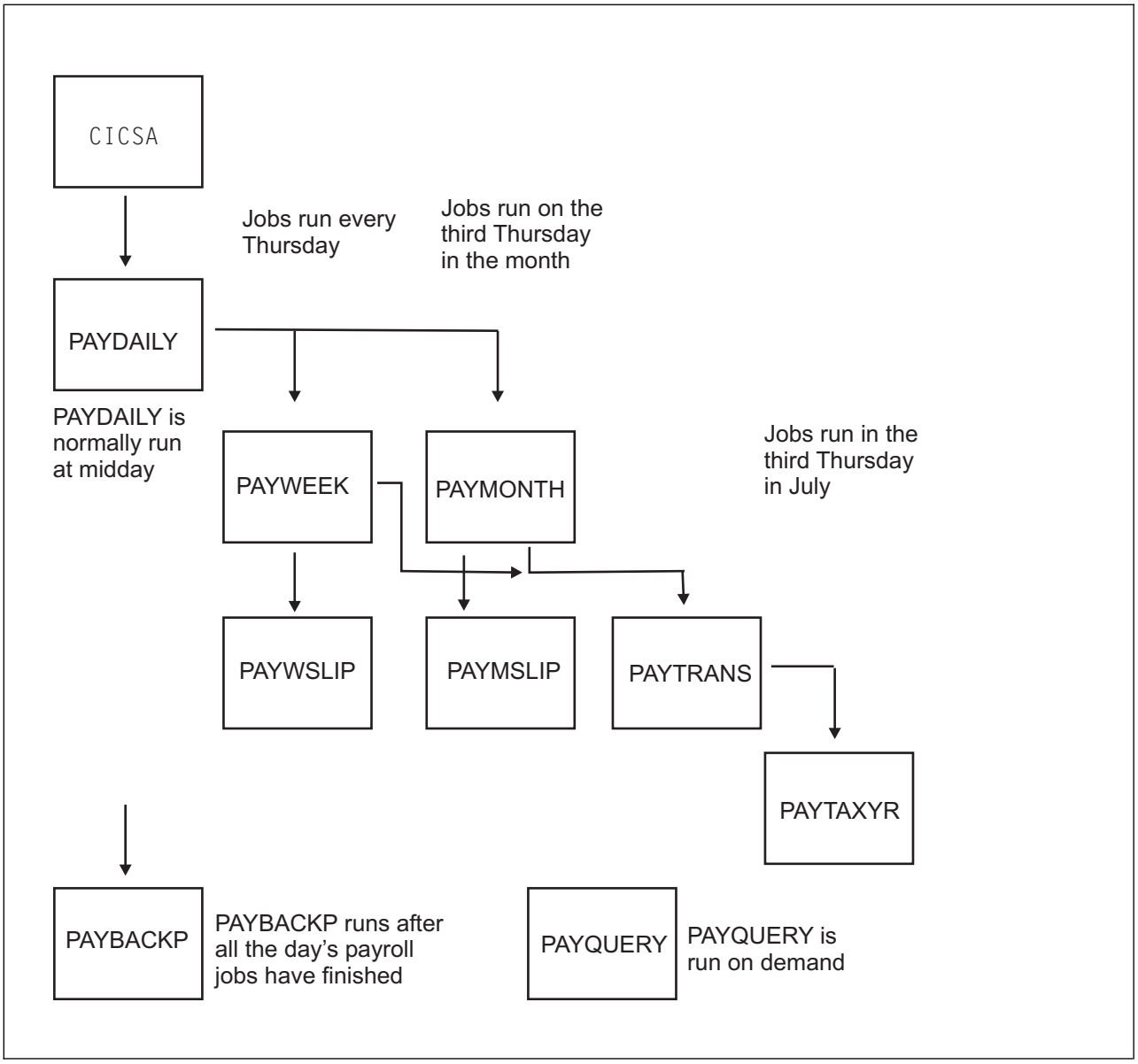


Figure 3. Example of payroll jobs at paymore incorporated

The payroll analyst describes the process for the IBM Workload Scheduler for z/OS scheduler:

1. CICSA runs 24 hours a day, but the payroll transactions are closed before PAYDAILY is started.
2. On each working day, payroll clerks enter information about hours worked, new employees, and so on, into a CICS system, CICSA.
3. Payroll closes the CICSA payroll data set and asks the job preparation team to schedule the daily PAYDAILY job.
4. The weekly job is PAYWEEK, which runs every Thursday or on the closest work day before Thursday if Thursday is a holiday. The weekly job must run after the daily PAYDAILY job.

   PAYWEEK calculates deductions, such as tax and insurance, and updates the bank-transfer data set. This is for people who choose to be paid by monthly bank transfer into their bank accounts. This job must run before the monthly bank-transfer job PAYTRANS, which runs on the third Thursday in the month.

5. When PAYWEEK completes successfully, the job PAYWSLIP runs to print pay slips. It includes these programs:
   a. PAY14 writes pay slips to a data set, and creates a management report.
   b. PAY15 prints the pay slips.
6. After the weekly payroll jobs:
   a. Job Preparation decollates the pay slips.
   b. Payroll checks the pay slips.
   c. The cash office takes the pay slips and prepares pay packets. This depends on the delivery of cash by security van.
7. Monthly jobs, including PAYTRANS, have similar gross-to-net and print programs for monthly-paid employees. These jobs run on the third Thursday of each month, after the weekly payroll run. But if Thursday is a holiday, they run the day before.
8. After the payroll run for the day, the job preparation team runs the backup job PAYBACKP and reopens the CICSA data set.
9. If updates fail, the PAYRECOV job is run before the update job is rerun.

This is a short description of the flow of jobs. When you design the automation of a system such as this, include manual work in the analysis, and the recovery procedure for each job. The operator might have recovery instructions for PAYDAILY like "Page the on-call payroll analyst." The reason for such instructions is that the recovery process is too complex to automate using standard JCL facilities. When you install IBM Workload Scheduler for z/OS, there is a good chance that you can automate recovery, so consider all procedures, even manual ones. One of the benefits of implementing IBM Workload Scheduler for z/OS is that analysts have to document procedures, and there is less risk that the vital person is on holiday, or left the corporation six months earlier, when something goes wrong.

Designing the payroll applications

Table 1 on page 12 shows how the payroll jobs can be grouped to run under IBM Workload Scheduler for z/OS. Here are other problems to solve:

How do you get PAYDAILY to run after the CICSA data set is closed?

Paymore runs CICS 24 hours a day. It shuts down only for essential maintenance. So PAYDAILY cannot be made dependent on the CICSA started task. Instead, it must be triggered by the CICS transaction that closes the payroll data set in CICSA. There are many ways to do this. Here are some examples:

1. Give PAYDAILY exclusive access to a special resource representing the payroll data set. Include code supplied by IBM Workload Scheduler for z/OS in your IEFU83 SMF exit to generate a special resource event when the data set is closed, allowing PAYDAILY to start. Refer to *Customization and Tuning* for information on data set triggering.
2. Give PAYDAILY exclusive access to a special resource as before. The CICS transaction can call the EQQUSIN subroutine, which can generate a special resource event. Refer to *Customization and Tuning* for information on the EQQUSIN subroutine. This is the solution adopted in this example.
3. Trigger the CICS transaction with a WTO operation, but use an automatic reporting WTO general workstation (see "Specifying workstation reporting attributes" on page 60) so that the WTO does not complete automatically. The CICS transaction sets the WTO operation

to status C (Complete) with the EQQUSIN subroutine. This solution is not used, because the special resource is needed for other reasons.

How do you automate the running of the CICS transaction?
Use IBM Workload Scheduler for z/OS to schedule PAYDAILY at a fixed time each day. The first operation in the PAYDAILY application is a write-to-operator (WTO) operation. NetView can intercept the operation and issue the CICS transaction that closes the data set.

How do you force the weekly and monthly jobs to run after the daily job?
Make PAYWEEK and PAYMONTH dependent on PAYDAILY.

How do you make the backup run after all the payroll jobs?
Make PAYBACKP dependent on all the payroll jobs. On days where no weekly or monthly job is scheduled, that dependency does not take effect, so PAYBACKP will run after PAYDAILY.

How do you automate the reopening of the CICSA data set?
Include a final WTO operation in PAYBACKP that triggers, via NetView, a CICS transaction that reopens the payroll data set in CICS.

How do you handle job recovery?
Consider the different error conditions that must be handled, such as:

- B37 abends arising from a lack of space.
- Invalid data; for example, hours-worked data for an employee who has left the company. There can be no automatic recovery for this error, but Paymore avoids the most common errors by validating each transaction against the database when the payroll clerks enter them into the CICS system.

You can include operator instructions for each operation in the IBM Workload Scheduler for z/OS OI database in the event that operators have to take manual action.

How do you stop PAYQUERY running alongside a scheduled job?
PAYQUERY is run on request. In IBM Workload Scheduler for z/OS terms, this means that an occurrence of the PAYQUERY application is added to the schedule, or current plan, by an operator using the MODIFY CURRENT PLAN panel. To stop PAYQUERY accidentally running beside a payroll job, create a resource that represents the payroll database. All payroll jobs that update the database are given exclusive control of the resource. If the resource is unavailable, IBM Workload Scheduler for z/OS waits until the allocating operation has freed it.

Table 1. Grouping of payroll applications

Groups	Applications	Operation names	Workstations	Operation numbers	Programs
	CICSA	CICSA	STC1	010	
	PAYDAILY	PAYDAILY PAYDAILY PAYDAILY	WTO1 SETP CPU1	005 010 020	PAY04 PAY06
GPAYW	PAYW	PAYWEEK PAYWSLIP PAYWSLIP PAYWSLIP	CPU1 CPU1 PRT1 PAY1	020 030 090 095	PAY07 PAY10 PAY16 PAY14 PAY15

Table 1. Grouping of payroll applications (continued)

Groups	Applications	Operation names	Workstations	Operation numbers	Programs
GPAYM	PAYM1 PAYM2	PAYMONTH PAYMSLIP PAYMSLIP PAYTRANS	CPU1 CPU1 PRT1 CPU1	040 050 099 040	PAYM07 PAYM10 PAYM16 PAYM14 PAYM15 PAYGIRO
	PAYTAXYR	PAYTAXYR	CPU1	015	PAYY10
	PAYQUERY	PAYQUERY	CPU1	050	PAYQ1
	PAYBACKP	PAYBACKP PAYBACKP	CPU1 WTO1	015 030	IDCAMS
	PAYRECOV	PAYRECOV	CPU1	015	IDCAMS

Creating workstations

Specify your environment to IBM Workload Scheduler for z/OS in terms of workstations and resources. A workstation is not necessarily hardware. It is a stage in the processing that is controlled by IBM Workload Scheduler for z/OS. The processor complex that runs your controller is a computer workstation, and you will probably create two workstations for it, because there must be separate workstations for jobs and for started tasks.

The job preparation team submits jobs, often adding runtime parameters on request. Often a runtime parameter is just the day's date. The program cannot simply get the date from the time-of-day clock because sometimes the date must be when the group of jobs starts, which must not change, even if the jobs continue to run past midnight. At other times, the date appears on the pay slips, and must be Friday's date, regardless of the date when the jobs run. In these cases, IBM Workload Scheduler for z/OS is usually able to automatically substitute the correct date in the jobs. Where manual intervention is unavoidable, IBM Workload Scheduler for z/OS can control when the job is available for variable substitution and submission. IBM Workload Scheduler for z/OS can also keep track of what stage the job is at. You specify manual job preparation work as a workstation.

Another type of workstation is a printer workstation. IBM Workload Scheduler for z/OS is notified when a print output group has finished printing. This way IBM Workload Scheduler for z/OS can keep track of the status of important print operations and the time they take. You do not have to specify a print operation for every job that prints something. Only specify a print operation when you want to track it.

If there is a manual process that you want to track, specify it as a general workstation. Such workstations do not, of course, have JES and SMF exits to tell IBM Workload Scheduler for z/OS what is going on, but you can have a terminal where the operator changes the IBM Workload Scheduler for z/OS status of an operation through the ISPF panel. If the status of an operation can be detected by VTAM®, NetView, or by one of your own programs, you can get the program to inform IBM Workload Scheduler for z/OS of the new status, and IBM Workload Scheduler for z/OS then starts the dependent operations.

Returning to Paymore, how many workstations do you create, and how do you create them? You need a:

- Computer workstation for jobs
- Computer workstation for started tasks, if CICSA is a started task and you want it to run under IBM Workload Scheduler for z/OS
- General workstation for job preparation
- Printer workstation
- General workstation for the payroll office, if you need to keep track of manual operations there, such as the collation of pay slips and preparation of pay packets

See Chapter 4, "Creating workstations," on page 47 for a full description of workstations. This section shows how you might create them for Paymore.

Select option 2 from the MAINTAINING WORKSTATION DESCRIPTIONS menu, (or option `1.1.2` from the main menu) to list workstations. The command `CREATE` displays the panel shown in Figure 4.

```
EQQWCGEP ----- CREATING GENERAL INFORMATION ABOUT A WORK STATION --------------
Command ===>
Enter the command R for resources or A for availability or O for end-to-end
options or D for Destinations above, or enter data below:

WORK STATION NAME   ===> CPU1
DESCRIPTION         ===> Local system processing_________
WORK STATION TYPE   ===> C         G  General, C  Computer, P  Printer
                                   R  Remote Engine
REPORTING ATTR      ===> A         A  Automatic, S  Manual start and completion
                                   C  Completion only, N  Non reporting
PRINTOUT ROUTING    ===> SYSPRINT  The ddname of daily plan printout data set
SERVER USAGE        ===> B         Parallel server usage, C, P, B or N
DESTINATION        ===> ________   Name of destination
Options: allowed Y or N
 SPLITTABLE         ===> N         JOB SETUP             ===> N
 STARTED TASK, STC  ===> N         WTO                   ===> N
 AUTOMATION         ===> N         FAULT-TOLERANT AGENT  ===> N
 WAIT               ===> N         Z-CENTRIC AGENT       ===> N
 VIRTUAL            ===> N         DYNAMIC               ===> N
REMOTE ENGINE TYPE  ===>           z z/OS or D Distributed

Defaults:
  TRANSPORT TIME    ===> 00.00     Time from previous workstation  HH.MM
  DURATION          ===> 00.05.00  Duration for a normal operation  HH.MM.SS
```

Figure 4. EQQWCGEP - Creating general information about a workstation

Figure 4 is one of several ISPF panels that you need to create a workstation. Use the `A` command to specify when the workstation is available.

Use the `R` command to specify workstation fixed resources, called R1 and R2. Although these fixed resources are less useful, because you can do more with special resources (see Chapter 5, "Creating special resources," on page 75). So the Paymore application does not use any workstation fixed resources.

Table 1 on page 12 shows values that you might specify for the workstations. If you have a general workstation to track manual operations in the payroll office, PAY1, create it like the job setup workstation SETP, but with JOB SETUP = N.

Controlling general workstations

You control general workstations such as SETP and PAY1 using the READY LIST panel, which you access using option 4 (WORK STATIONS) from the main menu.

Using the READY LIST panel, the job preparation team can see what operations are waiting for setup, initiate setup by setting *next status*, and complete the setup operation when they finish editing the JCL. The process is similar for other manual operations.

A general workstation is not a location or a device, but rather a logical stage in processing that you normally control with an ISPF session (although you could use a command or program interface to set the status of general workstations).

Using servers

For each workstation, you specify *parallel servers* on the availability panels. The number of parallel servers defined on a computer workstation represents the maximum number of operations that can be started at the same time. If CPU1 has 15 servers, IBM Workload Scheduler for z/OS counts how many are being used, and starts as many operations as the number of unused servers at that moment allows. On computer workstations defined with server usage C or B, the number of parallel servers defined must be at least 1 or no operations will be started. The maximum number of parallel servers that can be defined for a workstation is 65535.

For other types of workstation, you normally specify usage P (planning only) for parallel servers, because you do not want IBM Workload Scheduler for z/OS to refuse to start a setup operation, for example, if an operator requests it. If an operator wants to set up a job, the server (operator) must be available! IBM Workload Scheduler for z/OS still uses the count of servers on setup workstations, but only for planning, when it works out in advance whether there could be a backlog of setup operations.

If you do not need to use servers, specify N (neither) for the server usage.

Table 2. Creating workstations for paymore

Field name	Job setup workstation	Computer workstation	Printer workstation	WTO workstation
These fields are in the CREATING GENERAL INFORMATION ABOUT A WORKSTATION panel (Figure 4 on page 14):				
WORK STATION NAME	SETP	CPU1	PRT1	WTO1
DESCRIPTION	Used to prepare JCL	Main JES processor	Printer pool	Messages for NetView
WORK STATION TYPE	G (general)	C (computer)	P (printer)	G (general)
REPORTING ATTR	S (manual start and completion)	A (automatic)	A (automatic)	C (completion only)
FT WORK STATION	N (no)	N (no)	N (no)	N (no)
PRINTOUT ROUTING	SYSPRINT	SYSPRINT	SYSPRINT	SYSPRINT
SERVER USAGE	P (planning only)	B (both planning and control)	P (planning only)	N (neither)
SPLITTABLE	Y (yes)	N (no)	Y (yes)	N (no)
JOB SETUP	Y (yes)	N (no)	N (no)	N (no)
STARTED TASK, STC	N (no)	N (no)	N (no)	N (no)
WTO	N (no)	N (no)	N (no)	Y (yes)

Table 2. Creating workstations for paymore (continued)

Field name	Job setup workstation	Computer workstation	Printer workstation	WTO workstation
WAIT	N (no)	N (no)	N (no)	N (no)
DESTINATION	Blank (IBM Workload Scheduler for z/OS controlling processor)	Blank (IBM Workload Scheduler for z/OS controlling processor)	Blank (IBM Workload Scheduler for z/OS controlling processor)	Blank (IBM Workload Scheduler for z/OS controlling processor)
TRANSPORT TIME	00.00 (0 minutes)	00.00 (0 minutes)	00.00 (0 minutes)	00.00 (0 minutes)
DURATION	00.05.00 (5 minutes)	00.05.00 (5 minutes)	00.30.00 (30 minutes)	00.01.00 (1 minute)
These fields are in the AVAILABILITY OF A WORK STATION panel (Figure 40 on page 70):				
Days with STANDARD availability	M-F	All	All	All
Days with other availability	Saturday	—	—	—
Closed days	Sunday	—	—	—
These fields are in the ALL OPEN TIME INTERVALS panel (Figure 42 on page 71):				
Number of parallel servers	5 (clerks)	15 (initiators)	2 (printers)	99 (not used)

Creating special resources

About this task

The payroll system has several jobs that update the payroll database, and these cannot run together. If you submit them together, z/OS forces one job to wait because of the DISP=OLD disposition for the database (or similar mechanism for VSAM). Letting jobs compete and be locked out in this way ties up z/OS resources, such as initiators, and can result in deadlock.

One way of forcing serialization is to make one job a predecessor of the other, but often it is unimportant which job runs first: the important thing is that they do not run together.

The best way of doing this is to create a *special resource*, which in this case is the database. See Chapter 5, "Creating special resources," on page 75 for a full description of special resources. Create a resource to control the payroll database by following these steps:

1. Select option 6 from the MAINTAINING IWSz DATABASES menu (Figure 45 on page 83).
2. Select option 3 (LIST) on the MAINTAINING SPECIAL RESOURCES menu (Figure 46 on page 83). You can select option 2 (CREATE) instead, but option 3 gives you a chance to see the resources already created.

   When you select 3 (LIST), the SPECIFYING SPECIAL RESOURCE LIST CRITERIA panel is displayed, enabling you to filter the resources shown in the list. Enter an * (asterisk) in the SPECIAL RESOURCE and SPECRES GROUP ID fields to list all resources.

3. On the LIST OF SPECIAL RESOURCES panel, enter the CREATE command. The CREATING A SPECIAL RESOURCE panel is shown (Figure 5):

```
EQQQDCRP ---------------- CREATING A SPECIAL RESOURCE -------------------
Option ===>

Select one of the following:

1 INTERVALS  - Specify intervals
2 WS         - Modify default connected work stations

SPECIAL RESOURCE   ===> PAYROLL.DATABASE_____________________________
TEXT               ===> serializes access to the Paymore database________
SPECRES GROUP ID   ===> SAMPLE__
Hiperbatch         ===> N       DLF object Y or N
USED FOR           ===> B       Planning and control C , P , B or N
ON ERROR           ===> K_      On error action F , FS , FX , K or blank
ON COMPLETE        ===> _       On complete action Y, N, R or blank
MAX USAGE LIMIT    ===> 0       Max number of allocation before usage reset
MAX USAGE TYPE     ===> R       Status change type Y, N or R



Defaults
  QUANTITY         ===> 1_____  Number available 1-999999
  AVAILABLE        ===> Y       Available Y or N
```

Figure 5. Specifying the payroll database as a resource

4. Type the values shown. Note especially these values:

   SPECIAL RESOURCE
   This name must be exactly the same in all the application descriptions that use the database.

   USED FOR
   Type B, because you want IBM Workload Scheduler for z/OS to take account of resource availability when creating plans (planning), and to check resource status before starting an operation (control).

   ON ERROR
   Type K, because the jobs are to keep the resource allocation even if they fail. This is so that there is no risk of another job taking the database before the operator (or automatic recovery) handles the error.

   QUANTITY and AVAILABLE
   This is the default for all time intervals. For this resource, you do not need to specify intervals, so these values always apply, unless altered dynamically; for example, by the EQQUSIN subroutine or the SRSTAT TSO command.

5. Press PF3 (End) to save the resource definition.

For some resources, such as those representing tapes or communication lines, you would normally specify intervals, and, for each interval, the quantity, availability, and connected workstations.

For PAYROLL.DATABASE, the defaults are for all times, and the resource is accessible from all workstations.

Creating the default calendar

About this task

Paymore does not run its jobs at weekends or on national holidays. Specify the national holidays by creating the default calendar, which is a calendar with an ID of DEFAULT.

Create the default calendar like this:

1. Select option 1.2.2 from the main menu.
2. On the MODIFYING CALENDARS panel, enter the CREATE command. The CREATING A CALENDAR panel is shown, (Figure 6).

```
EQQTCCAL -------------------- CREATING A CALENDAR ---------- ROW 1 TO 20 OF 35
Command ===>                                                 Scroll ===> CSR

Enter/change data below and in the rows,
and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete

CALENDAR ID        ===> DEFAULT______
DESCRIPTION        ===> default calendar_____
WORK DAY END TIME  ===> 06.00

Row  Weekday or     Comments                        Status
cmd  date YY/MM/DD
'' MONDAY________ _____________________________    W
'' TUESDAY_______ _____________________________    W
'' WEDNESDAY_____ _____________________________    W
'' THURSDAY______ _____________________________    W
'' FRIDAY________ _____________________________    W
'' SATURDAY______ _____________________________    F
'' SUNDAY________ _____________________________    F
'' 03/12/25______ Christmas Day__________________  F
'' 03/03/28______ Good Friday____________________  F
```

Figure 6. Changing the default calendar

3. Enter `W` for the status of the days of the week that are work days, and `F` for the weekends and holidays. When work would otherwise be planned on a free (F) day, IBM Workload Scheduler for z/OS plans the work according to the free-day rule on each application run cycle. See “Selecting a free-day rule” on page 139 for detailed information about the free-day rule.

   The status specified for a particular date overrides the specification for the corresponding day of the week.
4. Specify the *workday end time*, which is the time that IBM Workload Scheduler for z/OS considers the day to end for planning purposes. Paymore's night shift, for example, goes home at 06.00, and work is run until 06.00 on holidays.

Remember to maintain your calendar once a year. Make full use of the calendar by using IBM Workload Scheduler for z/OS to schedule other things than batch jobs and started tasks. Why not use it to initiate events in NetView?

Preparing the payroll jobs

About this task

Consider these problems:

1. The PAYWEEK job can process data from many departments. Each department produces its own transaction data set, which must be concatenated with the head office data set, which is always present.

2. The PAYWEEK job uses the date of the Friday of the week in which the job is run. The job is usually run on Thursday, but if Thursday is a holiday, the job runs on the previous work day.

Both problems can be solved using variable substitution. Follow these steps:

1. Use the JCL VARIABLE TABLE panel (1.9.2 from the main menu) to create a variable table called PAY.
2. Specify a variable DEPT, as shown in Figure 7.

```
EQQJVVML -------------- MODIFYING VARIABLES IN A TABLE ------  ROW 1 TO 1 OF 1
Command ===>                                                  Scroll ===> PAGE

Enter/change data in the rows below,
and/or enter any of the row commands below
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete, S - Select
variable details.

Variable table       : PAY
OWNER ID          ===> SAMPLE_________
TABLE DESCRIPTION ===> paymore applications____

Row Variable Subst.   Setup  Val  Default
cmd Name     Exit            req  Value
'' DEPT____ ________ N      N__  N_____________________________________
****************************** BOTTOM OF DATA ******************************
```

Figure 7. Creating a variable

3. Code the JCL for PAYWEEK like this:

```
//PAYWEEK  JOB  ...
//*%OPC SCAN     1
//*       PAYMORE PAYROLL SAMPLE -- PAYWEEK
//*       THIS JOB RUNS PAY07, PAY10, AND PAY16
//*%OPC SETFORM OCDATE=(MM/DD/CCYY)              2
//*%OPC BEGIN ACTION=INCLUDE,COMP=(&ODAY..EQ.1)  3
//*%OPC SETVAR TFRIDAY=(OCDATE+4CD)              4
//*%OPC END   ACTION=INCLUDE
:
//*%OPC BEGIN ACTION=INCLUDE,COMP=(&ODAY..EQ.7)
//*%OPC SETVAR TFRIDAY=(OCDATE-2CD)
//*%OPC END   ACTION=INCLUDE
//PAY07    EXEC PGM=PAY07,PARM='&TFRIDAY.'          5
//STEPLIB  DD DSN=XRAYNER.OPC.LOADLIB,DISP=SHR
//PAYFILE  DD DSN=XRAYNER.HEAD.PAYTRANS,DISP=SHR
//*%OPC BEGIN PHASE=SUBMIT,ACTION=INCLUDE,COMP=(&DEPT..NE.N)  6
//         DD DSN=XRAYNER.&DEPT..PAYTRANS,DISP=SHR   7
//*%OPC END ACTION=INCLUDE                    8
//PAYDB    DD DSN=XRAYNER.PAYROLL.DATABASE,DISP=SHR
//SYSPRINT DD SYSOUT=*
```

This is an explanation of the marked lines:

1 is a statement that tells IBM Workload Scheduler for z/OS to perform variable substitution on the following lines. You need this unless you have VARSUB set to YES on the OPCOPTS initialization statement.

2 tells IBM Workload Scheduler for z/OS to use the format MM/DD/CCYY for OCDATE. If the input arrival date is 16 March 2003, for example, IBM Workload Scheduler for z/OS substitutes 03/16/2003 for &OCDATE.

3 tests the day of the week. If the input arrival day is Monday (ODAY=1), it includes a SETVAR statement **4** to add 4 calendar days, giving Friday's date.

This is repeated for the other days of the week. OCDATE and ODAY do not have to be in your variable table because they are predefined by IBM Workload Scheduler for z/OS.

5 passes Friday's date to the PAY07 program.

6 tests whether the variable DEPT has its default value N, and if not, it adds the extra line of JCL **7**, which is the extra data set for another department.

8 marks the end of the lines to be included.

4. Put the JCL into the partitioned data set that is allocated to the ddname EQQJBLIB. IBM Workload Scheduler for z/OS never updates this JCL. It always makes a copy and stores the modified copy in the job repository (a group of VSAM clusters used cyclically with DD names in the format EQQJSnDS). IBM Workload Scheduler for z/OS takes a fresh copy of the JCL from EQQJBLIB for each occurrence, but once the JCL is changed, the changed copy in the job repository is used.

IBM Workload Scheduler for z/OS changes JCL:

- When you set up the JCL for an operation. You use the READY LIST to perform setup and complete the operation on the job setup workstation.
- On request from the MODIFY CURRENT PLAN (MCP) panel. This is independent of the job setup operation. If you change the JCL for an occurrence, IBM Workload Scheduler for z/OS puts your edited job in the repository, where it will be picked up by any subsequent setup operation using the Ready list.
- On request from the LONG-TERM PLAN panel. This is how you change the JCL for an individual occurrence that is not yet in the current plan, without affecting the JCL for other occurrences of the job.
- When a job or started task completes successfully. IBM Workload Scheduler for z/OS removes the JCL for the previous occurrence from the job repository.
- When you specify automatic recovery. IBM Workload Scheduler for z/OS checks the JCL for IBM Workload Scheduler for z/OS recovery statements. If there are recovery statements, IBM Workload Scheduler for z/OS changes the JCL and stores it in the job repository.

See Chapter 25, “Job tailoring,” on page 487 for more details of variable substitution.

Note: PAYWEEK is a z/OS job, but you can use variable substitution for jobs that run on other operating systems. The syntax of the directives is the same. Job setup and variable substitution is always performed on the z/OS system that runs the controller, and the prepared job is then passed to the system where it will run.

Creating the groups, applications, and operations

About this task

There are two ways to create applications: using the ISPF panels and using the batch loader program. See Chapter 9, “Defining applications in batch,” on page 203 for a description of the batch loader program and a list of the control statements necessary to specify the Paymore system using the batch loader.

This section shows you the steps involved in creating the Paymore applications using the IBM Workload Scheduler for z/OS panels. You can create all applications and groups by using the APPLICATION DESCRIPTION panel, but simple

applications, having only one computer operation and optionally a job setup operation and another manual operation, can be created using the JOB DESCRIPTION panel.

First, create the PAYDAILY job, which is part of an application description of the same name, with three operations, as shown in Table 1 on page 12. Follow these steps:

1. From the main menu, enter the fast path 1.4 to display the MAINTAINING APPLICATION DESCRIPTIONS panel (see Figure 60 on page 128).
2. Select option 2 to display the CREATING AN APPLICATION (EQQACGPP) panel:

```
EQQACGPP ------------------ CREATING AN APPLICATION --------------------------
Command ===>

Enter/Change data below:
Enter the RUN command above to select run cycles, the DEP command to select
dependencies at application level or the OPER command to select operations.

Application:
 ID                ===> PAYDAILY________
 TEXT              ===> Daily PAYROLL backup___    Descriptive text
 TYPE              ===> A           A - Application, G - Group definition
Owner:
 ID                ===> SAMPLE_________
 TEXT              ===> Pay Office_____________
                                    Descriptive text of application owner
PRIORITY           ===> 5           A digit 1 to 9 , 1=low, 8=high, 9=urgent
VALID FROM         ===> 03/01/29    Date in the format YY/MM/DD
STATUS             ===> A           A - Active, P - Pending
AUTHORITY GROUP ID ===> ________    Authorization group ID
CALENDAR ID        ===> ________________   For calculation of work and free days
GROUP DEFINITION   ===> ________________   Group definition id
SMOOTHING FACTOR   ===> ____   LIMIT ===> ____  Deadline Feedback options
```

Figure 8. Creating the PAYDAILY application

3. Type the fields as shown and press Enter. See "Standard applications and group definitions" on page 127 for more information about each field.
4. To schedule PAYDAILY, enter the RUN command to specify a *run cycle*. The RUN CYCLES panel, shown in Figure 9, is displayed.

```
EQQAMRPL ------------------------ RUN CYCLES ----------------  ROW 1 TO 1 OF 1
Command ===>                                                 Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Specify run days/Modify rule

Application            : PAYDAILY         daily payroll jobs
     Name of                                In       Out of
Row  period/rule Input Deadline       F day effect   Effect
cmd  Text        HH.MM day HH.MM Type rule  YY/MM/DD YY/MM/DD Variable table
'' RULE01__    12.00 00  16.00 R    4     03/01/29 71/12/31 PAY__________
     Run every working day_____________________________

****************************** BOTTOM OF DATA ******************************
```

Figure 9. Creating the run cycle for PAYDAILY

5. Specify an *input arrival time* of 12.00. This time has two main purposes:
   a. It identifies the occurrence of the application, differentiating "the midday run of PAYDAILY" from other runs on the same day.

b. It tells IBM Workload Scheduler for z/OS when to try to start the application, if it is time-dependent. Normally, you need not make applications time-dependent, because they run immediately after their predecessors. But PAYDAILY is an exception, because it is the first payroll job of the day, and is also responsible for triggering the closure of the CICSA payroll data set at midday.

6. Specify the *deadline day and time*, which is the latest time that all operations in any occurrence of the application should be completed by. IBM Workload Scheduler for z/OS takes various actions if an operation is not started by its deadline time, depending on parameters that you specify. Day `0` and time `16.00` means that the deadline is 16.00 on the same day as the input arrival time.
7. Type `R` for a normal rule.
8. The value of 4 for F day rule (the free-day rule) means that the application is not scheduled on free days in the calendar. This is not so important for PAYDAILY, because avoiding free days is part of the rule definition, but for other rules, such as Last Friday in the Month, it is important because IBM Workload Scheduler for z/OS needs to know what to do if Friday is Christmas Day, for example.
9. Specify the in-effect and out-of-effect dates. If you leave these blank, IBM Workload Scheduler for z/OS fills them in with today's date and 71/12/31, 31 December 2071.
10. Specify the JCL variable table that will be used on the days selected by this run cycle. The PAYDAILY JCL can have variables, promptable or nonpromptable. IBM Workload Scheduler for z/OS looks for values to substitute into the JCL in a *variable table*.
11. Enter the `S` row command to specify the days that this rule will select. The MODIFYING A RULE panel, shown in Figure 10, is displayed.

```
EQQRULEP ---------------------- MODIFYING A RULE ------------------------------
Command ===>

Enter the GENDAYS command to display the dates generated by this rule
Enter S and user data in the fields below to define a rule

Application   : PAYDAILY                 daily payroll jobs
Rule          : RULE01     Run every working day

 --- Frequency ---         --- Day ---    --- Cycle Specification ---
-------------------------------------------------------------------------------
        _ Only          !  _ Day       !  _ Week       _ January    _ July
        S Every         !  _ Free day  !  _ Month      _ February   _ August
                        !  S Work day  !  S Year       _ March      _ September
 _ First     _ Last     !  _ Monday    !               _ April      _ October
 _ Second    _ 2nd Last !  _ Tuesday   !               _ May        _ November
 _ Third     _ 3rd Last !  _ Wednesday !               _ June       _ December
 _ Fourth    _ 4th Last !  _ Thursday  !  Week number  __ __ __ __ __ __
 _ Fifth     _ 5th Last !  _ Friday    !  Period name  ________ ________
   ___ ___     ___ ___   !  _ Saturday  !               ________ ________
   ___ ___     ___ ___   !  _ Sunday    !
   ___ ___     ___ ___   !              !  Shift default origin by  ___ days
-------------------------------------------------------------------------------
```

Figure 10. Creating the rule for PAYDAILY

12. Select the fields shown so that IBM Workload Scheduler for z/OS schedules PAYDAILY every work day, and then press PF3 (End) to return to the RUN CYCLES panel.
13. Press PF3 (End) again to return to the CREATING AN APPLICATION panel.

14. Enter the OPER command. The OPERATIONS panel, shown in Figure 11, is displayed.

```
EQQAMOPL ------------------------ OPERATIONS ----------------  ROW 1 TO 3 OF 3
Command ===>                                                  Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Select operation details, J - Edit JCL
Enter the PRED command above to include predecessors in this list, or,
enter the GRAPH command to view the list graphically.

Application            : PAYDAILY         daily payroll jobs

Row  Oper      Duration Job name  Operation text
cmd  ws   no. HH.MM.SS
'' WTO1 005   00.01.00    PAYDAILY  PAYX CLOSE DATASET______
'' SETP 010   00.05.00    PAYDAILY  setup for PAYDAILY job__
'' CPU1 020   00.05.00    PAYDAILY  pay04 and pay06_________
****************************** BOTTOM OF DATA ******************************
```

Figure 11. Creating operations in PAYDAILY

The first operation, the WTO, causes message EQQW775I to be issued at midday with the operation text (`PAYX CLOSE data set`) as part of the message, which NetView can then use as a CICS transaction.

15. For each operation, type the workstation (**Oper ws**), operation number (**Oper no.**), and, if the workstation is a job setup, computer, or printer workstation, the name of the job or started task that the operation represents.
16. Specify the estimated duration of each operation, which IBM Workload Scheduler for z/OS uses for planning purposes and also to judge whether an operation might finish late. IBM Workload Scheduler for z/OS can use the actual run times of PAYDAILY to adjust this estimate.
17. Specify the job name. For batch and setup operations, IBM Workload Scheduler for z/OS uses this to find the JCL in the EQQJBLIB partitioned data set. A setup operation must have the same job name as the successor computer operation. A print operation must have the same job name as its predecessor, because this identifies the spool file that IBM Workload Scheduler for z/OS tracks.
18. Enter the PRED command to specify the internal predecessors (the dependencies within this application). The panel shown in Figure 12 on page 24 is displayed.

```
EQQAMOSL ------------------------ OPERATIONS ----------------  ROW 1 TO 3 OF 3
Command ===>                                                  Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Select operation details, J - Edit JCL
Enter the PRED command above to include predecessors in this list, or,
enter the GRAPH command to view the list graphically.

Application           : PAYDAILY         daily payroll jobs

Row  Oper      Duration  Job name  Internal predecessors           Morepreds
cmd  ws   no.  MMMM.SS                                           -IntExt-
'''' WTO1 005  0001.00_  PAYDAILY  ___ ___ ___ ___ ___ ___ ___ ___   0  0
'''' SETP 010  0005.00_  PAYDAILY  ___ ___ ___ ___ ___ ___ ___ ___   0  0
'''' CPUV 020  0005.00_  PAYDAILY  005 010 ___ ___ ___ ___ ___ ___   0  0
****************************** Bottom of data ********************************
```

Figure 12. Specifying the predecessors for PAYDAILY operations

19. Specify the predecessors shown to tell IBM Workload Scheduler for z/OS that the setup operation and the WTO must come before the batch PAYDAILY job.

    The batch job, operation 020, also depends on CICSA successfully closing the payroll data set after getting the command from NetView. This dependency, however, is handled using resources. While CICSA has the data set open, it has exclusive use of the resource PAYROLL.DATABASE. When the PAYX transaction successfully closes the data set, it executes the EQQUSIN subroutine to release the special resource. Then the PAYDAILY job can run as soon as the job preparation team has finished any manual JCL overrides and has completed the SETP operation.
20. Specify the details of each operation by entering s beside the operation. The OPERATION DETAILS panel is displayed.
21. Specify option 3 (SPECIAL RES) to specify that the batch job must have exclusive use of the PAYROLL.DATABASE resource (see Chapter 5, "Creating special resources," on page 75 for details about using resources). Complete the fields shown in Figure 13 and press PF3 (End).

```
EQQAMSRL --------------------- SPECIAL RESOURCES ------------  ROW 1 TO 1 OF 1
Command ===>                                                  Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete

Operation             : CPU1 020         Runs pay04 and pay06

Row  Special                                    Qty    Shr Keep On
cmd  Resource                                          Ex  Error
'' payroll.database_____________________________ 1_____ x   y
******************************* BOTTOM OF DATA ********************************
```

Figure 13. Specifying the payroll database as a resource

22. You never have to select option 2 (WS RES and SERV) for Paymore operations, because they do not use workstation fixed resources, and the default number of parallel servers is one, which is what you need.
23. You do not need to specify a time for the operation (option 6), because the default is for the operation to take the input arrival time specified for the occurrence, which is what is needed for PAYDAILY. But you must specify that the WTO operation is time-dependent. From the OPERATION DETAILS menu, select option 4 (AUTOMATIC OPTIONS). The JOB, WTO, AND PRINT

OPTIONS panel, shown in Figure 14, is displayed.

```
EQQAMJBP ---------------- JOB, WTO, AND PRINT OPTIONS -------------------
Command ===>

Enter/Change data below:
Application            : PAYDAILY
Operation              : WTO1 005
 JOB CLASS          ===> _            ERROR TRACKING     ===> Y
 HIGHEST RETURNCODE ===> ____         EXTERNAL MONITOR   ===> N
 CENTRALIZED SCRIPT ===> N            COND RECOVERY JOB  ===> N
 CRITICAL           ===> P            POLICY             ===> _
 CLASS              ===> _______
Job release options:
 SUBMIT             ===> Y            HOLD/RELEASE       ===> Y
 TIME DEPENDENT     ===> N            SUPPRESS IF LATE   ===> N
 NOP                ===> _            MANUALLY HOLD      ===> _
 DEADLINE WTO       ===> N
WS fail options:
 RESTARTABLE        ===> _            REROUTEABLE        ===> _
Print options:
 FORM NUMBER        ===> ________     SYSOUT CLASS       ===> _
```

Figure 14. Specifying that the WTO is time-dependent

Specify y in the TIME DEPENDENT field. Now IBM Workload Scheduler for z/OS will not try to start the WTO operation until 12.00.

24. Return to the CREATING AN APPLICATION panel by pressing PF3 (End), and press PF3 (End) twice again to save the new application description in the IBM Workload Scheduler for z/OS database. It will now be included in the long-term plan when you create it.

You have now created one application and its operations. Continue in a similar manner for the other applications in Table 1 on page 12, but note especially:

GPAYW and GPAYM
These are groups, so you specify run cycles for these, but no operations. Their applications (PAYW, PAYM1, and PAYM2) have operations, but no run cycles.

Dependencies for PAYBACKP
PAYBACKP must run after all scheduled payroll updates, so give it external dependencies to all of them. PAYBACKP will therefore depend on PAYTAXYR, for example, but the dependency will not take effect on the 364 days of the year when PAYTAXYR is not scheduled.

Opening the CICSA payroll data set
The last operation of PAYBACKP is a WTO that triggers a CICS transaction to reopen the data set.

Job setup for other operations
There are no job setup operations other than for PAYDAILY. Normally, you do not need job setup, because most JCL variable substitution can be handled automatically with JCL variable tables, and in these cases IBM Workload Scheduler for z/OS edits the JCL and submits it when the job becomes ready.

Tracking print operations
Print operations are specified only for the payslip printing jobs, where it is important for IBM Workload Scheduler for z/OS to know if and when JES has finished printing. For these jobs, PAYWSLIP and PAYMSLIP, take care to specify the print form number and SYSOUT class when you specify the operation details. IBM Workload Scheduler for z/OS uses a key of job

name, form number, and SYSOUT class to track the event, and this key must be unique, or IBM Workload Scheduler for z/OS might track the wrong spool data set. See "Options that apply to print operations" on page 164.

Rule for the GPAYW run cycle

EVERY THURSDAY of every YEAR. You can find equivalent rules, such as:

- ONLY THURSDAY in every WEEK
- EVERY THURSDAY in every WEEK
- EVERY THURSDAY in every MONTH

Which one you specify does not matter. If you are unsure about the rule, use the GENDAYS command to check the selected days. Note that `EVERY FOURTH DAY in every WEEK` is not equivalent, because the day selected depends on whether free days are to be counted among the four days (the free day rule).

Rule for the GPAYM run cycle

ONLY THIRD THURSDAY of every MONTH. For this run cycle, as for GPAYW and PAYTAXYR, you need free-day rule 1, so that the occurrence is scheduled on the previous work day if the Thursday is a holiday.

Rule for the PAYTAXYR run cycle

ONLY THIRD THURSDAY of every JULY.

Rules for the on-demand jobs

Do not specify rules for PAYRECOV, CICSA, and PAYQUERY. You can add these to the long-term or current plan when you need them.

Creating plans

About this task

When you have specified your system environment (workstation, calendars, and periods) and your applications, you are ready to create the plans.

Follow these steps to create the plans:

1. Select option 2 (LTP) from the main menu. The MAINTAINING THE LONG-TERM PLAN menu is displayed.
2. Select option 2 (BATCH). The SELECTING THE LONG-TERM PLAN BATCH JOB menu is displayed.
3. Select option 7 (CREATE). The CREATING THE LONG-TERM PLAN panel, shown in Figure 15, is displayed.

```
EQQLCREP ---------------- CREATING THE LONG TERM PLAN -------------------
Command ===>

Enter/Change data below:

Long term plan:

 START             ===>  03/02/03   Date in format YY/MM/DD

 END               ===>  03/02/28   Date in format YY/MM/DD
```

Figure 15. Creating the long-term plan

4. Start the long-term plan a few days later than the current date, so that you have time to check it before it goes into effect.

5. Choose an end date about one month from the start date, and press Enter. The GENERATING JCL FOR A BATCH JOB panel is displayed.
6. Type the batch job parameters, and press Enter.
7. When the batch job finishes, check it for errors. If the long-term plan is created, you can scan the scheduled occurrences most easily online, using option 1 (ONLINE) from the LTP menu. Figure 16 shows the LONG-TERM PLAN OCCURRENCES panel.

```
EQQLSTOL ---------------- LONG TERM PLAN OCCURRENCES ------  ROW 1 TO 5 OF 189
Command ===>                                                  Scroll ===> PAGE

Enter the CREATE command above to create a new occurrence or
enter the GRAPH command above to view occurrences graphically, or,
enter any of the commands below:
B - Browse, D - Delete, J - Job setup, M - Modify, RG - Remove from Group

Row Application id   Owner id         Input arrival  Deadline      P C Pre Suc
cmd                                   date     time  date     time
'' PAYBACKP         SAMPLE           03/02/02 12.00 03/02/03 06.00 5 N   0   0
'' PAYDAILY         SAMPLE           03/02/02 12.00 03/02/02 16.00 5 N   0   0
'' PAYBACKP         SAMPLE           03/02/03 12.00          06.00 5 N   0   1
'' PAYDAILY         SAMPLE           03/02/03 12.00 03/02/03 16.00 5 N   0   0
'' PAYW             SAMPLE           03/02/03 12.00 03/02/03 16.00 5 N   1   0
```

Figure 16. Listing occurrences in the long-term plan

8. If things are not what you expect, you can change occurrences using this panel, but it is easier, while you have no current plan, to correct the database and re-create the long-term plan. You cannot re-create the long-term plan once you have a current plan; you have to delete the current plan first with the REFRESH function.
9. If the long-term plan is correct, put the jobs that you need into the EQQJBLIB data set. The member name must be the same as the operation name.
10. Create the current plan. Select option 3 (DAILY PLANNING) from the main menu. The PRODUCING IWSz DAILY PLANS menu is displayed.
11. Select option 2 (EXTEND). The EXTENDING CURRENT PLAN PERIOD panel, shown in Figure 17 on page 28, is displayed.

```
EQQDPEXP --------------- EXTENDING CURRENT PLAN PERIOD ------------------
Command ===>

Enter/change data below and press ENTER

Current plan end date :

START DATE         ===> 03/02/03    YY/MM/DD  If no current plan exists
      TIME         ===> 19.02       HH.MM
END DATE           ===> ________    YY/MM/DD  Specific END date
    TIME           ===> _____       HH.MM     Specific END time
EXTENSION LENGTH   ===> 02400       HHHMM     Extend plan by
          TYPE     ===> A           A - includes all days
                                    W - includes only work days in the
                                        extension length above

Report selection :                  Y if report wanted, otherwise N
 WS SUMMARY        ===> Y           Summary for all work stations
 OPERATING PLAN    ===> Y           Daily operation plan
 WS PLANS          ===> Y           Plans for all work stations
 INPUT ARRIVAL     ===> Y           List of input arrival operations
 NON REPORTING     ===> Y           Plans for non reporting work station
 CURRENT PERIOD    ===> Y           Print current period results
 PLANNED RESOURCE  ===> Y           Planned resource utilization
 ACTUAL  RESOURCE  ===> Y           Actual  resource utilization
```

Figure 17. Creating the current plan

12. Type the values shown, and press Enter.
13. Enter the batch parameters as before to submit the job, and check the output for error messages.

What happens if jobs or started tasks fail?

If you are automating a system, remember the 1% or 0.1% of cases when something goes wrong. Nobody likes a telephone call at 3 a.m., even if there is a terminal next to the bed. Ask your on-call experts what they do when they have to look at failed jobs. Then get IBM Workload Scheduler for z/OS to do it for them.

Here are the payroll analyst's notes on PAYDAILY:

1. PAY04 transfers the hours-worked data from the CICSA key-sequenced data set to a sequential data set. If this program fails, the job can be rerun.
2. PAY06 validates the hours-worked data and updates the payroll database if the data is valid. If there are validation errors (return code 4), payroll inspects and corrects the data, and the job is restarted from PAY04. If there are other errors, PAY04 can be rerun after running PAYRECOV.

This is how to change the PAYDAILY JCL so that IBM Workload Scheduler for z/OS handles it:

```
//PAYDAILY JOB  (890122,NOBO),'SAMPLE'
//*
//*       PAYMORE PAYROLL SAMPLE
//*       THIS JOB RUNS PAY04 AND PAY06
//*%OPC RECOVER ERRSTEP=PAY04                                  1
//*%OPC RECOVER ERRSTEP=PAY06,STEPCODE=4,RESTART=N             2
//*%OPC RECOVER ERRSTEP=PAY06,ADDAPPL=PAYRECOV                 3
//PAY04    EXEC PGM=PAY04
//STEPLIB  DD DSN=XRAYNER.OPC.LOADLIB,DISP=SHR
//PAYIN    DD DSN=XRAYNER.CICS.PAYDB,DISP=SHR
//PAYOUT   DD DSN=XRAYNER.DAY.TRANS,DISP=SHR
//SYSPRINT DD SYSOUT=*
//PAY06    EXEC PGM=PAY06,COND=(0,LT)
//STEPLIB  DD DSN=XRAYNER.OPC.LOADLIB,DISP=SHR
//PAYIN    DD DSN=XRAYNER.DAY.TRANS,DISP=SHR
//PAYOUT   DD DSN=XRAYNER.PAYROLL.DATABASE,DISP=SHR
//SYSPRINT DD SYSOUT=*
```

This is an explanation of the marked lines:

1 tells IBM Workload Scheduler for z/OS what to do if PAY04 fails for whatever reason. The default, with no action on the RECOVER statement, is that IBM Workload Scheduler for z/OS reruns the job. But before rerunning the job, it turns this RECOVER statement into an IBM Workload Scheduler for z/OS comment and saves the JCL in the job repository, so that PAY04 is not continually rerun in a loop if it keeps failing.

2 tells IBM Workload Scheduler for z/OS what to do if step PAY06 fails with return code 4. RESTART = N means leave the operation on the error list for the analysts to look at.

3 is the action for any other failure in PAY06. IBM Workload Scheduler for z/OS will add the PAYRECOV application to the plan, run it, and make the rerun of PAYDAILY dependent on PAYRECOV (PAYRECOV becomes the predecessor of PAYDAILY).

See Chapter 21, “Automatic recovery of jobs and started tasks,” on page 395 for a full description of automatic recovery.

Coping with more complex problems

Sometimes,

- A job creates a data set, and the NEW disposition gives an error on a rerun. IBM Workload Scheduler for z/OS handles problems like this with cleanup, (see Chapter 20, “Restart and cleanup,” on page 363). It can delete data sets that have been created by failing jobs.
- You have to look at the SYSOUT data set of a job before you know how to recover it. For example, PAY06 might issue a message just when it starts to update the database. If that message is there, you know you have to run PAYRECOV. Use the job completion checker, described in *Customization and Tuning*, to scan SYSOUT for messages and set an error code that you can pass to automatic recovery or to the operator.

Summary of what you need to do

If you are new to IBM Workload Scheduler for z/OS, implement it in stages. Specify just one of your applications, and wait for this to run smoothly before implementing the others. Leave the optional functions, such as restart and cleanup and JCL variable substitution, until later.

These are the implementation tasks:
- Design the automation.
- Create the workstations.
- Create the calendar.
- Create special resources.
- Create JCL variable tables and prepare JCL.
- Create groups, application and job descriptions.
- Create a long-term plan.
- Create a current plan.

These are the daily tasks:
- Control IBM Workload Scheduler for z/OS.
- Extend the current plan.

This is the weekly or monthly task:
- Extend the long-term plan.

This is the yearly task:
- Maintain the calendar and period definitions.

The following chapters in this book tell you in detail how to describe your data processing activities and how to build a schedule.

Chapter 3. Using the scheduler panels

To perform most operator tasks, you use IBM Workload Scheduler for z/OS panels, which run under Interactive System Productivity Facility (ISPF).

This chapter shows you how to get help, how to tailor the program function (PF) keys and ISPF options, and how to use IBM Workload Scheduler for z/OS filter panels to reduce the amount of data displayed in lists.

The scheduler ISPF panels

How you invoke the panels on your system depends on your installation standards. The department that installed IBM Workload Scheduler for z/OS can tell you how to invoke IBM Workload Scheduler for z/OS at your installation. Usually, you select IBM Workload Scheduler for z/OS option from the ISPF main menu.

The scheduler administration is performed on the controlling system in a multisystem complex, so you must use the panels on the system in your configuration that is running the controller.

You can reach all the controller panels from IBM Workload Scheduler for z/OS main menu. See Figure 18.

```
 EQQOPCAP -------------- IBM WORKLOAD SCHEDULER FOR z/OS ---------------------
 Option ===>


Welcome to IBM Workload Scheduler for z/OS (IWSz)
Connected to OPCC

 Select one of the following options and press ENTER.

 0 OPTIONS         - Define IWSz dialog user parameters and options

 1 DATABASE        - Display or update IWSz data base information
 2 LTP             - Long Term Plan query and update
 3 DAILY PLANNING  - Produce daily plans, real and trial
 4 WORK STATIONS   - Work station communication
 5 MCP             - Modify the Current Plan
 6 QCP             - Query the status of work in progress
 7 OLD OPERATIONS  - Restart old operations from the DB2 repository

 9 SERVICE FUNC    - Perform IWSz service functions
10 OPTIONAL FUNC   - Optional functions

 X EXIT            - Exit from the IWSz dialog
```

Figure 18. EQQOPCAP - Main menu

Before you can use any panel in IBM Workload Scheduler for z/OS, you must have the authority to access it. See your security administrator or system programmer if you do not have the access that you need.

Setting options

You do not have to set options every time you use the panels. The options, and many of the parameters that you enter in the panels, are saved when you leave ISPF (though not if the session is not terminated normally) and will be the default next time.

Select option 0 on the main menu to display the DEFINING PARAMETERS AND OPTIONS panel:

```
EQQXOPTP --------- DEFINING IWSz PARAMETERS AND OPTIONS ----------------
Option ===>

Select one of the following:

0 REINIT          - Re-initialize the application profile values
1 SUBSYSTEM NAME  - Set or change name of Subsystem and Server LU
2 DATE            - Specify date/time formats and default calendar
3 COLOR           - Specify panel color and highlight attributes
4 ISPF OPTIONS    - Specify ISPF/PDF options
5 AD/OI CHECKS    - Specify AD/OI consistency checks
6 JCL EDIT        - Specify JCL edit tool
7 CLEANUP CHECK   - Specify check option for Automatic Cleanup type
8 PANELS STYLE    - Specify the style for the operation panels
```

Figure 19. EQQXOPTP - Defining parameters and options

After you specify the options you prefer, they are used throughout IBM Workload Scheduler for z/OS. The options are stored in your ISPF profile data set. When you use the panels, the options are retrieved from your profile.

REINIT
Use this option to set IBM Workload Scheduler for z/OS profile to the default values defined at installation time. This is done automatically the first time that you use IBM Workload Scheduler for z/OS. If you start to use IBM Workload Scheduler for z/OS for a new language feature, perform a REINIT.

SUBSYSTEM NAME
Select this option to specify the name of the controller subsystem with which the panels are to communicate. The name must be an alphanumeric string of not more than 4 characters. If the controller is on a different z/OS, the SERVER LU NAME must be given. The logical unit (LU) name can be a fully qualified LU name networkid.luname, 3-17 characters. The LU name is sufficient if the Server is on the same net as the panels.

DATE Use this option to specify the format of dates and times in IBM Workload Scheduler for z/OS and, if required, to set a local time offset. The SETTING DATE AND TIME FORMAT panel is displayed:

```
EQQXDATP ----------- SETTING IWSz DATE AND TIME FORMAT ---------------------
Command ===>

Enter/change data below:

DATE-FORMAT        ===> YY/MM/DD  Combine the characters for
                                  year ( YY or CCYY ), and month ( MM ) and
                                  day ( DD ), or day number ( DDD ).
                                  You can use separation characters (such
                                  as - or /) if space permits.

TIME-FORMAT        ===> HH.MM     Combine the characters for
                                  hours( HH ) and minutes( MM ).
                                  Optionally separated by any character.

DURATION-FORMAT    ===> MMMM.SS   Specify the characters for hours( HH )
                                  and minutes( MM ) and seconds( SS )
                                  or minutes( MMMM ) and seconds( SS ).
                                  Optionally separated by any character.

LOCAL TIME OFFSET  ===> 0__       Specify local time offset in minutes.
                                  The value must be in the range 0 to 1439.
TIME OFFSET SIGN   ===> +         Specify - if local time is before IWSz.
                                  Specify + if local time is after IWSz.
CALENDAR ID        ===> _________________  Default calendar identification
```

Figure 20. EQQXDATP - Setting date and time format

DATE-FORMAT

You can specify dates with these formats:

- *CCYYMMDD* or *YY/MM/DD*, where *CC* is the century. *CC, YY, MM,*and *DD* can be in any order.
- *YY/DDD* or *CCYY/DDD*, where *DDD* is the day number in the Julian calendar. *CC*, *YY*, and *DDD* can be in any order.

The delimiter character, shown as a slash (/), is optional and can be any character other than *C*, *Y*, *M*, or *D*. If you specify *CCYYMMDD*, you cannot use delimiters. The date format can be no more than 8 characters. Example panels in this book use the format *YY/MM/DD*.

TIME-FORMAT

Specify the time in the *HH.MM* format. The delimiter character between hours and minutes can be a period (.), or any character other than H or M. Example panels in this book use the format *HH.MM*.

DURATION-FORMAT

You can specify hours (HH), minutes (MM), and seconds (SS) or minutes (MMMM) and seconds (SS). Any character can be specified as a separation character.

LOCAL TIME OFFSET

If you are in a different time zone from the controller, you can specify a local time offset. This means that actual start and end times are adjusted to take your local time into consideration. The local time offset is the number of minutes your local time is ahead of or behind *controller subsystem time*; that is, IBM Workload Scheduler for z/OS controlling processor clock time. The local time offset specified on this panel applies only to the ISPF profile that you are using.

Note: All time values stored in controller data sets are specified in controller subsystem time so that you cannot, for example, use the local-time offset option to specify or display workstation open intervals, input arrival times, or run-cycle start times, in your local time. Reports created by IBM Workload Scheduler for z/OS batch jobs always have time values expressed in controller subsystem time and not your local time.

TIME OFFSET SIGN
This option is used with LOCAL TIME OFFSET to specify whether your local time is ahead of or behind IBM Workload Scheduler for z/OS controller subsystem time. For example, you specify + if your local time is ahead of controller subsystem time.

CALENDAR ID
Specify the default calendar that IBM Workload Scheduler for z/OS uses for panel functions such as the LONG TERM PLAN panel, the GENDAYS command for checking run cycles, and substituting job control language (JCL) variables at job setup. For batch functions, IBM Workload Scheduler for z/OS uses the calendar specified in the BATCHOPT initialization statement. In both cases, IBM Workload Scheduler for z/OS looks for a calendar called DEFAULT if no other calendar is specified. For some functions (ETT and the EQQUSIN subroutine), IBM Workload Scheduler for z/OS has no access to BATCHOPT or the panel default, so the scheduler always looks for the calendar DEFAULT if no calendar is specified.

If no calendar is specified and there is no calendar called DEFAULT, IBM Workload Scheduler for z/OS treats all days as work days.

COLOR
Select this option to display the SETTING COLOR AND HIGHLIGHT ATTRIBUTES panel, where you specify color and highlighting attributes for different panel elements:

```
EQQXCOLP ------ SETTING COLOR AND HIGHLIGHT ATTRIBUTES ---------
Command ===>

Enter/change data below:

COLOR        HILITE        PANEL ELEMENT CATEGORY

WHITE__      _______       Panel titles and data items
BLUE___      _______       Directional lines and explanatory text
BLUE___      REVERSE       Header text
WHITE__      _______       Option numbers and command text
BLUE___      _______       Normal status (for instance output text)
WHITE__      _______       Important status (for instance output data)

RED____      _______       Command input
GREEN__      _______       Optional input
RED____      _______       Required input
RED____      BLINK__       Error flagged input

Valid color specifications are:
     WHITE, RED, BLUE, GREEN, PINK, YELLOW, and TURQ
Valid highlight specifications are:
     USCORE, REVERSE, BLINK, and blank for no highlighting
```

Figure 21. EQQXCOLP - Setting color and highlight attributes

The panels have different elements; for example, the title of the panel and the command input field. For each of these elements, you can specify color and highlighting. If you set a color to blank, the installation default is used.

To test the effect of the color and highlighting attributes, press Enter to re-display the panel with the specified attributes.

All panel elements in IBM Workload Scheduler for z/OS are subsequently displayed with the attributes specified on this panel. You can also use the COLOR command at any time.

ISPF OPTIONS

Select this option in the DEFINING OPC PARAMETERS AND OPTIONS panel to change the following:

TERMINAL

Specify these terminal characteristics:

- Terminal type
- Number of PF keys
- Input field pad characters: nulls or blanks
- Command delimiter for stacking commands
- Screen format

LOG/LIST

Specify the log data set and list data set options, print process options, and job statement information for the system printer.

PF KEYS

Specify the number of PF keys and the operations they will perform.

DISPLAY

Specify whether the command line is to be placed at:

- The top (ASIS) of the panel (as shown in the examples in this publication).
- The bottom (BOTTOM) of the panel.

LIST Specify the list data set record format (FBA or VBA), logical record length, and line length.

GRAPHIC

Specify Graphical Data Display Manager (GDDM) graphic print attributes.

ENVIRON

Use the ENVIRON commands to trace the TPUT, TGET, and PUTLINE buffers, to produce system ABEND dumps when not running in ISPF TEST mode, and to gather terminal status information.

KEYLIST

Modify keylist function. You can issue the KEYLIST command from the command line of a panel. If you issue the KEYLIST command from a panel displaying a keylist, that keylist will be marked `*** CURRENTLY ACTIVE KEYLIST ***`.

DIALOG TEST

Specify dialog test options. You can specify that ending Dialog Test (option 7 on the ISPF primary panel) will restore the TEST/TRACE values that were in effect when Dialog Test was called.

COLOR
Change the default color specifications for ISPF panels.

CUAATTR
Use the Common User Access (CUA) Color/Emphasis Change Utility to change the color, intensity, and highlight values for panel elements on CUA panels.

AD/OI CHECKS
Use this option to specify whether you want application description (AD) and operator instructions (OI) consistency checks done each time an Application is created, deleted, or modified.

Consistency checks consist of looking for a match in the AD database for the operator instruction used in the Application. All operator instructions for which no match is found are deleted.

These checks are made immediately after the AD panel action has been completed, either confirming or canceling it.

For example, if you start the creation of a new Application, APPLX, with one operation, 001, select option 7 from the OPERATION DETAILS panel and create an operator instruction, APPLX-001. Finally, press CANCEL instead of PF3 so that the APPLX application is not created; the consistency checks will lead to the deletion of the newly created operator instruction, because an operation with the key APPLX-001 could not be found in the AD database.

When you select option 0.5, the following panel is displayed:

```
EQQXAOIP ---------- SETTING AD/OI CONSISTENCY CHECK -------------
Command ===>


CONSISTENCY CHECK   ===> Y       Specify Y to check AD-OI consistency
                                 when you create, update, or delete an
                                 Application Description.
                                 Specify N to bypass AD-OI consistency
                                 checking.
                                 Default is Y.


CONFIRM PANEL      ===> Y        Specify Y to display a confirmation
                                 panel before AD-OI consistency check
                                 actions are applied.
                                 Specify N to bypass the confirmation
                                 panel.
                                 Default is Y.
```

Figure 22. EQQXAOIP - Setting AD/OI consistency check

CONSISTENCY CHECK
If Y is specified, consistency checks will be done from the APPLICATION DESCRIPTION panel. Y is the default.

CONFIRM PANEL
This field is meaningful only if Consistency Check has been set to Y.

If Y is specified, a confirmation panel is displayed before deleting any operations selected by the consistency checks. Y is the default.

JCL EDIT
Use this option if you have a tool to edit JCL, and you want to be able to call it from the AD panels.

When you select option 0.6 the following panel is displayed:

```
EQQXJCLP ------ SETTING JCL EDIT TOOL INFORMATION  ---------------------

Command ===>

Enter/change data below:

PANEL NAME     ===>    EQQAJCLE     Specify the name of the panel to be
                                    displayed when editing JCL from AD
                                    data base.
                                    This panel name is used to provide a
                                    way to call a user tool to edit JCL.
                                    Default value is EQQAJCLE which is a
                                    dummy panel.
```

Figure 23. EQQXJCLP - Setting JCL edit tool information

PANEL NAME

A link between AD panels and a user tool for editing JCL is established by using a panel name. When the JCL Edit option is selected from the AD panels, then the panel above is displayed.

The panel must exist, or you receive the ISPF error message: `Panel not found`.

The default value for the panel name is EQQAJCLE, which is the name of a dummy panel.

CLEANUP CHECK

When you select option 0.7 on the main menu, the SETTING CHECK FOR AUTOMATIC CLEANUP TYPE panel is displayed. Specify Y to check and possibly modify the Cleanup Data Set list, displayed on the MODIFYING CLEANUP ACTIONS panels, even if the Automatic option is specified at operation level.

Specify N to bypass the check. In this case, the CONFIRM RESTART panel is directly displayed when you request a RESTART function with the cleanup type automatic. The default is N.

PANELS STYLE

You can choose to use the advanced panels or the basic panels, which are the default. By using the advanced panels you can:

- Simplify the way in which you modify operations in the current plan.
- Enhance the way you view the list of all operations in the current plan.
- Browse comprehensive information about an operation in a single panel.

Select option 0.8 in the main menu to display the SETTING PANEL STYLE panel (Figure 24 on page 38). Enter Y for the advanced panels or N for the basic panels (default). You can change the style of panels at any time by changing the value in the SETTING PANEL STYLE panel. Alternatively, you can enter 0.0 from the main menu to reset the profile values to the default settings.

Because the advanced panels offer different functions, there are often different ways to complete some tasks in these panels.

```
EQQXPSTL----------—------- SETTING PANEL STYLE ----------------------------
Command ===>

Enter Y to use the advanced ISPF panels, or N to use the basic panels.

Advanced ISPF panels  ===> Y
```

Figure 24. EQQXPSTL - Setting the panel style

Common panel commands and facilities

The common commands that you use on IBM Workload Scheduler for z/OS panels are described in the following sections. Special commands, as they relate to a specific panel, are described in the individual task descriptions.

The following sections also provide some hints and tips for customizing, locating, and displaying IBM Workload Scheduler for z/OS information promptly.

Concatenating options

You can concatenate IBM Workload Scheduler for z/OS selection options in the standard ISPF manner. For example, entering 4.1.0 on the main menu takes you directly into the workstation ready list that you last displayed. The scheduler lets you enter concatenated options both in row input fields and on the command line.

Note: You cannot use the concatenated option to pass through a confirmation panel without displaying it. For example, entering 9.5.Y from the main panel takes you into option 9.5.

You can also use the ISPF command delimiter to concatenate options in IBM Workload Scheduler for z/OS. For example, enter this command string:

```
9.2;y;=9.1;y;=4.1.cpu1
```

to start and stop the job submission function and return to the ready list display for the CPU1 workstation. When you use the ISPF command delimiter, you pass through confirmation panels without displaying them. This can make completing or deleting a long list of applications or occurrences much faster.

From some list panels, you can also concatenate row commands. When the row command input field allows more than 1 character to be specified, you can concatenate options to reach faster the data to which you need access. For example, if you are browsing a list of occurrences in the current plan, you can enter s.2 as the row command for an occurrence in the list to display the list of operations in the selected occurrence. Entering s.6 as the row command for any computer operation in the subsequent list displays the job for the selected operation. Concatenating row commands lets you bypass the intervening panels that present the list of available options.

Quick return command

As with all ISPF applications, the END command returns you to the previously displayed panel. For example, if you select option 4.1. cpu1 from the main menu, the first panel displayed is the ready list. When you enter END or press PF3 from the ready list, the next panel displayed is the main menu. If you choose not to concatenate the options, it takes three panel displays to reach the ready list and three to return.

You can use the ISPF quick return command (=) as a fast path through IBM Workload Scheduler for z/OS. For example, to return to the ready list from wherever you are in IBM Workload Scheduler for z/OS panels, enter =4.1.0 on the command line.

When you are displaying occurrences and operations in the current plan, you can sometimes navigate through an exceptionally long path. In this case, consider using the quick return command even when you want to return to the same area of the panels.

Primary commands

You can use normal ISPF commands freely throughout the panel. Table 3 shows some of the ISPF commands used on the command line of IBM Workload Scheduler for z/OS panels.

Table 3. Primary commands for the panels

Command	Action
END	Save all changes made in the panel and return to the previous panel if no errors were found. END often starts the operation described in the panel. **Note:** If there is an error in an input field in a panel, you cannot leave that panel by pressing the End PF key or by issuing the END command; either correct the error or issue the CANCEL command.
RETURN	Return to main menu. An END operation is executed for each panel in the sequence leading back to the main menu; all changes in the individual panels are saved.
ENTER	Verify and save all changes. The panel is then redisplayed (if no error was found), unless you press Enter on a menu or selection criteria panel, in which case the next logical panel is displayed. If an error is discovered, a short error message is issued. You can obtain more information (a long error message) by pressing the Help PF key.
CANCEL	Return to the previous panel without making any changes.
UP *nn*	Scroll upward through the data by the number of lines specified by *nn*.
DOWN *nn*	Scroll downward through the data by the number of lines specified by *nn*.
RIGHT	Display the right part of the data. This is available only from panels that have the text LEFT PART in the panel title.
LEFT	Display the left part of the data. This is available only from panels that have the text RIGHT PART in the panel title.
HELP	Display help information.
SORT	Sort information in a list.
LOCATE *lparm*	Scroll to the field specified. If the field is not found, the list is displayed starting with the entry before which the specified field would have occurred. If the list is sorted by application name, then *lparm* is the name of the application; if sorted by job name, *lparm* is a job name.
GRAPH	Display a network of dependencies.
GDDM	Execute GDDM functions on a graphically displayed network.
ATTR	Set graphic attributes.

Specifying list criteria

Throughout all the IBM Workload Scheduler for z/OS panels, you can choose the options that determine which data elements to list. You can use commands to edit the data and to perform other operations on these lists. Depending on which panel

style you are using, the basic panels (default) or the advanced panels (see Panels Style), the content and layout of some of the panels look different.

You use selection criteria to specify the content of lists in IBM Workload Scheduler for z/OS panels. An example of a panel where you specify list criteria follows:

```
EQQSOPFP ------------------- SELECTING OPERATIONS --------------------------
Command ===>

Specify selection criteria below and press ENTER to create an operation list.

JOBNAME            => P*______          WORK STATION NAME => ____
APPLICATION ID     => ________________  OWNER ID          => ________________
AUTHORITY GROUP    => ________          PRIORITY          => _
GROUP DEFINITION   => ________________  STATUS            => __________
CLEAN UP TYPE      => ________________  CLEAN UP RESULT   => __
OP.EXTENDED NAME   =>________________________________________________
OP. SE NAME        => ________________
Input arrival in format YY/MM/DD   HH.MM
FROM               =>  ________  _____
TO                 =>  ________  _____
Additional Options:
FAST PATH          => Y                  Valid only along with jobname
Set Y, N, or leave blank to select all:
MANUALLY HELD      => _   WAITING FOR SE     => _   STARTED ON WAIT WS => _
CRITICAL PATH      => _   COND RECOVERY JOB  => _   RECOVERED BY COND  => _
UNEXPECTED RC      => _   UNDEFINED COND     => _   SHADOW JOB         => _
STARTED AT STARTUP => N
Set P, M, B, E, or leave blank to select all:
WAITING PEND.PRED. ==> _
```

Figure 25. EQQSOPFP - Selecting operations

You can use blanks, complete names, IDs, or generic search arguments in the input fields in this panel to determine the contents of the list.

When you request a list of operations in the current plan, IBM Workload Scheduler for z/OS scans sequentially through all operations defined in the plan to determine which operations match the criteria that you specified. If the current plan is large, this search can take a long time. On some selection criteria panels, you can choose the *fastpath* option to reduce the overhead of the search. When you use a fastpath, IBM Workload Scheduler for z/OS searches through operations included in the current plan job name table, which only has operations on automatic reporting workstations (such as print and computer workstations). When it finds a job name that matches, IBM Workload Scheduler for z/OS includes all operations with that job name, whether on an automatic workstation or not. So the search in Figure 25 finds all automatic workstation operations with a job name beginning with P *and* all other operations with the same name.

Specifying panel views

If you chose to use the advanced panels (see Panels Style) instead of the basic panels, the content and layout of some ISPF panels are different. Several of the advanced panels have a menu bar in which there is a **View** menu. Depending on which view you select, the type and amount of information changes.

When listing and browsing operations in the current plan, from the **View** menu at the top of the panel (see Figure 26 on page 41), you can choose from the following views:

Compact
The default view and displays the concise, summarized information.

Full An extended view that provides more in-depth information about dates and time, dependencies, and operation properties.

Job Detail
The view of detailed, job-centric data such as JCL execution and completion information, timings, and operational data.

Graph The graphical view of the operations, from which you can click an operation that you want to browse or modify.

In addition, the name of the template the panel uses is displayed next to the name of the view. There is a different template for each type of view of each type of advanced panel.

```
  Action  View  Help
EQQMOPRV ------------------ OPERATIONS IN THE CURRENT PLAN ------------------
Command  ===> _____________________________________________Scroll ===> PAGE

    View: Compact (EQQMOPRT)           Row 4 of 28
Row   Application ID  Operation           Input Arrival     Dep    Cond Dep  SXU
cmd                   WS    No.  Jobname  Date     Time   Suc Pre  Suc Pre
_____ PAYDAILY        CPU3  040  IEFBR1R  11/05/24 18.00   1   1    0   0    R N
__/__ PAYDAILY        CPU3  060  IEFBR1R  11/05/25 18.00   0   1    0   0    C N
_____ PAYDAILY        CPU1  010  IEFBR14  11/05/25 20.00   0   0    0   0    R N
_____ PYWEEKLY        CPU3  060  IEFBR1R  11/05/25 18.00   0   1    0   0    C N
```

Figure 26. EQQMOPRV - Choose View in the menu bar to change the panel view

When you are listing and browsing applications in the application database, from the **View** menu at the top of the panel, as shown in the example in Figure 27, you can choose from the following views:

Compact
The default view and displays the concise, summarized information.

Full An extended view that provides more in-depth information about dates and time, dependencies, and operation properties.

Graph The graphical view of the operations, from which you can click an operation you want to browse or modify.

The name of the template the panel is using is displayed next to the name of the view. There is a different template for each type of view of each type of advanced panel.

```
  Action  View  Help

EQQNALSL ------------------ LIST OF APPLICATIONS ------------------
Command  ===> _____________________________________________Scroll ===> PAGE

    View: Compact (EQQNALST)    Row 1 of 55                        >>
Row    Application        Text                 Valid       Valid     T  S
cmd    ID                                      From Date   To Date
_____  PAYDAILY      Daily run of pay calcs    15/07/11    14/07/12  A  A
__/__  PAYSUMMARY    Summay pay calculations   15/07/11    14/07/12  A  A
_____  PAYFORECAST   Forecast pay calcs        15/07/11    14/07/12  A  A
_____  PYWEEKLY      Weekly run of pay calcs   15/07/11    14/07/12  A  A

******************************** end of data ********************************
```

Figure 27. EQQNALSL - Choose View in the menu bar to change the panel view

Using generic search arguments

Many input fields in IBM Workload Scheduler for z/OS panel accept generic search arguments. You specify a generic search argument by entering either an asterisk (*) or a percent sign (%) in an input field. You can enter these characters by themselves or in combination with other characters.

Use an asterisk (*) to represent any character string or a null string. The percent sign (%) represents any single character.

If you want to select all applications whose first three letters are PAY, enter these characters in the input field:

```
APPLICATION ID ===> PAY*________
```

If you want to select all applications where P is the first letter and Y is the third letter, you enter:

```
APPLICATION ID ===> P%Y*_________
```

The percent sign in this example results in a search for application identifiers where there is any single character between P and Y.

Some section panels contain the:

```
TYPE OF MATCH ===>
```

field. Using this field you can specify the type of match that should be applied for filters, allocating wild characters (* and %) to be treated as normal characters. If the field is left blank, then standard generic matching is done.

When double-byte character set (DBCS) mode is specified for kanji, the DBCS asterisk (X'425C') and the DBCS percent sign (X'426C') are accepted as generic search arguments. These search arguments can be used for application and owner IDs.

Sorting list output

In all list displays, you can enter the SORT command at the command prompt to display a panel where you can specify the order of the list items. If you are using the advanced panels (see Panels Style), from the Operations in the current plan panel you can do either of the following actions:

- Click **Action > Sort**
- On the command line, enter `SORT` *<column identifier>* A | D

  where column identifer is the name of the column on which you want to sort your list in ascending or descending order.

The sort order you request remains in effect for that specific list type until changed.

For example, if you request a list of occurrences in the current plan and then enter SORT when the list is presented, the following panel is displayed:

```
EQQXSRTL ---------------------- SORTING A LIST  -----------  ROW 1 TO 14 OF 49
Command ===>                                                  Scroll ===> CSR

Enter/change data in rows
or enter DELETE in the command field to delete the active sort:
Sort order = 1-9, where 1 is the first sort field.
Direction  = A for ascending (default) or D for descending.

Sort  Direction
order Asc/Desc    Title of field       Description of field
  _      _        op.                  Operation no. first critical op.
  _      _        time                 Actual input arrival time of occ.
  _      _        time                 Actual completion time of the occ.
  _      _        time                 Actual start time of first critial op.
  _      _        time                 Latest start time first critical op.
  _      _        time                 Deadline time of first critical op.
  _      _        time                 Input arrival time of first critical op
  _      _        time                 Planned start time of first critical op
  _      _        time                 Deadline time of the occurrence
  _      _        Adding function      What added occurrence to current plan
  _      _        Application          Application ID
  _      _        Application text     Verbal description of the application
  _      _        Arrived              Actual input arrival date of occ.
  _      _        Authgrp              Authority group
```

Figure 28. EQQXSRTL - Sorting a list

DBCS identifiers in sorted lists appear in binary order.

Locating data strings in list output

You can enter LOCATE at the command prompt in any list display panel to find a particular data string in the primary sort field. The command also supports generic search strings. For example, if you enter LOC ABC* to find any item in the list beginning with ABC, the list scrolls to the specified field. If the field is not found, the list is displayed starting with the entry before which the specified field would have occurred.

If application name is the primary sort field, enter the following command:

```
LOCATE applname
```

Similarly, if sorted by job name, enter the following command:

```
LOCATE jobname
```

If you need to regularly issue a LOCATE command against a list of items that is not sorted by the item you want to locate, you can change the sort order by entering the SORT command.

This command is useful when working with lists of special resources or event-triggered-tracking criteria.

Graphically displaying lists

If you have Graphical Data Display Manager (GDDM) installed and have a terminal capable of displaying graphics, you can display lists of applications, occurrences, and operations graphically. Graphic displays contain the same information as edit or selection lists, only the format is different. On a graphically displayed list, you can see dependency connections that might be difficult to visualize from a conventional list. An entire network of applications can be represented.

To see a graphically displayed list, enter GRAPH or, if you are using the advanced panels (see Panels Style), click **View > Graph**. The clarity of the graph depends on

how much data GDDM is trying to present on your display terminal. For example, if you request a GRAPH of all operations in the current plan, you would probably see an attractive geometric design that resembles a bunch of grapes: there is simply too much data to present graphically on a standard workstation display terminal.

You can use the GDDM command to display the GDDM menu where you can choose the zoom and print functions. With GDDM Version 3, you can print a zoomed area. Before printing, change the colors so that you have a black-and-white image. It is often useful to save the graph in the ADMGDF format, which you can manipulate with other programs.

The attributes of a graphically displayed list can be customized. Enter ATTR at the command prompt from the graph panel. You can specify the color, shape, and line type for different items displayed in the graph. Press PF1 (HELP) for possible values for the attributes.

PF Key assignment

The scheduler panel maintains separate program function (PF) keys from your normal ISPF key assignments. Enter KEYS at the command prompt to display or change the current assignment.

You can assign a PF key to a command that you use regularly; for example, to display the ready list. To ensure that the command will be executed correctly regardless of IBM Workload Scheduler for z/OS panel it is entered from, assign the PF key like this:

```
PF5  ===> ;=4.1.cpu1
```

where the semicolon (;) is your ISPF command delimiter.

You can assign PF keys separately for each panel. For example, if you regularly use the application description panel, you can assign PF keys to the OPER and RUN commands. The PF keys that you assign for a particular panel are in effect only for that panel; in other parts of the panel, your standard PF keys for IBM Workload Scheduler for z/OS are in effect.

It is recommended that you do not alter the key assignments for PF1 (HELP), or PF12 (RETRIEVE). PF12 (RETRIEVE) returns the command you last executed to the command prompt; press PF12 again, and the command before that is returned. A stack of approximately 25 commands is maintained.

In support of the PFSHOW command, the PF KEY DEFINITIONS AND LABELS panel lets you optionally assign labels to the PF key definitions. A label is used for display in place of the corresponding definition when the user issues the PFSHOW command.

```
ISPOPT3B ------- PF KEY DEFINITIONS AND LABELS - PRIMARY KEYS ------------------
COMMAND ===>

NUMBER OF PF KEYS ===> 24                          TERMINAL TYPE ===> 3278

PF13 ===> ;=4.1.oper
PF14 ===> ;=4.1.cpu1
PF15 ===> ;=5.4.0
PF16 ===> ;=5.1
PF17 ===> ;=5.2
PF18 ===> ;=6.1
PF19 ===> ;=6.3
PF20 ===> ;=3.1
PF21 ===> ;=3.2
PF22 ===> ;=2.1
PF23 ===> ;=2.2
PF24 ===> ;=1.4.1

PF13 LABEL ===> rl_oper    PF14 LABEL ===> rl_cpu1    PF15 LABEL ===> errors
PF16 LABEL ===> mcp_add    PF17 LABEL ===> mcp_mod    PF18 LABEL ===> qcp_appl
PF19 LABEL ===> qcp_job    PF20 LABEL ===> dpreplan   PF21 LABEL ===> dpextend
PF22 LABEL ===> ltp_look   PF23 LABEL ===> ltpbatch   PF24 LABEL ===> ad_look

Press ENTER key to display alternate keys.  Enter END command to exit.

F13=rl_oper  F14=rl_cpu1  F15=errors   F16=mcp_add  F17=mcp_mod  F18=qcp_appl
F19=qcp_oper F20=dpreplan F21=dpextend F22=ltp_look F23=ltpbatch F24=ad_look
```

Figure 29. ISPOPT3B - PF key definitions and labels

When you enter the PFSHOW command from IBM Workload Scheduler for z/OS panels, the labels displayed at the bottom of Figure 29 are presented on IBM Workload Scheduler for z/OS panels. To remove the display from your panels, enter PFSHOW OFF.

Modeling your environment

To access your environment data that is stored in the scheduler databases, use the MAINTAINING IWSz DATABASES panel.

This publication groups the topics related to each type of data as follows:

- Chapter 4, “Creating workstations,” on page 47
- Chapter 6, “Creating calendars and periods,” on page 97
- Chapter 8, “Creating applications and groups,” on page 123
- “Specifying operator instructions” on page 169
- Chapter 5, “Creating special resources,” on page 75
- “Adding occurrences by event-triggered tracking” on page 478
- “Creating job descriptions” on page 185
- “User-defined variables and variable tables” on page 499

The graphical user interface

Dynamic Workload Console is the interactive interface for IBM Workload Scheduler for z/OS. This console enables you to create, modify, and delete objects in IBM Workload Scheduler for z/OS database. It also enables you to monitor and control objects scheduled in the current plan.

Dynamic Workload Console runs on operating systems other than z/OS, such as on Microsoft Windows and UNIX. It communicates with, and present data from, active scheduler systems.

For more information, refer to the Dynamic Workload Console documentation.

Utilities

The long-term plan and the current plan are created and extended using IBM Workload Scheduler for z/OS batch programs. Other programs and utilities provide update and report on data in IBM Workload Scheduler for z/OS databases. You can submit these programs using IBM Workload Scheduler for z/OS panels or using normal job submission. For several of the batch processes, particularly extending the plans, it is convenient to define the job in an application of IBM Workload Scheduler for z/OS and use the full facilities of IBM Workload Scheduler for z/OS to schedule, submit, and track the processing.

When you submit the jobs from IBM Workload Scheduler for z/OS panel, you see the panel in Figure 30.

```
EQQXSUBP -------------- GENERATING JCL FOR A BATCH JOB ----------------
Command ===>

Enter/change data below and press ENTER to submit/edit the JCL.

JCL to be generated for: REPLAN CURRENT PLAN PERIOD

SYSOUT CLASS       ===> C           (Used only if output to system printer)
LOCAL PRINTER NAME ===> ________    (Used only if output on local printer)
                                    (Used only if CLASS is blank)
DATASET NAME       ===> ____________________________________________
                                    (Used only if CLASS and LOCAL PRINTER
                                    are both blank). If blank default name
                                    used is XMAWS.EID4.DPREP.LIST

SUBMIT/EDIT JOB    ===> S           S to submit JOB, E to edit

Job statement    :
 ===> //XMAWSM JOB (825401,NOBO),'OPC/ESA EID4',CLASS=B,MSGCLASS=Q,______
 ===> //        MSGLEVEL=(1,1),TIME=5,NOTIFY=XMAWS_____________________
 ===> ____________________________________________________________________
 ===> ____________________________________________________________________
```

Figure 30. EQQXSUBP - Generating JCL for a batch job

When you submit the jobs that update or report on IBM Workload Scheduler for z/OS data using the panel:

- The job is submitted using TSO submit; as a result, the authority of the submitting user is assigned to the job.
- The JCL for the job is *not* saved in IBM Workload Scheduler for z/OS JCL repository. If the job needs to be rerun, you must re-create the JCL.
- If you select E for the SUBMIT/EDIT option in the GENERATING JCL FOR A BATCH JOB panel, an ISPF edit panel containing the JCL is displayed. Enter SUBMIT to run the job. When you enter END or use PF3 from the ISPF edit panel, the job is not submitted. From the edit panel, you can save the job using the CREATE command.

Chapter 4. Creating workstations

This chapter describes how to create and use workstations. It covers these topics:
- Workstation types
- Guidelines for creating workstations
- Creating a workstation
- Specifying workstation attributes
- Specifying workstation availability
- Specifying workstation fixed resources
- Controlling workstations

Each operation that IBM Workload Scheduler for z/OS tracks, whether a job, started task, or some other activity, must be associated with a workstation. The workstation is the point of control.

What types of workstation are there?

Each workstation supports one activity, which can be any DP activity, including:
- Manual job setup
- Job submission
- Started-task actions
- NetView communication
- Print operations
- Manual preprocessing or postprocessing activity
- Cross dependencies management
- Dynamic scheduling

These are the types of workstation:
- Computer workstations
- Printer workstations
- General workstations
- Remote engine workstations

Create one or more workstations for each activity that you want to schedule and control. For example, all operations representing jobs and started tasks are specified to run on a *computer workstation*, and print operations are specified to run on a *printer workstation*. Other operations are specified to run on *general workstations*.

In a multiple scheduling environment, *remote engine workstations* allow to define and monitor crossed environments job dependencies.

Computer workstations

The majority of operations are batch jobs and started tasks. These operations are specified to run on computer workstations where they are automatically started when the specified prerequisites are complete, or at a particular time of day, and when all required resources are available. Batch jobs and started tasks are automatically tracked to completion. To automate jobs and started tasks, create at least one job computer workstation and one started-task workstation, even though these might be the same physical processor.

Job computer workstations

A job computer workstation has the STC option in the panel shown in Figure 35 on page 57 set to N. IBM Workload Scheduler for z/OS cannot submit a job unless the computer workstation used by the operation representing the job is available.

To improve the automation of the workload submission to different destinations, you can define a virtual job computer workstation, by specifying a list of destinations for the workload submission (see "Virtual workstations" on page 49). A virtual workstation has the VIRTUAL option in the panel shown in Figure 35 on page 57 set to Y.

A computer workstation associated to a specific destination has the VIRTUAL option set to N. In this case, you can create your computer workstation *open intervals* (see "Specifying workstation open intervals" on page 70), and specify an alternate workstation where IBM Workload Scheduler for z/OS reroutes operations if the normal workstation becomes unavailable. You can also set the status of a workstation from the panel. See "Recovery of operations when a workstation becomes inactive" on page 399 for more details on rerouting computer workstation operations and workload restart.

A computer workstation can also submit operations to non-z/OS environments through a user-defined destination. The submission of these operations is handled by the operation-initiation exit, EQQUX009.

The way JCL is associated with a job or started-task operation is described in "Job statements and computer workstation operations" on page 181.

Note: When IBM Workload Scheduler for z/OS submits a job, it gives control to z/OS and JES, or some other operating environment. IBM Workload Scheduler for z/OS keeps track of what happens to the job or started task and acts accordingly, such as reporting successor operations as ready or starting recovery processing if there is an abnormal termination, but IBM Workload Scheduler for z/OS cannot affect how the job or started task executes.

Started-task computer workstations

A started-task computer workstation has the STC option in the panel shown in Figure 35 on page 57 set to Y. Operations you specify to run on this workstation are treated as started tasks, not as jobs.

To improve the automation of the workload submission to different destinations, you can define a virtual STC computer workstation, by specifying a list of destinations for the workload submission (see "Virtual workstations" on page 49). A virtual workstation has the VIRTUAL option in the panel shown in Figure 35 on page 57 set to Y.

The JCL for the started task is stored in the same way as the JCL for jobs (see "Job statements and computer workstation operations" on page 181). But, instead of submitting the job to the internal reader on the destination system, IBM Workload Scheduler for z/OS puts it into the procedure library allocated to the EQQSTC ddname, and issues the z/OS START command to invoke it.

If you specify the deadline-WTO option, described in "Started-task operations" on page 183, IBM Workload Scheduler for z/OS can automatically send a WTO message to advise the system operator, or NetView, when an operation has passed its deadline. You could use this function to coordinate the shutdown of an online system that executes as a started task.

Virtual workstations

To spread the workload across your trackers, you can create a computer workstation with the automatic reporting attribute and the virtual option, defining a list of destinations for the workload submission. When the scheduler processes the operations submitted to a virtual workstation, it distributes the workload according to a sequenced turn criteria, based on a round-robin algorithm. To submit the job, at least one of the destinations in the list must be available.

You can associate open intervals, parallel servers, and fixed resources with each destination belonging to the defined pool. The association is disabled at virtual workstation level, because the jobs that you submit on a virtual workstation are actually run on a single destination. When you associate parallel servers with a virtual workstation destination, you can specify a value up to 65535.

The alternate workstation definition is not applicable either at workstation level or at single destination level.

For a procedure to define a virtual workstation including previously used destinations, see "Using virtual workstations" on page 54.

Fault-tolerant workstations

In IBM Workload Scheduler for z/OS, a fault-tolerant agent is a computer workstation configured to schedule jobs on a distributed agent. Thus, you use a fault-tolerant agent so that you can schedule jobs on computers in the IBM Workload Scheduler network.

When you create a fault-tolerant agent, you must define it in the database and also in the CPUREC initialization statement in the parameter library. For more information about initialization statements and fault-tolerant agents, see *Scheduling End-to-end with Fault Tolerance Capabilities*.

IBM Workload Scheduler for z/OS Agent workstations

An IBM Workload Scheduler for z/OS Agent is a computer automatic workstation and has the Z-CENTRIC AGENT option in the panel shown in Figure 35 on page 57 set to Y. IBM Workload Scheduler for z/OS Agents are distributed workstations that run jobs scheduled from IBM Workload Scheduler for z/OS. Like fault-tolerant agents, they are installed in an IBM Workload Scheduler distributed domain. Unlike fault-tolerant agents, they do not:

- Have fault tolerance
- Require the end-to-end server
- Need topology definitions

Communication with the agents is handled directly by the controller.

An IBM Workload Scheduler for z/OS Agent is a computer running the IBM Workload Scheduler agent. For more information about the end-to-end scheduling with z-centric capabilities environment, see *IBM Workload Scheduler for z/OS: Scheduling End-to-end with z-centric Capabilities*.

Dynamic workstations

A dynamic workstation is a computer automatic workstation and has the DYNAMIC option in the panel shown in Figure 35 on page 57 set to Y. Dynamic workstations are associated to the dynamic workload broker component that can schedule dynamic jobs in a z-centric end-to-end configuration. You associate the dynamic workstation to the dynamic workload broker component by specifying an

HTTP or HTTPS destination in the ROUTOPTS statement. For details, see the description of the ROUTOPTS statement in *IBM Workload Scheduler for z/OS: Customization and Tuning*.

You define the dynamic workstation options in the WORKSTATION END-TO-END OPTIONS panel. Depending on your choice in this panel, you can have one of the following scenarios:

- If you select the BROKER option in the WORKSTATION END-TO-END OPTIONS panel, you can submit dynamic jobs by writing in the IBM Workload Scheduler for z/OS JCLs only the job name of the dynamic jobs. The dynamic jobs have been previously defined using the Dynamic Workload Console or the broker command line. This method is known as submission by reference because you only need to reference the job you want to submit, without having to write or import the whole job into the JCL.
- If you select the POOL option in the WORKSTATION END-TO-END OPTIONS panel, you can submit standard z-centric jobs to a pool of agents managed by the dynamic workload broker component. You can define the pool using the Dynamic Workload Console or the broker command line, and identify the pool in the IBM Workload Scheduler for z/OS workstation using ISPF panels or the Dynamic Workload Console.
- If you select the D-POOL option in the WORKSTATION END-TO-END OPTIONS panel, you can submit standard z-centric jobs with the added value of the resource requirements specified in the database. You can define the dynamic pool using the Dynamic Workload Console or the broker command line, and identify the dynamic pool in the IBM Workload Scheduler for z/OS workstation either using ISPF panels or the Dynamic Workload Console.

Alternate workstations

When you specify a job or started-task computer workstation as an alternate workstation for another workstation of the same type, try to ensure that their configurations are symmetrical. IBM Workload Scheduler for z/OS assumes this for special resources; you do not have to specify that resources are connected to alternate workstations.

An advantage of symmetry is that two workstations can be alternates for each other.

Printer workstations

With a printer workstation you can track (but not control) the production of print output. When a output group, tracked by IBM Workload Scheduler for z/OS, stops printing, IBM Workload Scheduler for z/OS is notified by an event record, and the corresponding operation is set to completed status. If the print operation completes successfully, any successor operations can be started.

General workstations

A general workstation lets you control operations that are normally not controlled automatically. To do this, the operation can create events to notify IBM Workload Scheduler for z/OS of its status, or an operator can report the status manually. For operations and workstations that are associated with z/OS jobs and started tasks, these events are created automatically by JES and SMF exits. On computer workstations with other non-z/OS operating systems, events are also created automatically. Operations that are specified to run on general workstations, or

computer workstations that have a user-defined destination, must use one of several methods to inform IBM Workload Scheduler for z/OS of the operation status:

- IBM Workload Scheduler for z/OS ISPF panels
- The TSO command OPSTAT, used either in TSO, or in a CLIST or REXX EXEC
- The EQQEVPGM batch program, using the OPSTAT command as input
- The program interface
- The EQQUSIN subroutine, which lets you create events from your own programs

IBM Workload Scheduler for z/OS also uses three special general workstations to perform these tasks:

- Set up JCL for jobs and started tasks
- Issue WTO messages, possibly to trigger action by NetView
- Create dummy operations that run for specified periods of time (WAIT option).

When you add an operation that is defined on a general non reporting workstation to the current plan, the estimated duration of the instance is automatically set to 1 second, regardless of the value that is set in the operation definition. This rule applies for all general non reporting workstations, except the WAIT workstations.

Job setup general workstations

A job setup general workstation has the JOB SETUP option in the panel shown in Figure 35 on page 57 set to Y. The job setup workstation lets you prepare your job or started-task JCL manually before execution. Any variables in your JCL are resolved either automatically from information in the IBM Workload Scheduler for z/OS databases or manually using the panels. You do not need a job setup workstation if IBM Workload Scheduler for z/OS can resolve all the variables automatically.

To select an operation for setup, specify N (set next logical status) next to the job setup operation on the ready list.

In IBM Workload Scheduler for z/OS, the job setup operation must be an immediate predecessor of the computer workstation operation for the job. When you have prepared the job, the job operation can be started if it is not waiting for other predecessors.

If the setup operation has more than one succeeding processor operation with the same job name, IBM Workload Scheduler for z/OS displays a list of the operations that you can choose from.

WTO general workstations

A WTO general workstation has the WTO option in the panel shown in Figure 35 on page 57 set to Y. A WTO workstation lets you use the extensive scheduling and calendar facilities to issue a write-to-operator (WTO) message at the designated destination operator console. When an operation at a WTO workstation is started, IBM Workload Scheduler for z/OS builds a WTO message containing the text for the operation. NetView can then intercept the WTO message and take necessary action.

IBM Workload Scheduler for z/OS attempts to automatically dispatch a WTO operation when it becomes ready; however, like operations at any workstation, the scheduling criteria for the operation must be met before the operation can be started.

WAIT general workstations

A WAIT workstation is a general non reporting workstation with the WAIT option set to Y in the panel shown in Figure 35 on page 57. Using a WAIT workstation you can create a dummy operation that runs for a specified period of time. This time period is defined as the duration of the operation.

You can insert dummy operations on wait workstations between two dependent operations to obtain a controlled delay within a sequence.

Operations started on wait workstations have the extended status set to Executing on a WAIT workstation to remind users that a delay in the defined sequence of operations is occurring.

Note: To change your system local time while operations are active on a WAIT workstation, *do not* use the command `/SET DATE=yyyy.ddd,CLOCK=hh.mm.ss` because setting the seconds could cause the operation to delay or anticipate its completion by 1 minute. Change your system local time by using the command:

```
/SET TIMEZONE=W/E.hh.mm
```

Remote engine workstations

Use remote engine workstations if you want to define in your scheduling environment dependencies from batch activities managed by other IBM Workload Scheduler environments. This kind of dependencies is called *cross dependencies*.

The remote engine workstation manages the exchange of information about cross dependencies resolution between your environment and a remote IBM Workload Scheduler for z/OS engine (controller) or an IBM Workload Scheduler engine (master domain manager).

To define a cross dependency between a job defined in your environment and another job defined on a different IBM Workload Scheduler engine, you must add a dependency from a *shadow job* defined on the remote engine workstation. Using an HTTP or HTTPS connection, the remote engine workstation requests the remote engine to identify in the plan the specific job instance that must be bound with the shadow job. The IBM Workload Scheduler for z/OS controller is then notified about any changes of status related to the remote job instance. These status changes are mapped into shadow job status changes to allow you to track locally the remote dependency resolution. For more information about shadow jobs, see "Specifying remote job information in shadow jobs" on page 174.

Because remote engine workstations use the HTTP or HTTPS protocol to let the IBM Workload Scheduler environments communicate, before defining a new remote engine workstation, you must define in ROUTOPTS a destination for the remote scheduling environment. The destination must be specified in the remote engine workstation definition. For more details, see "Specifying remote engine workstations" on page 66.

If the remote IBM Workload Scheduler environment is z/OS based, a single HTTP address is sufficient to manage in a transparent way failover scenarios because the configuration with a hot standby controller is supported through VIPA and controller and standby controller listen on the same hostname and port.

Guidelines for creating workstations

Here are some guidelines for the workstations you might want to create. Remember that these are only guidelines and should be adapted to your installation. Keep the model as simple as possible.

Note: Do not delete a workstation description or change its type if it has operations defined to it. First, request a report detailing the operations that use that particular workstation and would therefore be affected by the change. To request the report, use fastpath 1.4.4.3.

When updating a workstation description, changes to certain fields will never take effect in the current plan as long as that workstation exists in the plan: the old definition is always carried forward. These fields are workstation type, option (AUTOMATION and FAULT-TOLERANT AGENT only) reporting attribute, control on servers, control on resources 1 and 2, and closed status. If you need the change to be reflected in the plan, make the same change in the plan using the MODIFYING CURRENT PLAN (MCP) panel.

Which workstation types are needed?

Although you must create at least one workstation to enable IBM Workload Scheduler for z/OS to run, you do not need all workstation types. Create the workstation types that fit the workload that runs at your installation. For example, if certain operations are dependent on the completion of prints produced by other operations, use a printer workstation. However, if the production of prints does not have any great impact on the running of the rest of your workload, you probably do not require a printer workstation.

Because the main function of IBM Workload Scheduler for z/OS is to control jobs and started tasks, at least two computer workstations will probably be required at any installation running IBM Workload Scheduler for z/OS: one for jobs and one for started tasks.

Use a remote engine workstation if you need to define dependencies from jobs running on a differentIBM Workload Scheduler environment to accomplish your tasks.

How many workstations of each type?

Your installation configuration influences the number of workstations you need. Normally, you should have two computer workstations for each z/OS system in your complex (one for started tasks and one for jobs). Make the computer workstations available when the z/OS system they represent is available. If you are working in a shared spool environment with one job queue for several systems, you might consider having only two computer workstations for all systems in the JES complex.

Also consider the potential benefits that could be gained by creating further computer workstations to represent a single z/OS system. For example, you could create a computer workstation for IMS™-related batch processing and another for CICS processing. Specifying your operations in this way can give you significantly more control when handling both planned and unexpected outages that do not affect the z/OS system.

If you create individual computer workstations for the unique components of your z/OS batch workload, you have access to the IBM Workload Scheduler for z/OS

controlled shutdown function to facilitate an orderly shutdown for planned outages. In the event of an online system failure and subsequent extended recovery facility (XRF) takeover, you can restart and reroute the workload to the specified alternate system even in situations where the z/OS system remains operational.

Because a remote engine workstation is assigned to an HTTP destination mapping a remote scheduling environment, use one remote engine workstation for each IBM Workload Scheduler engine you need to interoperate with.

Using virtual workstations

About this task

You can define virtual workstations running version 8.3 with APAR PK46296 or higher. The following table shows the supported combinations in terms of controller and tracker components:

	Controller without virtual workstations support	**Controller with virtual workstations support**
Tracker without virtual workstations support	No error message is issued.	• The tracker destination results active, waiting for connection. • EQQE136E error message is issued in the controller message log.
Tracker with virtual workstations support	No error message is issued. The controller ignores some information sent by the tracker.	Normal scenario

Suppose you want to define a unique workstation matching the following JES2 MAS system configuration, including three computer automatic workstations: CPU1 with local destination, CPU2 with destination D2, and CPU3 with destination D3.

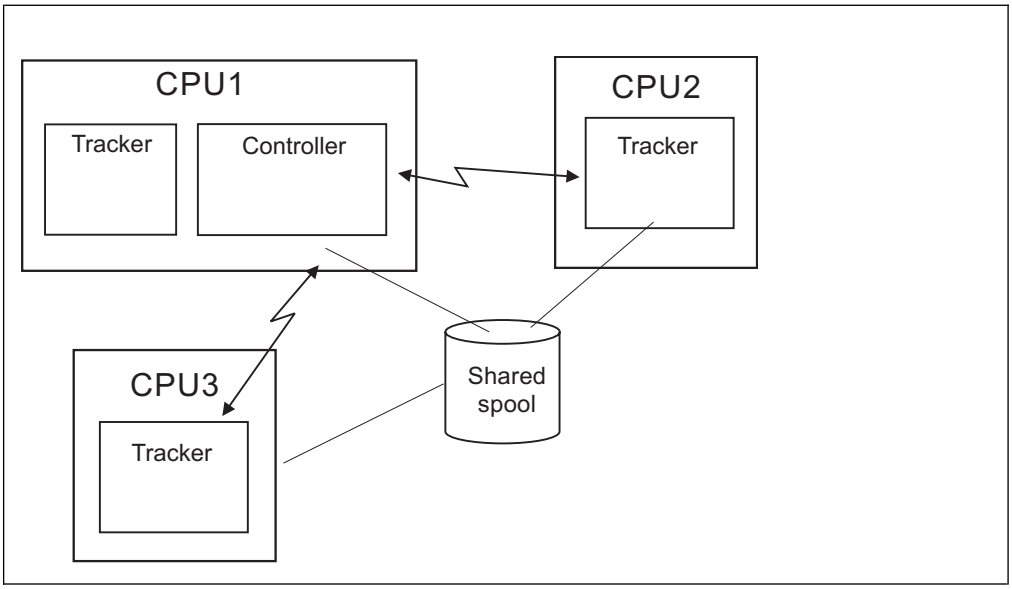


Figure 31. Example of virtual workstation matching a JES2 MAS

You can use the following procedure:

1. Define a computer automatic workstation in the database, with the VIRTUAL option set to Y. In this example, the name of the virtual workstation is V000. Add ******** to the destination list.
2. Save the current definition of the application descriptions. You can save it in a sequential data set, in batch loader format.
3. Using the mass update utility, change from CPU1 to V000 the workstation name for all the operations associated to CPU1.
4. Run a current plan extend or replan process.
5. Verify that the workload scheduling for V000 works as expected.
6. Consider removing CPU1 from the database once no more applications remain in the database referring to it and no associated operations remain in the current plan.
7. Add D2 to the destination list for V000 and iterate, for CPU2, the steps from 2. to 6.
8. Add D3 to the destination list for V000 and iterate, for CPU3, the steps from 2. to 6.

Note:

1. If you activated the WLM interface and use a virtual workstation for an operation that has a scheduling environment defined, all the destinations in that virtual workstation must belong to the same Sysplex and JESplex.
2. Before assigning an operation to a virtual workstation, make sure the job can run correctly on all the destinations, checking for possible JCL errors or security violation on any virtual workstation destination.

Dummy workstations

You can sometimes simplify complex dependencies between operations in your applications by using a dummy workstation and creating dummy operations on it.

For example, assume that operations W, X, Y, and Z are all dependent on operations A, B, C, and D. That is, A, B, C, and D must complete before W, X, Y, or

Z can start. Figure 32 shows this.

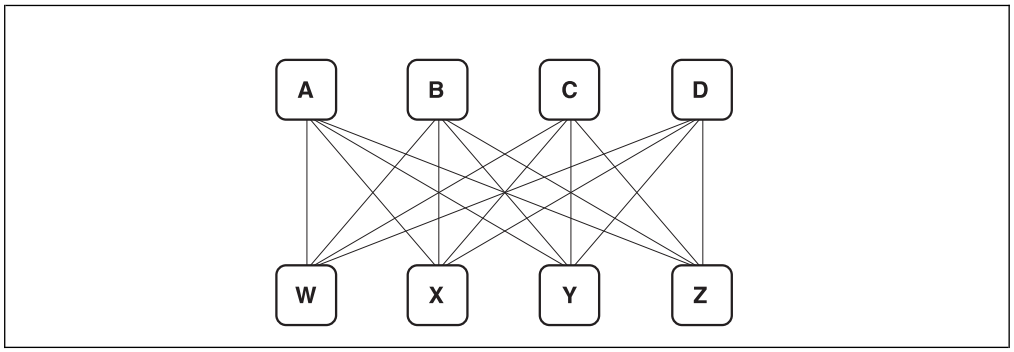


Figure 32. Dependent operations with complex dependencies

This arrangement can be simplified by using a dummy operation, O. You can make O dependent on A, B, C, and D and then make W, X, Y, and Z dependent on O. See Figure 33.

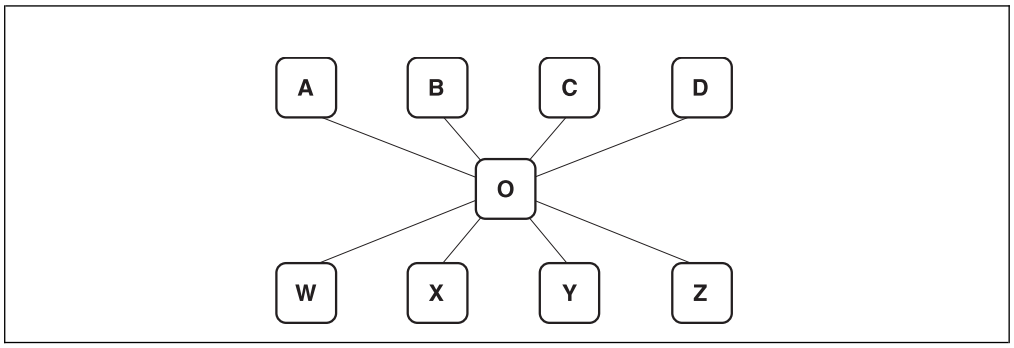


Figure 33. Using a dummy operation to simplify complex dependencies

To create such an operation, first set up a dummy workstation: a general workstation with the REPORTING ATTR field set to N in the panel shown in Figure 35 on page 57. Any operation that becomes ready on a nonreporting workstation is immediately set to status C, complete. If all other conditions are met, any successor operations to this dummy operation can then be started.

You can also create a dummy operation as a separate application, so that its dependencies are all external. This can simplify complicated dependencies between different applications.

In the same way, you can use dummy workstations to insert a delay between two operations in a sequence. Do this by creating operations on wait workstations.

For example, assume that operation B is a successor of operation A and your business policy requires that operation B wait at least 30 minutes before starting. Add a new operation C on a general non-reporting wait workstation. You define this operation as a successor of operation A and as a predecessor of operation B and you set its duration to 30 minutes. When operation A completes, dummy operation C starts and IBM Workload Scheduler for z/OS waits 30 minutes before completing it. Operation B is started only after operation C is complete.

Creating a workstation

About this task

Follow these steps to create a workstation:

1. Access the workstation panel by entering option 1.1 from the main menu. The Maintaining Work Station Descriptions menu is displayed.
2. Select option 2 (LIST). The LIST OF WORKSTATION DESCRIPTIONS panel, shown in Figure 34, is displayed.

```
EQQWMLSL ------------- LIST OF WORK STATION DESCRIPTIONS ----  ROW 1 TO 6
Command ===>                                                 SCROLL ===>

Enter the CREATE command above to create a workstation description or enter
any of the following row commands:
B - Browse, D - Delete, M - Modify, C - Copy.

Row  Work station                          T  R  Last update
cmd  name  description                          user      date
'    CPU1  Main JES processor              C  A  XRAYNER   97/01/30
'    PAY1  payroll office                  G  A  XRAYNER   97/01/30
'    PRT1  Printer pool                    G  A  XRAYNER   97/01/30
'    SETP  Used to prepare JCL             G  N  XRAYNER   97/01/30
'    STC1  Processor for started tasks     C  N  XRAYNER   97/01/30
'    WTO1  Messages for NetView            G  N  XRAYNER   97/01/30
****************************** BOTTOM OF DATA ************************
```

Figure 34. EQQWMLSL - List of workstation descriptions

3. Enter the CREATE command. The CREATING GENERAL INFORMATION ABOUT A WORKSTATION panel, shown in Figure 35, is displayed.

```
EQQWCGEP ----- CREATING GENERAL INFORMATION ABOUT A WORK STATION --------
Command ===>
Enter the command R for resources or A for availability or O for end-to-end
options or D for Destinations above, or enter data below:

WORK STATION NAME   ===> CPU1
DESCRIPTION         ===> Main JES processor_______________
WORK STATION TYPE   ===> C         G  General, C  Computer, P  Printer
                               R  Remote Engine
REPORTING ATTR      ===> A         A  Automatic, S  Manual start and completion
                               C  Completion only, N  Non reporting
PRINTOUT ROUTING    ===> SYSPRINT  The ddname of daily plan printout data set
SERVER USAGE        ===> B         Parallel server usage, B, N, P, or C
DESTINATION         ===> ________  Name of destination
Options: allowed Y or N
 SPLITTABLE         ===> N         JOB SETUP             ===> N
 STARTED TASK, STC  ===> N         WTO                   ===> N
 AUTOMATION         ===> N         FAULT-TOLERANT AGENT  ===> N
 WAIT               ===> N         Z-CENTRIC AGENT       ===> N
 VIRTUAL            ===> N         DYNAMIC               ===> N

REMOTE ENGINE TYPE  ===>           Z z/OS or D Distributed
Defaults:
 TRANSPORT TIME     ===> 00.00     Time from previous work station  HH.MM
 DURATION           ===> 00.05.00   Duration for a normal operation  HH.MM.SS
```

Figure 35. EQQWCGEP - Creating general information about a workstation

4. Complete the fields as described in "Specifying workstation attributes and options" on page 59. Note that:
   - A, O, and R commands are not available when the workstation is an FT workstation.

- O and R commands are not available when the workstation is a remote engine workstation.

5. Enter the A command to specify:

   Workstation availability and open time intervals
   See "Specifying workstation availability" on page 69.

   The number of parallel servers in each time interval
   See "Specifying workstation parallel servers" on page 66.

   The number of fixed resources in each time interval
   See "Specifying workstation fixed resources" on page 73.

   The alternate workstation in each time interval
   For details about how to redirect work, see "Redirecting work to alternate workstations" on page 628.

6. If you are using workstation fixed resources, described in "Specifying workstation fixed resources" on page 73, enter the R command to specify them.
7. If you are creating a virtual workstation, set the VIRTUAL option to Y, then enter the D command to specify a list of destinations associated to this workstation:

```
EQQWMDES -------- MODIFYING VIRTUAL WORKSTATION DESTINATIONS - Row 1 to 1 of 1
Command ===>                                                  Scroll ===> CSR

Change data in the rows, and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat,  D(nn),DD - Delete, or,
A - Availability

Row  Dest.     Parallel Server  Resource 1 Resource 1 Resource 2 Resource 2
cmd  Name      Usage            Usage      Name       Usage      Name
'''' VDEST2__  N                N          R1         N          R2
'''' ********  N                N          R1         N          R2
****************************** Bottom of data ********************************
```

Figure 36. EQQWMDES - Modifying virtual workstation destination

   To indicate the system where the controller and a local tracker run, specify ******** in the destination name field.

8. Enter the A row command to specify the destination availability and open time intervals:

```
EQQWMAVV -------------- AVAILABILITY OF A WORK STATION ------- Row 1 to 8 of 8
Command ===>                                                  Scroll ===> CSR

Work station            : VWS1
Destination             : VDEST2

Enter the ALL command above to get all open time intervals or
change data in the rows, and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat,  D(nn),DD - Delete
C - Close a day/date, S - Define open intervals for a day/date

Row     Day of week or   Status            Description of day
cmd     YY/MM/DD
''''    STANDARD______   DEFINED           ____________________________
''''    MONDAY________   STANDARD          ____________________________
''''    TUESDAY_______   STANDARD          ____________________________
''''    WEDNESDAY_____   STANDARD          ____________________________
''''    THURSDAY______   STANDARD          ____________________________
''''    FRIDAY________   STANDARD          ____________________________
''''    SATURDAY______   STANDARD          ____________________________
''''    SUNDAY________   STANDARD          ____________________________
****************************** Bottom of data ********************************
```

Figure 37. EQQWMAVV - Availability of a workstation

The same concepts apply as in the "Specifying workstation availability" on page 69, but instead of a workstation, here, it is a destination that is defined as available or not available.

9. To change the STANDARD open interval, and to create other open intervals, and the associated number of resources, enter the ALL command. The ALL OPEN TIME INTERVALS panel is displayed:

```
EQQWMTAL ------------------ ALL OPEN TIME INTERVALS ---------- Row 1 to 1 of 1
Command ===>                                                  Scroll ===> CSR

Work station            : VWS1
Destination             : VDEST2

Change data in the rows, and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat,  D(nn),DD - Delete

Row    Day of week or    Open time interval    Parallel   Resources
cmd    YY/MM/DD           HH.MM   -   HH.MM    servers     R1   R2
''''   STANDARD______     00.00       24.00     65535      99   99
****************************** Bottom of data ********************************
```

Figure 38. EQQWMTAL - All open time interval

The same concepts apply as in "Specifying workstation open intervals" on page 70, but instead of a workstation, here, it is a destination that is defined as available or not available.

Note: You can specify a value up to 65535 in the Parallel servers field.

10. If you are creating a dynamic workstation, set the DYNAMIC option to Y, then enter the O command to specify the end-to-end options associated to this workstation. For details, see "Specifying dynamic workstations" on page 63.

Specifying workstation attributes and options

You also specify these workstation attributes and options:

- Reporting attributes
- Parallel servers
- Splittable attribute

- Destination
- Default transport time
- Default duration
- Use of a fault-tolerant agent

These are described in the following sections. See also Table 1 on page 12 for the attributes used for the Paymore example.

Specifying workstation reporting attributes

Every operation in the current plan is assigned a status. The status of an operation describes its current condition. When all processing for an operation is finished, the operation is assigned status C (complete). Before it reaches completion, the operation will have many different statuses as it progresses through the system.

IBM Workload Scheduler for z/OS changes the status of the operation in response to:
- JES and SMF exits
- IBM Workload Scheduler for z/OS panel requests
- The EQQUSIN subroutine
- The program interface
- The OPSTAT and WSSTAT TSO commands

The sequence of statuses that an operation is assigned and the mechanism used for reporting status updates depends on the reporting attribute of the workstation the operation is defined on.

A workstation can have one of four reporting attributes:

A Automatic.

The status change of operations is normally reported automatically, in response to event records created by the JES and SMF exits in IBM Workload Scheduler for z/OS. You can also change the status of these operations using the panels, the OPSTAT command, the EQQUSIN subroutine, the EQQEVPGM batch program, or the program interface. This reporting attribute is normally used for computer and print workstations, or workstations that specify a user-defined destination.

When a general workstation with the WTO option is assigned automatic reporting, IBM Workload Scheduler for z/OS attempts to dispatch the operation as soon as all normal submission criteria have been satisfied. When the WTO has been submitted, the status is set to SQ. Use this attribute for synchronous WTO operations, where you want successor operations to wait until actions (that NetView, for example, takes when it intercepts the WTO) are reported complete. When you want the successor operations to run, report C (Complete) status using, for example, the OPSTAT command. If you need to measure the elapsed time of the operation that the WTO triggers, report S status when you want the timing to start (this changes the status to SS).

If an operation at an automatically reporting workstation is set to started status manually, this will not cause IBM Workload Scheduler for z/OS to submit the job, started task or WTO that the operation represents. IBM Workload Scheduler for z/OS selects work to be started from the queue of ready operations: those operations in A, R, or * status.

C Completion only.

The status change of operations is normally reported from the READY LIST panel. You can also change the status of operations with the OPSTAT command, the EQQUSIN subroutine, the EQQEVPGM batch program, or the program interface. This reporting attribute is normally used for general workstations that are not used for JCL preparation.

When a general workstation with the WTO option is assigned completion-only reporting, IBM Workload Scheduler for z/OS attempts to dispatch the operation as soon as all normal submission criteria have been satisfied. Use the completion-only attribute when you want to trigger actions asynchronously. When the WTO has been submitted, IBM Workload Scheduler for z/OS automatically sets the status to C (completed), so successor operations can run immediately.

N Non reporting.

Operations on a non-reporting workstation are set to complete as soon as they become eligible to be started. No job, started task, or WTO is submitted; instead the operation is set to completed status. You can use this reporting attribute for operations that do not require any processing. For example, the operations can be used to hold the dependencies for successors, or the operation might represent a milestone in the processing. This is a good way to keep track of the important processing points in large installations.

When a general work station with non-reporting attribute has the WAIT option, IBM Workload Scheduler for z/OS does not complete the operation as soon as it becomes eligible. The operation is started and remains in started status for the time defined as operation duration.

This type of workstation is often used for dummy operations created to simplify the sequencing of other operations. (See "Dummy workstations" on page 55.)

S Start and completion.

The status change of operations is normally reported from the READY LIST panel. You can also change the status of operations with the OPSTAT command, the EQQUSIN subroutine, the EQQEVPGM batch program, or the program interface. This reporting attribute is normally used for general workstations that are used for JCL preparation, or for other general workstations where the duration of the task needs to be tracked. You should consider using this reporting attribute for operations on a data entry workstation, where the operation represents a task that must be performed manually, and the duration of the task is important.

For general workstations with the WTO option, this has the same effect as automatic reporting.

Specifying fault-tolerant or IBM Workload Scheduler for z/OS Agent workstations

You define fault-tolerant agents or IBM Workload Scheduler for z/OS Agent workstations when you want to schedule jobs on non-z/OS systems using IBM Workload Scheduler distributed agents. In IBM Workload Scheduler for z/OS, fault-tolerant agents and IBM Workload Scheduler for z/OS Agent workstations are computer automatic workstations configured to schedule jobs on distributed agents that run on Windows, UNIX, or Linux.

Both fault-tolerant and IBM Workload Scheduler for z/OS Agent workstations share some of the same properties with other workstations. Table 4 summarizes the settings for a fault-tolerant agent:

Table 4. Settings for fault-tolerant workstations

Field	Value	Value Description
Workstation type	C	Computer
Reporting attribute	A	Automatic
Started task, STC	N	No
Server usage	N	Neither
Destination	Blank	–

Table 5 summarizes the settings for an IBM Workload Scheduler for z/OS Agent workstation:

Table 5. Settings for IBM Workload Scheduler for z/OS Agent workstations

Field	Value	Value Description
Workstation type	C	Computer
Reporting attribute	A	Automatic
Started task, STC	N	No
Server usage	N	Neither
Destination	Alphanumerical string of up to 8 characters	The destination name that was defined with the HTTP parameter in the ROUTOPTS statement. You can add, modify, or delete the destinations. For details, see the description of the ROUTOPTS statement in *IBM Workload Scheduler for z/OS: Customization and Tuning*.
Job user (JOBUSR)	Alphanumerical string of up to 47 characters	For J2EE jobs, the WebSphere® Application Server administrator. For all the other jobs, the name of the user submitting the job. If the user schedules jobs to run on Windows workstations, ensure that a user password is also defined. If you are defining a Windows domain user, use the following format: `JOBUSR(domainName\user1)` It can be overwritten by the user specified either through EQQUX001 or in a JOBREC statement in the job JCL.

Table 5. Settings for IBM Workload Scheduler for z/OS Agent workstations (continued)

Field	Value	Value Description
Job password (JOBPWD)	Y, N, or A	Specifies if the user name entered in JOBUSR or set by using the job-submit exit EQQUX001 is associated with a password. If you set JOBPWD to `Y`, IBM Workload Scheduler for z/OS searches for the user password in the USRPSW keyword of the USRREC statement. For details, see the description of the USRREC statement in *IBM Workload Scheduler for z/OS: Scheduling End-to-end with z-centric Capabilities*. If you set JOBPWD to `A`, this means that the password is resolved locally on the agent. The password must have been defined on the agent by means of the `param` command. For details, see the description of the `param` command in *IBM Workload Scheduler for z/OS: Scheduling End-to-end with z-centric Capabilities* Typically, the password is required for users who schedule jobs to run on Windows workstations. Set JOBPWD to `N` if the user works with UNIX workstations and does not run job types with advanced options (only native job types). Valid values are `Y`, `N`, or `A`. The default is `Y`. It can be overwritten by the user specified in a JOBREC statement in the job JCL.
Job type (JOBTYPE)		The type of job to be run. Supported job types are: • native • database • file transfer • web service • java • xajob • j2ee jms It can be overwritten by the user specified in a JOBREC statement in the job JCL. For information about supported job types, see the description of the JOBREC statement in *IBM Workload Scheduler for z/OS: Scheduling End-to-end with z-centric Capabilities*

Specifying dynamic workstations

You define dynamic workstations to schedule distributed jobs in a z-centric end-to-end configuration. Dynamic workstations are associated to the dynamic workload broker component that can schedule distributed jobs in a z-centric end-to-end configuration. You associate the dynamic workstation to the dynamic workload broker component by specifying an HTTP or HTTPS destination in the

ROUTOPTS statement. For details, see the description of the ROUTOPTS statement in *IBM Workload Scheduler for z/OS: Customization and Tuning*.

The dynamic workstations share some of the same properties with other workstations.

Table 6 summarizes the settings for a dynamic workstation:

Table 6. Settings for dynamic workstations

Field	Value	Value Description
Workstation type	C	Computer
Reporting attribute	A	Automatic
Started task, STC	N	No
Server usage	N	Neither. Supported values are: Parallel server usage, B, N, P, or C
Destination	Alphanumerical string of up to 8 characters	The destination name that was defined with the HTTP parameter in the ROUTOPTS statement. You can add, modify, or delete the destinations. For details, see the description of the ROUTOPTS statement in *IBM Workload Scheduler for z/OS: Customization and Tuning*.
Job user (JOBUSR)	Alphanumerical string of up to 47 characters	For J2EE jobs, the WebSphere Application Server administrator. For all the other jobs, the name of the user submitting the job. If the user schedules jobs to run on Windows workstations, ensure that a user password is also defined. If you are defining a Windows domain user, use the following format: `JOBUSR(`*`domainName`*`\user1)` It can be overwritten by the user specified either through EQQUX001 or in a JOBREC statement in the job JCL.

Table 6. Settings for dynamic workstations (continued)

Field	Value	Value Description
Job password (JOBPWD)	Y, N, or A	Specifies if the user name entered in JOBUSR or set by using the job-submit exit EQQUX001 is associated with a password. If you set JOBPWD to `Y`, IBM Workload Scheduler for z/OS searches for the user password in the USRPSW keyword of the USRREC statement. For details, see the description of the USRREC statement in *IBM Workload Scheduler for z/OS: Scheduling End-to-end with z-centric Capabilities*. If you set JOBPWD to `A`, this means that the password is resolved locally on the agent. The password must have been defined on the agent by means of the `param` command. For details, see the description of the `param` command in *IBM Workload Scheduler for z/OS: Scheduling End-to-end with z-centric Capabilities* Typically, the password is required for users who schedule jobs to run on Windows workstations. Set JOBPWD to `N` if the user works with UNIX workstations and does not run job types with advanced options (only native job types). Valid values are `Y`, `N`, or `A`. The default is `Y`. It can be overwritten by the user specified in a JOBREC statement in the job JCL.
Job type (JOBTYPE)		The type of job to be run. Supported job types are: • native • database • file transfer • web service • java • xajob • j2ee jms It can be overwritten by the user specified in a JOBREC statement in the job JCL. For information about supported job types, see the description of the JOBREC statement in *IBM Workload Scheduler for z/OS: Scheduling End-to-end with z-centric Capabilities*
BROKER		Specifies that the workstation is associated to the dynamic workload broker component and can schedule distributed jobs in a z-centric end-to-end configuration. Supports the submission by reference of jobs defined locally on the dynamic workload broker component. Valid values are `Y`, `N` or blank.

Table 6. Settings for dynamic workstations (continued)

Field	Value	Value Description
POOL		The name of the pool of dynamic workload broker component agents associated to this workstation.
D-POOL		The name of the dynamic pool meeting the resource requirements associated to this workstation.

Specifying remote engine workstations

You define a remote engine workstation if you want to federate your IBM Workload Scheduler for z/OS environment with another IBM Workload Scheduler environment, either distributed or z/OS based, to add and monitor dependencies from jobs running in the other scheduling environment.

Table 7 summarizes the settings for a remote engine workstation:

Table 7. Settings for remote engine workstations

Field	Values	Value description
Remote engine type	Z or D	Z for z/OS remote engine, D for distributed remote engine
Destination	Alphanumerical string of up to 8 characters	The destination name defined with the HTTP or HTTPS parameter in the ROUTOPTS statement. You can add, modify, or delete the destinations. For details, see the description of the ROUTOPTS statement in *IBM Workload Scheduler for z/OS: Customization and Tuning*.
Reporting attribute	A	Automatic

For more information see section "Remote engine workstations" on page 52.

Specifying workstation parallel servers

When you create an operation, you specify how many parallel servers it requires (see "Using parallel servers" on page 160). The workstation that the operation is using must have that number of parallel servers available before the operation can run. This option does not apply to fault-tolerant agents.

The number of parallel servers a workstation owns limits the number of operations that can be in started status at any time. You set this value when you create the workstation (see Figure 42 on page 71), but you can change it using the MODIFY CURRENT PLAN (MCP) panel.

You can specify, by setting server usage = P (planning only), that the number of parallel servers should not be considered when IBM Workload Scheduler for z/OS is deciding when to start an operation. If you do this, the number of parallel servers will be used only for planning purposes, and the plans that IBM Workload Scheduler for z/OS produces cannot accurately predict the behavior of real work in your system, because IBM Workload Scheduler for z/OS will submit as many jobs as are ready, regardless of its count of the number of servers in use. It is better

to specify server usage = B (both planning and control), so that IBM Workload Scheduler for z/OS submits jobs only up to the limit of the number of servers specified.

Operations defined to a computer workstation must allocate at least one parallel server.

If you specify a server usage of B (both) or C (control only), the number of *parallel servers* required by the operation must also be available on the workstation for the operation to be started. So the number of computer workstations and their availability are important factors when you specify your system to IBM Workload Scheduler for z/OS.

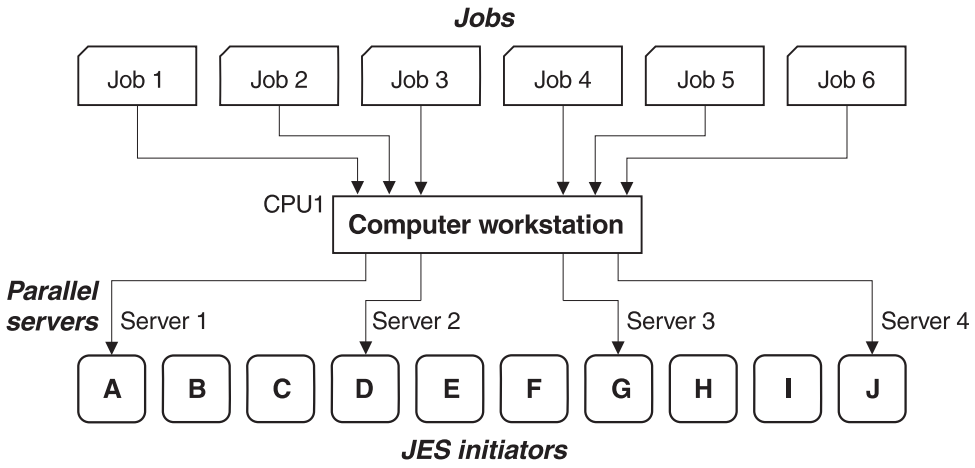


Figure 39. Computer workstation with server usage set to B or C, controlling job submission

In Figure 39, jobs 1 through 6 were defined on an IBM Workload Scheduler for z/OS (tracker) computer workstation, CPU1, which has four parallel servers. Server usage B was specified for this workstation. This means that CPU1 can start only four of the six waiting jobs, even though there are several JES initiators free to run the jobs that are waiting. It selects the jobs using the algorithm described in Chapter 15, "How work is selected for automatic submission," on page 331.

Specifying splittable workstations

A workstation is described as *splittable* if operations on the workstation can be interrupted and then continued at a later time. A good candidate for this attribute is a *job setup general workstation* where you prepare JCL for submission. If the preparation of the JCL is interrupted by the person issuing the TSAVE command, the operation is given status I, interrupted. Preparation of the JCL can continue at a later time.

Printer workstations can also be splittable, but operations on computer workstations cannot be split.

Specifying workstation destinations

For workstations representing computer systems (computer workstations and WTO general workstations), the destination is the tracker. The tracker can communicate with the controller in several ways:

- Shared DASD containing an IBM Workload Scheduler for z/OS SUBMIT/RELEASE data set

- z/OS cross-system coupling facility (XCF) communication links
- A VTAM connection and the network communication function (NCF) of the tracker
- A TCP/IP communication link
- A user-defined method invoked from the operation-initiation exit, EQQUX009

Therefore, you can specify the destination as:
- The ddname of a SUBMIT/RELEASE data set
- The XCF member name of a tracker
- The NCF receiving LU name of a tracker
- The logical name associated with the IP address or host name of the tracker
- A user-defined name

For workstations representing a remote engine, an IBM Workload Scheduler for z/OS Agent, or a dynamic domain manager, which are directly connected to the controller, the destination is defined by the fully-qualified host name or TCP/IP address and the port number of the agent. The remote engine, IBM Workload Scheduler for z/OS Agent, and dynamic domain manager, communicate with the controller through an HTTP/HTTPS communication link.

When you create a workstation, specify a destination that corresponds to a destination specified in the ROUTOPTS initialization statement (for details about this statement, see *Customization and Tuning*). The default destination is the system where the controller is started.

Specifying the default workstation transport time

The *transport time* for an operation is the time that the system should allow between the end of a predecessor operation and the beginning of the present operation. This is the time needed for materials to be transported from one workstation to another.

For example, a tape might be written by operation A in New York and be required by operation B in Chicago. Both sites are controlled by IBM Workload Scheduler for z/OS. The transport time of operation B is the time that should be allowed for the tape to be transported from New York to Chicago.

The transport time of the workstation is the default transport time for all operations defined on that workstation. You can override this by specifying a transport time when you create an operation.

Note: The transport time is used only for planning purposes. Jobs, for example, are started regardless of the transport time specified. Transport time is not used even in planning if the predecessor and successor operations are on the same workstation.

Specifying the default duration

The duration specified for the workstation is the default estimated processing time for all operations on that workstation. You can override this by specifying a duration when you create an operation. The minimum value is one second, and the maximum value is 99 hours 59 minutes 00 seconds. If you specify 99 hours 59 minutes 01 seconds, you do not receive an alert message if the actual duration is greater than the planned duration.

IBM Workload Scheduler for z/OS uses the estimated processing time when creating the current plan, to work out a timetable for the operations. Each operation has a:

- Planned start time
- Latest start time
- Planned end time

It is not necessary to give an accurate figure, because IBM Workload Scheduler for z/OS can adjust this figure dynamically from its experience of the actual durations (see "Options that apply to all operations" on page 165).

Specifying the Automation option

Set the AUTOMATION option to YES to enable the workstation to send commands to System Automation. Enter the command text and any additional automation information in the EQQAMAIP or EQQMMAIP panel. For details about these panels, see "Creating a workstation" on page 57.

Note: The Automation option requires that the workstation type is general and the reporting attribute is automatic. The Automation option is incompatible with setting the workstation options FTA, WTO, STC, JCL, and Z-CENTRIC AGENT.

To select the target NetView by using a workstation, you can either:

- Use the correspondence between the workstation name and the target NetView domain ID that is set in the System Automation database.
- In the Destination field of the EQQWCGEP panel, specify the NetView target domain ID where to run the commands. In this case, you must also define this destination to IBM Workload Scheduler for z/OS by setting the destination parameter in the ROUTOPTS USER statement of the controller.

Specifying workstation availability

Some workstations are not available 24 hours every day; IBM Workload Scheduler for z/OS can run work on the workstation only when it is available. When it is unavailable, either as scheduled or unexpectedly, IBM Workload Scheduler for z/OS can reroute work to an alternate workstation. This feature does not apply for scheduling a job on non-z/OS systems using a fault-tolerant agent. Fault-tolerant workstations are always available.

To be available for work, a workstation must be open, active, and connected. To specify when a workstation is available for processing, enter the A command on the CREATING GENERAL INFORMATION ABOUT A WORKSTATION panel (Figure 35 on page 57). This panel is displayed:

```
EQQWMAVL -------------- AVAILABILITY OF A WORK STATION ------  ROW 1 TO 8
Command ===>                                                  Scroll ===>

Work station            : CPU1          Main JES processor

Enter the ALL command above to get all open time intervals or
change data in the rows, and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat,  D(nn),DD - Delete
C - Close a day/date, S - Define open intervals for a day/date

Row     Day of week or   Status            Description of day
cmd     YY/MM/DD
''    STANDARD______   DEFINED          ____________________________
''    MONDAY________   STANDARD         ____________________________
''    TUESDAY_______   STANDARD         ____________________________
''    WEDNESDAY_____   STANDARD         ____________________________
''    THURSDAY______   STANDARD         ____________________________
''    FRIDAY________   STANDARD         ____________________________
c''   SATURDAY______   STANDARD         ____________________________
''    SUNDAY________   STANDARD         ____________________________
****************************** BOTTOM OF DATA *************************
```

Figure 40. EQQWMAVL - Availability of a workstation

In Figure 40, one open interval, called STANDARD, is created, and all days use this interval. To close the workstation on Saturday, enter the C command beside this row, as shown.

If you enter the S row command on a row that refers to the STANDARD interval (such as TUESDAY in Figure 40), the OPEN TIME INTERVALS FOR ONE DAY panel, shown in Figure 41, is displayed.

```
EQQWMOTL -------------- OPEN TIME INTERVALS FOR ONE DAY -----  ROW 1 TO 1 OF 1
Command ===>                                                  Scroll ===> PAGE

Work station             : CPU1             Main JES processor
Day or specific date     : TUESDAY
All work station closed  : NO

Change data in the rows, and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat,  D(nn),DD - Delete

Row    Open time interval          Parallel   Resources    Alternate
cmd    HH.MM   -   HH.MM           servers     R1   R2     Work Station
''     _____       _____            00       00   00      ____
****************************** BOTTOM OF DATA ******************************
```

Figure 41. EQQWMOTL - Open time intervals for one day

If you press F3 (Exit) in this panel without specifying an open interval, the workstation will be closed for that day. Use F12 (Cancel) to leave the day connected to the STANDARD interval.

Specifying workstation open intervals

Before IBM Workload Scheduler for z/OS can start an operation, the workstation that the operation is defined on must be available. So, by controlling workstation availability, you control the running of operations defined on the workstation. IBM Workload Scheduler for z/OS establishes the availability of a workstation by using the *open intervals* in the workstation description database. These are the times when workstation resources and parallel servers are available to process work. If no parallel servers or resources are available, no work is run at the workstation.

In IBM Workload Scheduler for z/OS, workstations are usually created to represent specific elements in your system configuration; the availability of these workstations should reflect the availability of those elements in the real world. For instance, a computer workstation might be created for each z/OS system in an IBM Workload Scheduler for z/OS complex. See "How many workstations of each type?" on page 53. So, the availability of the computer workstation should reflect the availability of the z/OS system it represents. This prevents IBM Workload Scheduler for z/OS from submitting work to a z/OS system that is not physically available. Also, the accuracy of any planning predictions that IBM Workload Scheduler for z/OS produces for you depends on how accurately you have described your installation to IBM Workload Scheduler for z/OS.

To change the STANDARD open interval, and to create other open intervals, and the associated number of resources, enter the ALL command on the AVAILABILITY OF A WORKSTATION panel (Figure 40 on page 70). The ALL OPEN TIME INTERVALS panel will then be displayed.

```
EQQWMATL ------------------ ALL OPEN TIME INTERVALS --------------  ROW 1 OF 7
Command ===>                                                 Scroll ===> PAGE

Work station             : CPU1             Main JES processor

Change data in the rows, and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat,  D(nn),DD - Delete

Row    Day of week or    Open time interval    Parallel   Resources   Alt.
cmd    YY/MM/DD           HH.MM   -   HH.MM    servers     CR   R2    WS
''   STANDARD_______      00.00       06.00       21       26   06    CPU2
''   STANDARD_______      06.00       16.00       13       26   06    CPU2
''   STANDARD_______      16.00       18.30       21       26   06    CPU2
''   STANDARD_______      18.30       24.00       25       26   06    CPU2
''   SUNDAY_________      00.00       08.00       10       26   06    CPU2
''   SUNDAY_________      08.00       16.00       00       00   00    CPU2
''   SUNDAY_________      16.00       24.00       10       26   06    CPU2
****************************** BOTTOM OF DATA ********************************
```

Figure 42. EQQWMATL - All open time intervals

Figure 42 shows four intervals for STANDARD, and three intervals for SUNDAY. The CPU1 workstation has its availability and resources specified by STANDARD from Monday to Friday, it is closed on Saturday, and its availability and resources on Sunday are specified by the three SUNDAY intervals.

Closing workstations

Work and free days, as specified in the IBM Workload Scheduler for z/OS calendar, are used by IBM Workload Scheduler for z/OS to decide whether applications should be scheduled to start on a particular day. IBM Workload Scheduler for z/OS must also consider the availability of workstations. It takes this information from the workstation description database. Before it schedules an operation, IBM Workload Scheduler for z/OS checks that the workstation on which the operation will run is available throughout the estimated run time of the operation. Whether IBM Workload Scheduler for z/OS starts the operation depends on the result of this check and the *shutdown policy* that you have specified in the SHUTDOWNPOLICY parameter of the JTOPTS initialization statement (for details about JTOPTS, see *Customization and Tuning*). Note that workstations must be defined with the option CONTROL ON SERVERS=Y to make SHUTDOWNPOLICY work and to prevent jobs from being submitted when the workstations are closed.

When you have a holiday, which is specified in the calendar as a free day, IBM Workload Scheduler for z/OS does not schedule operations on that day (unless the run cycle specifies free day rule = 3), but it schedules operations right up to the end of the previous day, regardless of their estimated duration. This might be what you want.

But when you have a z/OS maintenance period, for example, you want to avoid having any jobs running at the start of the period. In this case, make the workstations unavailable for this period. IBM Workload Scheduler for z/OS does not start an operation on a workstation if there is less time than its estimated duration until the start of a closed interval.

If no work at all is to be done on a particular day; that is, no work must be started on that day or carried forward from the previous day:

- Specify it as a free day.
- Check that no applications with free day rule 3 are scheduled on that day.
- Do not have any open intervals for the workstation on the holiday, so that IBM Workload Scheduler for z/OS does not start any work on the previous day that will run over into the closed day. You can specify dates when all workstations should be closed on the MODIFYING ALL WORKSTATIONS CLOSED panel (Figure 43), which you reach by selecting option 4 from the MAINTAINING WORKSTATION DESCRIPTIONS panel.

```
EQQWMACL ------------ MODIFYING ALL WORK STATIONS CLOSED ---------  ROW 1 OF 3
Command ===>                                                  Scroll ===> PAGE

Change data in the rows, and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat,  D(nn),DD - Delete

Row  Date:    Comments                       WS closed:   Last update
cmd  YY/MM/DD                               HH.MM-HH.MM  user     date
'' 97/09/16 Night shift operation only____ 08.00 24.00  ANDERSM  97/04/21
'' 97/09/17 Night shift operation only____ 08.00 24.00  ANDERSM  97/04/21
'' 97/10/14 Hardware upgrade shutdown_____ 00.00 24.00  ANDERSM  97/04/21
****************************** BOTTOM OF DATA ********************************
```

Figure 43. EQQWMACL - Modifying all workstations closed

You can specify when workstations are open with the WORKSTATION DESCRIPTION panel, in any of these ways. The list is in order of highest to lowest precedence.

1. For each workstation, you can create open time intervals for a specific date.
2. For all workstations, you can create intervals for specific dates when they are all closed (for example, 95/12/25 00:00–23:59).
3. For each workstation, you can create open time intervals for a particular weekday (for example, Friday).
4. For each workstation, you can create open time intervals for a standard day. You then specify which days of the week are to be considered standard days (for example, Monday, Tuesday, Wednesday, and Thursday).

IBM Workload Scheduler for z/OS never cancels a job: a job that is submitted is allowed to complete, even if it runs over to a day where no work is to be done.

When you have made a change with the WORKSTATION DESCRIPTION panel, you must run daily planning for the change to take effect. But a change to the

closed status does not take effect, even after a daily planning EXTEND or REPLAN, if you have closed the workstation in the current plan (using the MCP panel, for example).

Specifying workstation fixed resources

Some workstations have limited resources:
- A computer workstation has a limited number of JES initiators.
- A printer workstation has limited number of printers.
- A job setup workstation has a limited number of people able to edit JCL.

IBM Workload Scheduler for z/OS can keep track of these limited resources and take account of them in its plan for jobs on z/OS systems. This feature does not apply for scheduling a job on non-z/OS systems using a fault-tolerant agent.

When you set up a workstation, you can specify the quantity of two resources available to operations at the workstation, *R1* and *R2*. You can also assign a 2-character name to these resources.

If you are new to IBM Workload Scheduler for z/OS, you are recommended not to use these fixed resources, but to use the special resources described in Chapter 5, "Creating special resources," on page 75 instead, because these do not have the restrictions associated with workstation fixed resources, the most important being that:
- You might have no more than 99 of each resource.
- The name is limited to 2 characters.
- Workstations cannot share the resources.

To specify workstation fixed resources, enter the R command from the CREATING GENERAL INFORMATION ABOUT A WORKSTATION panel (Figure 35 on page 57). The RESOURCES FOR A WORKSTATION panel, shown in Figure 44, is displayed.

```
EQQWMREP --------------- RESOURCES FOR A WORK STATION -------------------------
Command ===>

Enter/change data below:

Work station          : CPU1             Main JES processor

Resource 1
 NAME              ===> R1
 PLANNING          ===> Y         Used at planning, Y or N
 CONTROL           ===> N         Used at control, Y or N

Resource 2
 NAME              ===> R2
 PLANNING          ===> Y         Used at planning, Y or N
 CONTROL           ===> N         Used at control, Y or N
```

Figure 44. EQQWMREP - Resources for a workstation

Workstation resources can be used for scheduling purposes. When you create an operation, you can specify how many of the workstation resources (R1, R2, or both) the operation will use. If that quantity of the resources is not available, the operation will not be started by IBM Workload Scheduler for z/OS (see "Specifying workstation fixed resources" for exceptions to this rule).

R1 and R2 can represent any physical resource in your system that is significant to you for scheduling purposes. For example, if you create computer workstation CPUA, which represents a z/OS system in your configuration, you can make R1 represent the tape drives on that system. If, when you create an operation, you also specify the number of tape drives (that is, how much of R1 the operation will use), IBM Workload Scheduler for z/OS will not schedule the operation unless its required number of tape drives is available.

Note: IBM Workload Scheduler for z/OS does not check the actual availability of resources. It reaches its scheduling decisions based on information contained in its database. From this information, it can decide whether IBM Workload Scheduler for z/OS-controlled operations are using a resource. If a resource is being used outside the control of IBM Workload Scheduler for z/OS or you have not specified to IBM Workload Scheduler for z/OS that an operation uses a resource, IBM Workload Scheduler for z/OS has no means of knowing that the physical resource is not available.

When IBM Workload Scheduler for z/OS builds the current plan, it uses information from the databases, and considers the workstation resources and their availability. If you do not want workstation resources to be considered when the plan is built, specify N for the PLANNING option.

The plan contains the best estimation of when operations will start. If something unexpected happens (for example, a job exceeds its expected run time or a tape drive needs repair) IBM Workload Scheduler for z/OS might need to reassess the start time of some of its operations. At this point, the IBM Workload Scheduler for z/OS CONTROL option becomes important. If you specified Y for this option, IBM Workload Scheduler for z/OS considers the workstation resources when rescheduling its operations. Otherwise, the workstation resources are ignored.

Controlling workstations

When you create workstations, this updates the workstation database, which is used when you update the long-term plan.

If you need to make immediate changes to the status of a workstation, or query its status, use the MODIFY CURRENT PLAN panel. These tasks dynamically control the availability of workstations:

- Modifying the workstation open intervals in the current plan from the MODIFY CURRENT PLAN panel (option 5.5 from the main menu)
- Setting the workstation to active
- Looking at the workstation status
- Closing a workstation
- Redirecting work from one workstation to an alternate workstation

Chapter 5. Creating special resources

This chapter explains *special resources*, and shows you how to create and use them. There are three types of resources:

Special resources
These resources are the most flexible. Create them using the panel that is described in this chapter.

Workstation fixed resources
These resources, called by default R1 and R2, are owned by one workstation only. A common use is for tape pools, but you cannot share these between workstations, so you might have problems if a computer workstation and a started task workstation share the same tape drives. Specify them using the workstation panel.

Parallel servers
These resources represent the number of operations that can be simultaneously started on computer workstations running the z/OS operating system. Specify them using the workstation panel.

Understanding special resources

You can use special resources to represent any type of limited resource, such as tape drives, communication lines, or a database. You create resources using the SPECIAL RESOURCES panel, which is described in this chapter. The SPECIAL RESOURCES panel updates the resource database, which has these details of each resource:

Name The resource name. It can be up to 44 characters.

Availability
Available (Y) or not available (N).

Connected workstations
A list of the workstations where operations can allocate the resource.

Quantity
It can be from 1 to 999999.

Used for
Specifies how IBM Workload Scheduler for z/OS is to use the special resource. Allowed values are:

P Planning

C Control

B Both control and planning

N Neither control nor planning

On-error action
Specifies the action to take if the operation that allocates this resource ends in error (and does not have an overriding keep-on-error specification in the operation definition). Possible values are:

F Free all

FX Free exclusively-held resources

FS Free shared resources

K Keep all

IBM Workload Scheduler for z/OS uses the attribute specified at operation level first. If this is blank, it uses the attribute specified in the resource database. If this is also blank, it uses the ONERROR keyword of the RESOPTS statement.

On Complete
Specifies the value to which the global availability is reset after the operation that uses the resource completes. It can be one of the following:

Y Sets the global availability to Yes.

N Sets the global availability to No.

R Sets the global availability to blank.

Blank Uses the system default, according to the following order:
1. The On Complete value set at operation definition level, if not blank.
2. The On Complete value set at special resource definition level, if not blank.
3. The ONCOMPLETE or DYNONCOMPLETE keyword value, respectively set for the not dynamically added resources or the dynamically added resources, in all the other cases.

Max Usage Limit
Specifies after how many allocations of the special resource, its availability is reset according to the value set for Max Usage Type. An internal usage counter is increased each time an operation allocates the resource. When the internal counter reaches the Max Usage Limit value, the global availability is reset to the value specified with Max Usage Type.

The default value is 0, meaning that no usage counter check is done.

Max Usage Type
Specifies the value to which the global availability is reset when the Max Usage Limit is reached. This value is valid only if the Max Usage Limit is nonzero. Possible values are:

Y Sets the global availability to Yes.

N Sets the global availability to No.

R Sets the global availability to blank.

The quantity, availability, and list of workstations, can vary with time. You can create time *intervals* to control each special resource.

You also specify, for each operation, the special resources that it uses: how (shared or exclusive), how many (quantity), and the on-error attribute.

The long-term plan is built without taking the special resources into account, but when you extend the current plan, it schedules operations taking account of all the special resources that are used for planning (though the daily planning program does not take manually changed availability, quantity, and deviation into account. This because they are assumed to be usually temporary changes and the values will reset to the normal values when, for example, an engineer has repaired a tape unit). The special resource details of the operations in the current plan are copied

from the database and held in the current plan extension data set. These details include the information from the resource database, but also have these fields:

Quantity
It can be from 1 to 999999, or blank. If you specify a quantity, this overrides the scheduled quantity from the database.

Availability
It can be Y, N, or blank. If you specify an availability, this overrides the scheduled availability from the database.

Deviation
It can be from -999999 to 999999, or blank. You use the deviation to make a temporary alteration to the scheduled quantity.

To change the quantity and availability of a special resource, and the connected workstations, use the Special Resource Monitor, which is option 7 (SPECRES) in the MODIFY CURRENT PLAN panel. You might need to make a resource unavailable (to prevent the submission of all jobs needing a database, if some corruption is suspected), alter the quantity by specifying a deviation (if a tape drive is broken), or change the list of connected workstations (to include a workstation that will take over processing from the normal one). Refer to "Using the special resource monitor" on page 652 for details.

Other ways of changing resource attributes are:
EQQUSIN subroutine
Refer to *Customization and Tuning*.
SRSTAT command
See "SRSTAT" on page 744.

If the availability of a resource is known to the Resource Object Data Manager (RODM), IBM Workload Scheduler for z/OS can, by subscribing to RODM for that resource, be notified automatically of any changes. This is the best alternative where RODM is installed.

Changes to special resources using any of these methods override the scheduled quantity and availability, but you can at any time reset the values to those specified for the current interval.

For an operation running on a distributed agent, the usage of special resources causes the loss of fault tolerance. Only the controller determines the availability of a resource and consequently lets the distributed agent start the operation.

Thus if an operation running on a distributed agent uses a special resource, the following situation occurs:

- When the resource is available, the controller sets the state of the operation to started and the extended status to waiting for submission.
- The controller sends a release-dependency event to the distributed agent.
- The distributed agent starts the operation.

If the connection between the controller and the distributed agent breaks, the operation does not start on the distributed agent even if the resource becomes available.

Note: When you monitor a job on a fault-tolerant agent by means of the IBM Workload Scheduler interfaces, you will not be able to see the special resources used by the job. Instead, you see the job,

OPCMASTER#GLOBAL.SPECIAL_RESOURCES. The dependency on OPCMASTER#GLOBAL.SPECIAL_RESOURCES is set by the controller for every operation that is dependent on special resources. This dummy job is always added to the Symphony file with a priority of zero, even if no operations depend on a special resource. As a result, the status of the schedule OPCMASTER1GLOBAL is always STUCK and the message AWS22010069E is shown in the STDLIST. Refer to *IBM Workload Scheduler Troubleshooting and Error Messages* for an explanation of the message. When you monitor using the IBM Workload Scheduler for z/OS interfaces, you see the special resources as expected.

Example using data sets

The payroll application has many jobs that use the payroll database and must, therefore, not run together. You could let z/OS resolve the contention problem, using DISP=OLD in the JCL, but a job that waits in z/OS uses a JES initiator and other resources. This can reduce your batch throughput.

To prevent IBM Workload Scheduler for z/OS from scheduling or starting an operation that uses the payroll database when it is already being used, create a resource PAYROLL.DATABASE that represents the payroll database. Give each update job, such as PAYDAILY, exclusive control. Jobs that merely read the database, such as PAYQUERY, can have shared control.

In this case, the resource has a quantity of 1 (there is one database). Specify keep on error, because operators want to correct and resubmit a job without another job taking control of the database in the meantime.

When you extend the current plan, IBM Workload Scheduler for z/OS makes sure the jobs are not scheduled to run together or run at a time when the resources are unavailable. This is how the product makes use of the resource at the planning stage. When the product is ready to submit each job, it checks that the resource is available. This is how the product makes use of the resource at the control stage.

Specify the resource like this:

Name PAYROLL.DATABASE. Make sure that all operations specify this name exactly.

Quantity
1

Used for
B (both planning and action).

On-error action
Keep all.

Workstations
Connect to all workstations that can use the data set; for Paymore, this is CPU1 and STC1.

Intervals
The data set is always available.

Example using tape drives

Tape drives are usually owned by only one machine, but they can be used by a started task workstation and a computer workstation on the same machine, so you can, for example, allocate a tape pool to workstations CPU1 and STC1.

Do not keep this resource on error, because you normally want to release a tape drive for other work while you prepare a rerun of a failed job.

If you have 10 drives (quantity is 10), you do not need to allocate all 10 drives to both STC1 and CPU1. If CICS runs as a started task, you might need to reserve a tape drive for dumps of its journal, so give STC1 exclusive use of one tape drive in the intervals when CICS is available.

Specify the resource like this:

Name TAPES

Quantity
10 (for example). You need not make all the drives available for automatic allocation.

Used for
B (both planning and action).

On-error action
Free all.

Workstations
Connect to all workstations that can use the tapes.

Intervals
Reduce the number available when online systems might need a tape, and set the number to zero when the tape room is unstaffed.

Example using communication lines

Lines are often shared between processors, and can even be shared between operations. Lines are never allocated by z/OS, because they are owned by a communication controller, but you might want to ration the number of file transfer jobs, for example. If you have a number of lines from New York to London, with a total capacity of 256 kbaud, you can specify a quantity of 256. If you give a file transfer operation exclusive use of 20 units, for example, that gives the lines a limit of 12 file transfers.

You can protect online and voice systems that use the same lines by giving them a shared allocation of, for example, 50 units each. Because they share units, they do not compete with each other; you can have an unlimited number of operations each sharing 50 units, but this limits the quantity available for file transfers to 206.

Specify the resource like this:

Name LINES.TO.LONDON

Quantity
256

Used for
B (both planning and action).

On-error action
Free all.

Workstations
Connect to all workstations that can use the lines.

Intervals

Reduce the number available at peak hours, which will keep more transfer jobs out and improve the performance of online systems.

How are special resources used?

IBM Workload Scheduler for z/OS just keeps a record of the state of each resource and its allocation. The product does not know that PAYROLL.DATABASE is a database, and it is unaware that TAPES resources are tape drives. Only you know this, and you have the responsibility of making sure that the product knows the true availability of the objects that the resources represent.

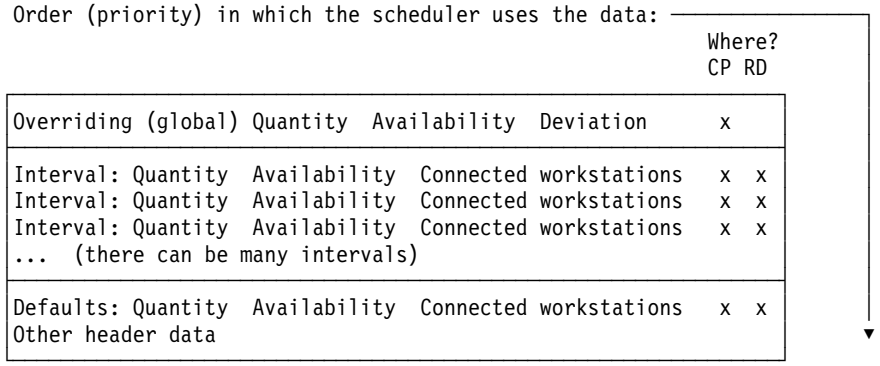
VSAM will not tell IBM Workload Scheduler for z/OS when the payroll database is opened, and z/OS is not going to tell IBM Workload Scheduler for z/OS when you vary a tape drive offline. This is your responsibility.

The best way to tell IBM Workload Scheduler for z/OS about changes in special resources is through the RODM interface. System components such as Automated Operations Control (AOC) inform RODM about changes to their resources. You can subscribe to RODM updates by setting the RODMTASK keyword on the OPCOPTS initialization statement, and using the RODMOPTS initialization statement. Refer to *Customization and Tuning* for details of initialization statements.

If you do not have RODM installed, and for resources that RODM does not know about, you can automatically notify IBM Workload Scheduler for z/OS about changes in resources by intercepting messages, for example, and issuing the IBM Workload Scheduler for z/OS SRSTAT command, or calling the EQQUSIN subroutine. If you cannot automatically notify IBM Workload Scheduler for z/OS of a change in resource status, use the Special Resource Monitor.

Updating the special resource database

Each resource is created with this structure:



The interval and default (header) data is maintained in the resource database (RD) and copied to the current plan (CP), where you can change it with the MCP panel Resource Monitor. The overriding (global) fields are present only in the current plan.

The header has default values that are always used to complete any missing fields in the intervals. For example, suppose that you have created a special resource TAPES with these default values:

	Quantity	Availability	Connected workstations
Defaults	8	Y	CPU1 STC1

and you specify intervals with some values specified (shown in **bold**). The missing values are completed from the default (shaded) values:

Day and time	Quantity	Availability	Connected workstations
STANDARD 08.00 to 22.00	**6**	Y	CPU1 STC1
SATURDAY 00.00 to 24.00	8	Y	**CPU1**
SUNDAY 08.00 to 10.00	8	**N**	CPU1 STC1

STANDARD specifies the days of the week that are not otherwise specified (in this case, Monday to Friday). Days and times not covered by the intervals (such as Monday at 01.00 and Sunday at 01.00) take the default values of 8 drives available on the CPU1 and STC1 workstations. The STC1 workstation cannot use the TAPES resource on Saturdays. No workstation can use the resource (it is unavailable) between 08.00 and 10.00 on Sundays.

Do not confuse the default availability and quantity with the overriding (or global) values, which exist only in the current plan. When you alter the quantity with the SRSTAT command, for example, you always change the overriding quantity. If you use the MCP panel, you can change both default and overriding values.

Creating special resources

Operations hold and release special resources automatically, according to their descriptions in the current plan, and the resources are available and connected to workstations, also as scheduled in the current plan. You specify how operations use special resources when you create the operation (see “Standard applications and group definitions” on page 127). But first you must create the resource, its attributes, what workstations it is connected to, and the number available in each interval. That is described in this chapter.

Resources represent something, such as tape drives, and the current plan is built assuming that so many tape drives will be available. If one breaks down, IBM Workload Scheduler for z/OS continues to allocate the broken tape drive to a job that needs one. The job will wait, because z/OS knows that the tape drive is offline. Because availability can be affected in this way, there are ways for programs to automatically change resource status, and for operators to manually change resource status:

1. A program that detects a change in status can call the EQQUSIN subroutine to set an availability or a deviation (an alteration to the planned quantity). For example, if a program detects that online response times are poor, it can set a deviation of -40 for the resource representing lines for file transfer use.
2. An operator can use the SPECIAL RESOURCE MONITOR panel to set a resource unavailable. Refer to “Using the special resource monitor” on page 652 for details.
3. A program or an operator can issue the SRSTAT command, either directly from TSO or as input to the EQQEVPGM program.

4. If you have RODM, and IBM Workload Scheduler for z/OS subscribes to it, IBM Workload Scheduler for z/OS can keep in step with the system automatically for the resources defined to RODM.

All these methods can change the availability, the deviation, and the quantity of a resource from that specified in the planned availability intervals.

Table 8 shows how the planned availability of some resource such as tape drives is affected by unplanned events such as input from the Special Resource Monitor, the SRSTAT command, the EQQUSIN subroutine, and RODM. Manually altered overriding quantity, availability, and deviation values are honored across an interval boundary and batch daily planning EXTEND and REPLAN jobs. To make IBM Workload Scheduler for z/OS revert to a scheduled value after a manual alteration, you must reset the value, as at 11.20.

Table 8. How resource quantity and availability can be changed

	Planned values		**Actual values**			
Start of interval / time of event	Planned quantity	Planned availability	Actual quantity	Actual availability	Deviation	Number available
08.00	8	N	Interval specifies quantity 8, not available			
			8	N	0	0
08.40	You set the availability to Y with the EQQUSIN subroutine					
			8	Y	0	8
09.00	8	N	A new interval specifies the resource unavailable			
			8	Y	0	8
09.40	You set a deviation of -1 with the SRSTAT command					
			8	Y	-1	7
09.41	You set a deviation of -1 with the SRSTAT command					
			8	Y	-2	6
09.42	You set the deviation to -1 with the Special Resource Monitor					
			8	Y	-1	7
10.00	9	Y	Extend CP, and interval specifies 9 available			
			9	Y	-1	8
10.20	You set the quantity to 6 with the SRSTAT command					
			6	Y	-1	5
11.00	8	Y	Interval specifies 8 available			
			6	Y	-1	5
11.20	You reset the quantity with the SRSTAT command					
			8	Y	-1	7

The number available (the last column) is the actual number available for allocation, taking into account the actual quantity, the deviation, and the actual availability.

The three events starting at 09.40 show the difference between altering the deviation with SRSTAT (or a subroutine) and with the Special Resource Monitor.

SRSTAT adds the specified deviation to the current deviation, but the panel replaces the current deviation with the value you specify.

If you change values other than the overriding (global) quantity, availability, and deviation, or the values for an interval, you lose the changes at the next daily planning run, but the job issues a warning message about any manually changed values that will be lost. For example, if you change the default quantity (the quantity used where intervals are not specified) in the current plan, this is replaced at the next daily planning run with the value from the database.

Example creating special resources

About this task

Follow these steps to create the TAPES resource:

1. Select option 6 from the MAINTAINING IWSz DATA BASES menu (Figure 45).

```
EQQODBSP ---------------- MAINTAINING IWSz DATA BASES -------------------------

 Select one of the following:

 1 WS              - Work station descriptions
 2 CALENDAR        - Calendar descriptions
 3 PERIOD          - Period descriptions
 4 AD              - Application descriptions
 5 OI              - Operator instructions
 6 SPECRES         - Special resource descriptions
 7 ETT             - Event triggered tracking criteria
 8 JD              - Job descriptions
 9 JCLVAR          - JCL variable tables
 10 RUN CYCLE      - Run cycle groups
```

Figure 45. EQQODBSP - Maintaining IWSz databases

2. Select option 3 (LIST) on the MAINTAINING SPECIAL RESOURCES menu (Figure 46). You can select option 2 (CREATE) instead, but option 3 gives you a chance to see the resources that already exist.

```
EQQQDTOP --------------- MAINTAINING SPECIAL RESOURCES -----------------------

 Select one of the following:

 1 BROWSE          - Browse a special resource
 2 CREATE          - Create a special resource
 3 LIST            - List special resources for further processing
                     (browse, modify, copy, delete and create)
```

Figure 46. EQQQDTOP - Maintaining special resources

   When you select 3 (LIST), you see the SPECIFYING SPECIAL RESOURCE LIST CRITERIA panel, where you can filter the resources shown in the list. To list all resources, enter * (asterisk) in the SPECIAL RESOURCE and SPECRES GROUP ID fields.

3. In the LIST OF SPECIAL RESOURCES panel (Figure 47 on page 84), enter the CREATE command.

```
EQQQDLSL ----------------- LIST OF SPECIAL RESOURCES --------- Row 1 to 4 of 4

 Enter the CREATE command above to create a new resource, or,
 enter any of the row commands below:
 B - Browse, M - Modify, C - Copy, D - Delete

 Row Special                                    Specres  A Qty    Num
 cmd Resource                                   group ID          Ivl
 ''' HEIDE.ISPF.PROFILE                                  Y 1      1
 ''' HEIDE.OPCESA.EQQDUMP                                Y 1      1
 ''' PAYROLL.DATABASE                                    Y 1      1
 ''' RITZMAN.DSCLOSE.TEST                                Y 1      1
 ****************************** Bottom of data ********************************
```

Figure 47. EQQQDLSL - List of special resources

The CREATING A SPECIAL RESOURCE panel is displayed:

```
EQQQDCRP ---------------- CREATING A SPECIAL RESOURCE ----------------------

 Select one of the following:

 1 INTERVALS  - Specify intervals
 2 WS         - Modify default connected work stations

 SPECIAL RESOURCE   ===> tapes_____________________________________________
 TEXT               ===> tape drives_______________________________________
 SPECRES GROUP ID   ===> sample__
 Hiperbatch         ===> N       DLF object Y or N
 USED FOR           ===> B       Planning and control C , P , B or N
 ON ERROR           ===> F_      On error action F , FS , FX , K or blank
 ON COMPLETE        ===> _       On complete action Y , N , R or blank
 MAX USAGE LIMIT    ===> 3___    Max number of allocations before usage reset
 MAX USAGE TYPE     ===> N       Status change type Y, N or R


 Defaults
   QUANTITY         ===> 8_____  Number available 1-999999
   AVAILABLE        ===> Y       Available Y or N
```

Figure 48. EQQQDCRP - Creating a special resource

4. Type values in the fields on the CREATING A SPECIAL RESOURCE panel:

   SPECIAL RESOURCE
   The name of the resource, up to 44 characters. The name of the special resource is translated to uppercase. You can include national characters in the name, but you are recommended not to include % and *, because IBM Workload Scheduler for z/OS uses these for filtering and searching in the panels. It is also good practise not to use the comparison operators: greater-than symbol (>), less-than symbol (<), caret (^), equals sign (=), or blank spaces. These might by used in search arguments passed by programming interface programs.

   TEXT A description of the resource, up to 46 characters.

   SPECRES GROUP ID
   The resource group, up to 8 characters. The group ID is for selecting subsets of resources in the panel (a list filter).

   HIPERBATCH
   Whether the resource represents a Data Lookaside Facility (DLF) object, Y or N. See “Setting the global values” on page 94.

   USED FORr
   Whether the resource is used for:

P Planning, when the current plan is extended

C Control, when an operation starts

B Both planning and control

N Neither planning nor control

ON ERROR

What happens if an operation that allocates this resource ends in error (and does not have an overriding keep-on-error specification in the operation definition):

F Free the full allocation of this resource, both those allocated exclusive and those allocated shared

FS Free the full shared allocation of this resource

FX Free the full exclusive allocation of this resource

K Keep the full allocation of this resource

Blank Use the value specified in the ONERROR keyword of the RESOPTS statement. For details, refer to *Customization and Tuning*.

You might want critical jobs to keep their resources even when they fail, so that there is no delay waiting for resources when they are restarted.

The QUANTITY and AVAILABLE values, at the bottom of the panel, apply to intervals where a quantity or availability is not specified, and apply also to time ranges where there is no interval specified. You can save time by specifying the normal quantity and availability here, and specifying only the exceptions in intervals.

ON COMPLETE

The value to which the global availability is reset after the operation that uses the resource completes. It can be one of the following:

Y Sets the global availability to Yes.

N Sets the global availability to No.

R Sets the global availability to blank.

Blank Uses the system default, according to the following order:

a. The On Complete value set at operation definition level, if not blank.
b. The On Complete value set at special resource definition level, if not blank.
c. The ONCOMPLETE or DYNONCOMPLETE keyword value, respectively set for the not dynamically added resources or the dynamically added resources, in all the other cases.

MAX USAGE LIMIT

The number of allocations of this resource after which the resource global availability is changed to the value specified by Max Usage Type.

MAX USAGE TYPE

The value to which the global availability of the resource is reset, when its maximum usage limit is reached:

Y Sets the global availability to Yes.

N Sets the global availability to No.

R Sets the global availability to blank.

QUANTITY
1 to 999 999.

AVAILABLE
Whether the resource is available, Y or N.

5. Enter option 2 on the command line to specify the default connected workstations. The MODIFYING CONNECTED WORK STATIONS FOR A SPECIAL RESOURCE panel, shown in Figure 49, is displayed.

```
EQQQDWML - MODIFYING CONNECTED WORK STATIONS FOR A SPECIAL RES Row 1 to 2 of 2

 Enter/Change data in the rows, and/or enter any of the following
 row commands:
 I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete

 Special resource : TAPES
 Text             : tape drives on CPU1 and STC1


 Row Ws
 cmd
 ''' CPU1
 ''' STC1
 ******************************** Bottom of data ********************************
```

Figure 49. EQQQDWML - Modifying connected work stations for a special resource

When creating the resource, you see an asterisk (*) in the Ws column. This means that the resource is connected, by default, to all workstations. If you want to restrict the resource to named workstations, specify them as shown for TAPES in Figure 49.

Note: When an operation is switched to an alternate workstation, when the primary workstation is offline, the operation is still allowed to allocate the resource; the alternate workstation does not have to be in the list of connected workstations. Be sure to check that the resource is physically accessible from the alternate workstation.

6. Save the default connected workstations by pressing PF3 (End).
7. Enter option 1 on the command line of the CREATING A SPECIAL RESOURCE panel to create availability intervals. The MODIFYING INTERVALS FOR A SPECIAL RESOURCE panel, shown in Figure 50 on page 87, is displayed.

```
EQQQDIML -------- MODIFYING INTERVALS FOR A SPECIAL RESOURCE - Row 1 to 3 of 3

 Enter any of the row commands below:
 I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete, or,
 S - Work stations

 Special resource : TAPES
 Text             : tape drives on CPU1 and STC1

 Row Day of         From  To    Qty    A
 cmd week or Date   Time  Time
 ''' STANDARD______ 08.00 22.00 6_____ _
 ''' SATURDAY______ 00.00 22.00 ______ _
 ''' SUNDAY________ 08.00 10.00 ______ N
 ****************************** Bottom of data ********************************
```

Figure 50. EQQQDIML - Modifying intervals for a special resource

8. Type values in the fields of the MODIFYING INTERVALS FOR A SPECIAL RESOURCE panel:

   Day of week or Date
   Specify a date in the format specified in the OPTIONS panel, or one of these:
   STANDARD (meaning default for the days not mentioned)
   MONDAY
   TUESDAY
   WEDNESDAY
   THURSDAY
   FRIDAY
   SATURDAY
   SUNDAY

   From time and To time
   Specify a time range, with times in the format specified in the OPTIONS panel.

   Qty The quantity of the resource in the time interval being specified. The default quantity and availability are those specified in step 4 on page 84.

   A Available (Y) or unavailable (N).

   Note: You cannot alter intervals that you have already modified in the current plan, the daily planning job never replaces a changed interval with values from the database.

9. Enter the S command beside the Saturday interval row to specify that STC1 operations cannot use the resource on that day. The MODIFYING CONNECTED WORK STATIONS FOR A SPECIAL RESOURCE panel, shown in Figure 51 on page 88, is displayed.

```
EQQQDWML - MODIFYING CONNECTED WORK STATIONS FOR A SPECIAL RES Row 1 to 1 of 1

 Enter/Change data in the rows, and/or enter any of the following
 row commands:
 I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete

 Special resource : TAPES
 Text             : tape drives on CPU1 and STC1
 Interval         : SATURDAY         00.00      24.00

 Row Ws
 cmd
 ''' CPU1
 ****************************** Bottom of data ********************************
```

Figure 51. EQQQDWML - Modifying connected work stations for a special resource

10. Specify the CPU1 resource only. Press PF3 (End) to return to the MODIFYING INTERVALS FOR A SPECIAL RESOURCE panel.
11. When you have specified all the intervals, press PF3 (End) to return to the CREATING A SPECIAL RESOURCE panel.
12. Press PF3 (End) again to save the resource definition.

Table 9 shows the origin of each value in some intervals for the TAPES resource: whether from the default values, the STANDARD interval, or from a specific interval.

Table 9. Where values are taken from for each interval

Time	Quantity	Availability	Workstations
Monday 00.00 to 07.59	Default	Default	Default
Monday 08.00 to 22.00	Standard	Default	Default
Monday 22.01 to 24.00	Default	Default	Default
Saturday	Default	Default	Interval
Sunday 00.00 to 07.59	Default	Default	Default
Sunday 08.00 to 10.00	Default	Interval	Default
Sunday 10.01 to 24.00	Default	Default	Default

IBM Workload Scheduler for z/OS uses, in order of priority:
1. A specific date and time, if specified
2. A specific day and time, if specified
3. The STANDARD entry
4. The default values

A more specific interval overrides the standard interval and the default values.

Setting the availability of a resource

If a resource is available at fixed times, use the RESOURCES panel to specify this. If the availability cannot be predicted, change the availability status with the SRSTAT command, entered either from TSO or from the batch program EQQEVPGM.

For example, if a resource represents a data set, you can make this resource available when the data set is created and loaded with valid data. If the data set is created and loaded by a TSO user, the user can set the availability status with the

SRSTAT command immediately after the data set is loaded. If a batch job creates and loads the data set, add an extra step that executes EQQEVPGM to set the availability status to YES. Use condition codes to execute the EQQEVPGM step only if the create and load steps are successful.

When you set availability in this way, the daily planning program cannot know in advance when the resource is available, and therefore cannot predict accurate start times; it schedules operations according to the values in the database.

You can browse and modify the availability status of resources, and browse the allocation status, using the RESOURCES panel.

By default, IBM Workload Scheduler for z/OS starts an operation if a required resource is available, even if the operation will last one hour and the interval specifies that the resource will be unavailable after one minute. If you want the product to take the expected future availability and operation duration into account, use the LOOKAHEAD keyword of the RESOPTS initialization statement. The special resource must be used for control, for LOOKAHEAD to take effect. Refer to *Customization and Tuning* for details of the RESOPTS statement.

Using NetView to set the availability of a resource

Consider using resources to control the batch component of an online system. NetView can automatically generate an SRSTAT to make a resource unavailable if it is detected that the online system or the database has become unusable. This can prevent unnecessary abends in your batch processing if you specify all relevant operations as requiring shared access to the resource.

Using RODM to change the availability of a resource

If you have the Resource Object Data Manager (RODM) on your z/OS systems, you can subscribe to changes in resource availability using the RODMOPTS keyword on the OPCOPTS initialization statement. Refer to *Customization and Tuning* for details of the OPCOPTS statement. RODM can pass on to IBM Workload Scheduler for z/OS changes in resource status detected by such products as AOC.

Using On Complete to change the availability of a resource

Use the On Complete option to change the global availability of a special resource used by an operation that completes successfully. For example, to prevent other operations from using the special resource that is being used by the current operation, set the On Complete option to No. In this way, after the operation completes successfully, the special resource will no longer be available.

Suppose you plan to run an operation named JOBY every day. JOBY requires an input file FILEX that is updated daily by an external process. Represent FILEX as a special resource and define JOBY as an operation using FILEX in exclusive way, quantity 1, with default availability set to No. Each time the external process updates FILEX, an event is generated to set the resource global availability to Yes. If, after the current occurrence of JOBY is run, you do not want the next occurrence to run on the same day, set the On Complete option to No. In this way, after JOBY completes successfully, the global availability of the special resource FILEX is set to No and the next occurrence is run only on the following day, when another event is generated to set the resource global availability to Yes again.

The On Complete option can be specified at three different levels:

- Operation definition. Possible values are:

  Y Sets the global availability of the special resource to Yes.

  N Sets the global availability of the special resource to No.

  R Sets the global availability of the special resource to blank.

  Blank Uses the system default.
- Special resource definition. Possible values are:

  Y Sets the global availability to Yes.

  N Sets the global availability to No.

  R Sets the global availability to blank.

  Blank Uses the system default.
- RESOPTS initialization statement (either the ONCOMPLETE or DYNONCOMPLETE keyword). Possible values are:

  YES Sets the global availability of the special resource to Yes.

  NO Sets the global availability of the special resource to No.

  RESET
  Sets the global availability of the special resource to blank.

  NOCHANGE
  Does not change the global availability. This is the default.

When the operation completes, the On Complete value is applied according to the following order:
1. The On Complete value set at operation definition level, if not blank.
2. The On Complete value set at special resource definition level, if not blank.
3. The ONCOMPLETE or DYNONCOMPLETE keyword set in the RESOPTS statement (respectively for resources added not dynamically or dynamically), in all the other cases.

   The On Complete default value for special resources dynamically added is blank.

The On Complete option is valid only if the special resource is used for controlling purposes (the field Used For is set either to **C** or **B**).

Note: The On Complete action is performed any time the Complete status is set (either manually or as a consequence of a real run).

You can check if the global availability of a special resource was changed due to an On Complete action, in the Last Updated section of the BROWSING A SPECIAL RESOURCE and MODIFYING A SPECIAL RESOURCE panels.

Daily plan batch processes update the On Complete value:

In the current plan extension (CX) data set
With one of the following values, chosen according to this order:
1. The On Complete value specified in the RD database, if the special resource is defined in the RD database.
2. The On Complete value specified in the old CX data set, if the special resource exists in CX.
3. Blank, if the special resource is dynamically added.

In the current plan operation (CP) data set
With the Available On Complete value set in the application definition.

Using Max Usage Limit to change the availability of a resource

To change the global availability of a special resource after a specific number of operations have used it, independently of their successful completeness or actual run, use the Max Usage Limit option. For Max Usage Limit to be effective:

- Set the Max Usage Limit for the special resource to a value different from 0
- Set the Max Usage Type for the special resource to a meaningful value

When you set the Max Usage Limit, an internal usage counter is increased each time an operation allocates the resource. When the internal counter reaches the maximum usage limit, the global availability of the resource is reset to the value specified in the Max Usage Type field.

The usage counter is increased at each operation start and the resource availability is immediately reset if the maximum limit is reached. This means that the maximum usage limit is reached even if the operation fails or it is not submitted by the tracker, and the global availability of the resource is reset as soon as the operation is started.

For this reason, there are some cases where this option is not recommended. Consider, for example, that you are using WLM scheduling environment integration and your WLM job uses the special resource FILEX, whose maximum usage limit is 2 and maximum usage type is No. Suppose also that FILEX was already used once by another operation. When your WLM job is started and sent to the tracker, FILEX is allocated and the usage counter is increased to 2, reaching the maximum limit set. As a consequence, the FILEX global availability is immediately reset to No, preventing any operation from using it. If the scheduling environment is not available, the WLM job is set back to Ready, waiting for scheduling environment availability and the special resource is deallocated. Nevertheless, its global availability remains unchanged (not available), therefore the WLM job will not be able to start when the scheduling environment becomes available.

You can monitor the usage counter in the BROWSING A SPECIAL RESOURCE panel, but you cannot change the value calculated.

The Max Usage Limit value is valid only if the special resource is used for controlling purposes (the field Used For is set either to **C** or **B**).

For dynamically added special resources, the default values are:

Max Usage Limit
0, meaning that the function is not active

Max Usage Type
Reset

If you change the maximum usage limit so that the new value is incongruent with the current usage counter, the following actions are taken:

- If the new maximum usage limit is 0 and the usage counter is nonzero, the usage counter is reset to 0. A message is issued in EQQMLOG.

- If the new maximum usage limit is nonzero, but is lower than the usage counter, the usage counter is reset to 0 and the resource availability is reset according to the Max Usage Type. A message is issued in EQQMLOG.

The same actions are taken any time the daily plan batches make an update that causes incongruence with the current usage counter. Note that daily plan batch actions might be changed by the reapplying of the events generated during daily plan batch run. For details about current plan turnover, see the *Diagnosis Guide and Reference*.

You can check if the global availability of a special resource was changed due to maximum usage limit reached, in the Last Updated section of the BROWSING A SPECIAL RESOURCE and MODIFYING A SPECIAL RESOURCE panels.

Daily plan batch processes update the Max Usage Limit and Max Usage Type in the current plan extension (CX) data set with the first values available, taken in this order:

1. The Max Usage Limit and Max Usage Type specified in the RD database, if the special resource is defined in the RD database.
2. The Max Usage Limit and Max Usage Type specified in the old CX data set, if the special resource exists in CX.
3. Max Usage Limit=0 and Max Usage Type=Reset, if the special resource is dynamically added.

Using SRSTAT LIFESPAN to change the availability of a resource

To change the global availability of a special resource, you can use the SRSTAT command with the LIFESPAN parameter. The LIFESPAN parameter sets:

- The interval of time, expressed in minutes, after which the global availability will be changed.
- The value to which the global availability will be changed.

For detailed information about the SRSTAT command, see "SRSTAT" on page 744.

When you issue an SRSTAT LIFESPAN command, the controller stores the information that there is a pending LIFESPAN action for the special resource that will be performed after the specified interval of time expires. You can check whether a pending LIFESPAN action exists by looking at the MODIFYING A SPECIAL RESOURCE and BROWSING A SPECIAL RESOURCE panels.

Only one LIFESPAN action can exist for a resource. If you issue an SRSTAT LIFESPAN command for a resource that already has a pending LIFESPAN action, the old LIFESPAN action is replaced with the current one. To delete a pending LIFESPAN action, you can issue an SRSTAT with LIFESPAN interval of time set to 0.

Using event-triggered resource handling to change the availability of a resource

To set the global availability of a special resource, you can use an event-driven process that triggers special resource changes based on a configuration file that correlates system activities and required changes.

For detailed information, refer to "Data set triggering" on page 472.

Creating a resource dynamically

If an operation in one of your applications needs a resource but the resource it requires is not created, IBM Workload Scheduler for z/OS can create the resource, either when it creates the current plan or later.

Creating missing resources during batch planning

Use the DYNAMICADD keyword of the BATCHOPT initialization statement to specify whether IBM Workload Scheduler for z/OS should create resources that are not in the database when it creates or extends the current plan. Refer to *Customization and Tuning* for details of BATCHOPT.

Use the DYNAMICDEL keyword of the BATCHOPT initialization statement to specify whether IBM Workload Scheduler for z/OS should consider eligible for deletion those resources, which have been dynamically added, when it creates or extends the current plan. Refer to *Customization and Tuning* for details of BATCHOPT.

Creating missing resources during the life of the plan

IBM Workload Scheduler for z/OS distinguishes between these two cases:

1. An operation or event refers to a resource that is in the database but is not in the current plan. See "Dynamically copying resources from the database."
2. An operation or event refers to a resource that is neither in the database nor in the current plan. See "Dynamically adding resources that are not in the database."

Dynamically copying resources from the database

These are some cases where a resource is dynamically copied to the current plan:

- An SRSTAT command refers to a resource that is not in the plan. The details (including interval data) are copied to the current plan. IBM Workload Scheduler for z/OS ignores the CREATE keyword on the SRSTAT command, and the DYNAMICADD keyword on the RESOPTS initialization statement.
- You add an occurrence to the current plan using the MCP panel. One of the operations in the occurrence references the resource. IBM Workload Scheduler for z/OS ignores the DYNAMICADD keyword on the RESOPTS initialization statement. The details (including interval data) are copied to the current plan. This happens as soon as the occurrence is added; IBM Workload Scheduler for z/OS does not wait until it starts the operation.

IBM Workload Scheduler for z/OS always creates a resource in the plan if it is in the database but was not added during daily planning. Resources are only added during daily planning if there is an operation in the plan that references the resource. When you refer to the resource during the life of the plan, IBM Workload Scheduler for z/OS adds the resource from the database.

Dynamically adding resources that are not in the database

These are some cases where a resource might be dynamically added to the current plan:

- An SRSTAT command refers to a resource that is not in the plan. If the resource is not in the database, IBM Workload Scheduler for z/OS looks at the CREATE keyword of SRSTAT (it must be YES) and the DYNAMICADD keyword of RESOPTS (it must be EVENT or YES) to decide whether to build an entry for the resource in the current plan.

- You add an occurrence to the current plan using the MCP panel. One of the operations in the occurrence references the resource. IBM Workload Scheduler for z/OS looks at the DYNAMICADD keyword of RESOPTS (it must be OPER or YES) to decide whether to build an entry for the resource in the current plan.

Refer to *Customization and Tuning* for details of RESOPTS.

Setting the global values

Values that you specify on an event (for example, on the SRSTAT command) update the overriding (or global) quantity, availability, and deviation, which are stored in the current plan separately from the default values from the database.

The batch daily planning process (REPLAN or EXTEND) never deletes resources from the current plan if you have set the overriding quantity, availability, or deviation, even though there might be no operations in the plan that reference the resource.

An SR is considered eligible for deletion if all of the following conditions are satisfied:

- The global quantity is not set.
- The global availability is not set.
- The deviation is not set.
- No intervals are modified.
- RODM Availability, Quantity, and Deviation are set to N.

To make a resource eligible for deletion at the next REPLAN or EXTEND, reset the manually set value. For example, consider this sequence:

1. The resource TAPES is not in the current plan.
2. You issue the command:
   ```
   SRSTAT 'TAPES' SUBSYS(OPC1) AVAIL(YES)
   ```
3. IBM Workload Scheduler for z/OS adds TAPES to the current plan, taking the values from the resource database.
4. IBM Workload Scheduler for z/OS sets the overriding (global) availability to YES. It leaves the overriding quantity and deviation fields blank, so that IBM Workload Scheduler for z/OS uses the quantity from the intervals (or default quantity).
5. You run a daily planning REPLAN or EXTEND. There are no operations in the plan that reference TAPES.
6. The TAPES resource remains in the plan, because you have set its availability.
7. You issue the command:
   ```
   SRSTAT 'TAPES' SUBSYS(OPC1) AVAIL(RESET)
   ```
8. IBM Workload Scheduler for z/OS resets the availability of TAPES to its default value.
9. You run a daily planning REPLAN or EXTEND. There are no operations in the plan that reference TAPES.
10. The TAPES resource is deleted from the plan.

Note: The previously-described process applies to dynamically-added SRs only when a daily planning REPLAN or EXTEND is run with DYNAMICDEL(YES). In this instance, dynamically-added SRs are deleted, provided they satisfy the same conditions to be considered eligible for deletion.

Hiperbatch and the Data Lookaside Facility

Hiperbatch is a z/OS performance enhancement that works with the Data Lookaside Facility (DLF) to allow batch jobs and started tasks to share access to a data set, or *data object*. IBM Workload Scheduler for z/OS provides control information to DLF concerning which operations are allowed to connect to which DLF object, and which data sets are eligible for Hiperbatch.

Within IBM Workload Scheduler for z/OS, a data set that is eligible for Hiperbatch is treated as a resource. Using the RESOURCES panel, you can define data sets with the DLF attribute. The DLF exit sample, EQQDLFX, can then make the following decisions about DLF processing:

- Is this data set eligible for Hiperbatch?
- Should this operation be connected to this data object?

IBM Workload Scheduler for z/OS issues enqueues on the job and data set name to notify the DLF exit that the job to be scheduled will use Hiperbatch. When the job ends, IBM Workload Scheduler for z/OS checks if the same data set will be used by the immediate successor operation or by any other ready operation. If so IBM Workload Scheduler for z/OS does not purge the data object. Otherwise, IBM Workload Scheduler for z/OS initiates purge processing of the data object (that is, IBM Workload Scheduler for z/OS removes it from Hiperspace™). For details about installing IBM Workload Scheduler for z/OS Hiperbatch support, refer to *Customization and Tuning*.

Note: The controller can create DLF objects on any system in the controller's global resource serialization (GRS) ring, but operations that need to connect to the object must run on the same system as the controller.

Reporting on special resources

When you run the daily planning job (EXTEND or REPLAN), IBM Workload Scheduler for z/OS reports on special resources that are included in the new plan, but limits the report to resources specified on RESOURCE statements. Refer to *Customization and Tuning* for information on the RESOURCE statement, which you include in the same member as your BATCHOPT statement.

You can cross-reference special resources (for example, listing the operations that reference each special resource) by selecting option 6 (XRF OF ITEMS) from the AD panel print menu, or option 1.4.4.6 from the main menu.

Using availability changes for workload automation

Based on system activities that occur at tracker side, you can:

- Start an operation automatically when some resource becomes available.
- Define special resource dependencies to make a regularly scheduled job (one which is already in the current plan) dependent on the activity that affects a data set. For example, you can make a job wait for a data set to be created before it starts.

For details, refer to Chapter 24, “Running event-driven workload automation,” on page 471.

Chapter 6. Creating calendars and periods

This chapter shows how you create your installation calendar, create period definitions, and how these work together with run cycles to specify when work will run. Run cycles are described in detail in "Creating run cycles" on page 132, where you specify these as part of the application definition.

When you run work manually without IBM Workload Scheduler for z/OS, you submit jobs according to a calendar. Some jobs run every day, some run every working day, some run on a fixed date each month, and so on. There are jobs that run at the end of each tax year, which varies from country to country. If IBM Workload Scheduler for z/OS is to be able to automate this, you must specify when jobs are to run. To achieve this, IBM Workload Scheduler for z/OS has three important objects:

Calendars
The calendar specifies normal working days and public holidays. IBM Workload Scheduler for z/OS uses the calendar to determine when applications are scheduled, and to calculate dates for JCL tailoring.

You can specify the calendar when you create an application. If no calendar is specified for the application, IBM Workload Scheduler for z/OS uses the calendar in the CALENDAR keyword of the BATCHOPT initialization statement, for batch services such as extending the long-term plan, or the calendar specified under the OPTIONS panel (0.2 from the IBM Workload Scheduler for z/OS main menu), for online services such as testing a rule with GENDAYS. If no calendar is specified, a calendar with the name DEFAULT will be used. If the DEFAULT calendar does not exist, all days are considered work days. You might have several calendars, but always call your default calendar DEFAULT, and specify the same calendar name on BATCHOPT and in the panel.

A calendar is created only if it contains at least one work day.

Periods
Periods are either *cyclic*, such as a week or 28-day period, or *noncyclic*, such as an academic semester. Cyclic periods are defined by their origin date and their length, and noncyclic periods by the origin date of each interval. Noncyclic periods can optionally have an end date for each interval.

Run cycles
When you create an application, you specify when it should run using a run cycle, which has one of two forms:

1. A *rule* with a format such as `The SECOND TUESDAY of every MONTH`, where the words in capitals are selected from lists of ordinal numbers, types of day, and common calendar intervals or period names, respectively.
2. A combination of period and offset. For example, an offset of 1 in a weekly period specifies Monday. An offset of 10 in a monthly period specifies the tenth day of each month.

Run cycles generate either positive or negative occurrences in the long-term plan. A negative occurrence always cancels any matching positive occurrences. You can specify a negative occurrence only if the positive equivalent already exists. You use negative occurrences to identify

the days when an application would normally be scheduled but is not required. For example, when you normally schedule the application every Friday but not if Friday is also the last day of the month.

The run cycle *type* identifies whether positive or negative occurrences will be generated. You can specify many run cycles, positive and negative, when you create an application. You can mix run cycles that use offsets and run cycles that use rules in the same application.

Run cycle groups
Run cycle groups are sets of several run cycles. They are defined in the IBM Workload Scheduler for z/OS as database objects and are independent of applications. This implies that the same run cycle group can be used by more than one application and that an application can use a mix of its own run cycles and of one or more run cycle groups. The advantages of using run cycle groups are multiple and they are explained in Chapter 7, "Defining and managing run cycle groups," on page 109.

The long-term planning process uses the calendar information, the period definitions, and the run cycle, to determine the days on which an application should be scheduled. The daily planning process does not use the calendar and period definitions—IBM Workload Scheduler for z/OS uses the input arrival date and time in the long-term plan when it extends the current plan to include a new application occurrence. This does not determine when the operations run, because this depends on other factors such as predecessor completion, resource availability, deadline time, and priority.

Creating the default calendar

About this task

A calendar in IBM Workload Scheduler for z/OS defines the status of each day and the workday end time. IBM Workload Scheduler for z/OS uses the calendar when it creates the long-term plan. When it creates the current plan, and when it decides whether to submit work, it does not refer to the calendar, so you cannot use the calendar to close down a system at short notice. Instead, use the MODIFY CURRENT PLAN panel to change the workstation open intervals as described in "Changing workstation availability" on page 626.

To create the default calendar:

1. Select option 1.2.2 from the IBM Workload Scheduler for z/OS main menu.
2. You see a list of calendars, if any exist. You can modify an existing calendar or to create a new calendar, enter `CREATE` at the command prompt. The CREATING A CALENDAR panel (Figure 52 on page 99) is displayed.

```
EQQTCCAL -------------------- CREATING A CALENDAR ---------- ROW 1 TO 20 OF 35
Command ===>                                                  Scroll ===> CSR

Enter/change data below and in the rows,
and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete

CALENDAR ID        ===> default______
DESCRIPTION        ===> lots and lots of holidays_____
WORK DAY END TIME  ===> 00.00

Row  Weekday or     Comments                        Status
cmd  date YY/MM/DD
'' SUNDAY________ _____________________________    F
'' MONDAY________ _____________________________    W

'' 03/05/05______ Spring May Holiday - UK_______   F
'' 03/06/21______ Midsummer's Day - Sweden______   F
'' 95/07/01______ Canada Day____________________   F
'' 95/07/04______ US Independence Day___________   F
```

Figure 52. EQQTCCAL - Creating a calendar

3. Type DEFAULT for the calendar ID.
4. Enter W for the status of the days of the week that are work days, and F for the non-work days and holidays. A day is specified as either:

   Work day
   When IBM Workload Scheduler for z/OS schedules work as normal

   Free day
   When IBM Workload Scheduler for z/OS plans work according to the free-day rule on each application run cycle. See "Selecting a free-day rule" on page 139 for detailed information about the free-day rule.

   The status specified for a particular date overrides the specification for the corresponding day of the week.
5. Specify the workday end time. If your installation shuts down, it probably does not do so at midnight. Normally, a system shuts down at the end of a shift, for example 6 a.m. This could be considered as the workday end time for your installation: the time that a normal work day ends. The workday end time is the time of day that a work day ends and a free day begins, and is the time of day that a free day ends and a work day begins, but be careful if you specify a time before midnight: **the work day after a free day starts at the first workday end time on the work day**. If the workday end time is after midnight, the workday end time determines when work is planned to run. If the workday end time is before midnight on the free day, IBM Workload Scheduler for z/OS waits for the next workday end time: the one on the work day after the free day, which is probably not what you expect, so it is recommended that you specify a workday end time at 00.00 or a later time.

   Note: Specify all times of day in 24-hour notation: never use a.m. and p.m.

   Example 1: the workday end time is 02.00, and Saturday and Sunday are free days

   - The long-term plan (LTP) has work until 02.00 Saturday morning.
   - There is no work in the long-term plan starting between 02.00 Saturday morning and 01.59 Monday morning, unless the free-day rule in the run cycle specifies that the application can run on a free day.
   - Work for Monday begins at 02.00 Monday morning.
   - Run cycles that specify an input arrival time between 00.00 and 01.59 generate an occurrence on the following day. For example, the rule Every

Monday in the Year generates occurrences early on every Tuesday morning (taking the free-day rule into account if Monday is a free day).

Example 2: the workday end time is near midnight

In this example, Sunday is a free day and Monday is a work day. Assume that the free-day rule in the run cycle specifies that no applications are run on free days.

End time
Effect on scheduling

00.00 No applications will be scheduled to run on a Sunday. Applications scheduled to run on Monday will start just after midnight between Sunday and Monday.

00.01 The Sunday free day runs from 00.01 on Sunday to 00.00 (midnight between Sunday and Monday) inclusive. If you specify a day with an input arrival time of 00.00 on the run cycle, IBM Workload Scheduler for z/OS assumes that you mean midnight between that day and the next day—times before the workday end time come at the **end** of the work day.

23.59 This work day end time is not recommended. The free day, Sunday, starts at 23.59 on Sunday and ends at 23.59 on Monday. The following work day, Monday, starts at 23.59 on Monday and lasts for 1 minute. In other words, almost no applications would be scheduled for Monday.

24.00 This work day end time is not recommended. The work day, Monday, would be lost because the start of the day would be midnight between Monday and Tuesday.

The workday end time has no effect on the daily planning process; when IBM Workload Scheduler for z/OS creates the current plan, it is the workstation open hours that determine if work will start within a particular period. If you do not want IBM Workload Scheduler for z/OS to plan or start work on a free day, close all workstations. If workstations are open on a free day, operations that have not finished processing by the workday end time will continue to process on the free day.

When you use an extra calendar , specify the calendar name for the application, job, or group definitions that do not use the default calendar.

When you modify the current plan using the ETT, ARC, or PIF, the subsystem has no access to the OPTIONS panel calendar name, or to the calendar specified in the BATCHOPT initialization statement. Unless you explicitly specify a calendar in the application description, the subsystem tries to use the calendar called DEFAULT. It is strongly recommended that you use the name DEFAULT for your normal calendar.

Creating periods

About this task

Periods can be *cyclic* or *noncyclic*. A cyclic period starts on a specific date and has a specified number of days. There are two kinds of cyclic periods; work-days-only cyclic periods where only work days are counted, and all-days cyclic periods where all the days are counted.

A noncyclic period such as a an academic semester, has a varying interval, so you must specify the origin date of each interval.

If you run work at fixed days of the week, month, or year, and take one of the standard IBM Workload Scheduler for z/OS actions when this day falls on a free day (holiday), you do not need to create your own periods. You can describe most cases with rules such as:

First Sunday in June
First work day in the week
Last Friday in the year
Last free day in the month

If you do need to create your own periods, either for use in rules or in the older (offset-based) type of run cycle definition, follow this procedure:

1. Create periods using the PERIOD panel. From the main menu, select option 1.3, to display the MAINTAINING THE PERIODS menu.
2. Select option 2 to display the LIST OF CALENDAR PERIODS panel:

```
EQQTPERL ----------------- LIST OF CALENDAR PERIODS -------  ROW 1 TO 5  OF 5
Command ===>                                                  Scroll ===> CSR

Enter the CREATE command above to create a new period or
enter any of the row commands below:
B - Browse, C - Copy, D - Delete, M - Modify

Row Period   Description                   Origin   Cyc Per Last update
cmd name                                   date     int typ user     date
'   ADVENT   Before Christmas              03/11/30   0  N  XCHAS    03/01/30
'   SEMESTER University term               03/01/06   0  N  XCHAS    03/01/02
'   TAXYEAR  British tax year              03/04/03   0  N  XMAWS    03/01/30
'   BACKUP   A cyclic interval of 4 days   03/01/01   4  W  XMAWS    03/01/30
'   QUARTER  Three calendar months         03/01/01   0  N  XMAWS    03/01/30
****************************** BOTTOM OF DATA ********************************
```

Figure 53. EQQTPERL - List of calendar periods

3. To create a new period, enter CREATE at the command prompt. The following panel is displayed:

```
EQQTCRPL ---------------- CREATING A CALENDAR PERIOD --------  ROW 1 TO 1 OF 1
Command ===>                                                 Scroll ===> CSR

Enter/change data below and in the rows,
and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat,  D(nn),DD - Delete

PERIOD NAME        ===> ________   Name of the period
PERIOD TYPE        ===> _          A = cyclic based on all days, W = cyclic
                                   based on work days, N = non-cyclic
DESCRIPTION        ===> ______________________________
                                   Descriptive text of the period
INTERVAL           ===> 000        Number of days between cyclic run period.
VARIABLE TABLE     ===> ________________ JCL variable table id

Row     Interval  Interval
cmd     origin    end
''     ________  ________
****************************** BOTTOM OF DATA ********************************
```

Figure 54. EQQTCRPL - Creating a calendar period

4. Complete the fields in the CREATING A CALENDAR PERIOD panel:

   PERIOD NAME
   The period name can be up to 8 characters.

PERIOD TYPE

There are three types:

A All-days cyclic. IBM Workload Scheduler for z/OS counts both work days and free days when calculating period dates.

W Work-days-only cyclic. IBM Workload Scheduler for z/OS counts only work days when calculating period dates. However, it is still possible for an offset-based run cycle to select a free day. See "Using work-days-only cyclic periods" on page 105.

N Noncyclic.

For example, if the calendar you are using specifies that 25 December 2003 is a free day, as are every Saturday and Sunday, and you create a type W period with an origin of December 1 and a length of 10 days, cyclic intervals will begin on these dates:

- 1 December, 2003
- 15 December, 2003
- 30 December, 2003
- 13 January, 2004, and every 10 work days after that

If you create a run cycle for an application that references this period with an offset of 1, the application will be scheduled on these dates. Because 25 December is a free day, it is not counted when IBM Workload Scheduler for z/OS calculates the run dates of the period.

DESCRIPTION

Type a description of the period.

INTERVAL

For cyclic periods, type the length of the period. For noncyclic periods, leave blank.

VARIABLE TABLE

If you use an offset-based run cycle, and do not specify an overriding table name on the run cycle, IBM Workload Scheduler for z/OS uses the JCL variable table that you specify here. If you use this period with a rule-based run cycle, IBM Workload Scheduler for z/OS ignores any table name specified here. See Chapter 25, "Job tailoring," on page 487 for a full description of job tailoring and variable substitution.

You can override the variable table, specified here or on the run cycle, using the MODIFY CURRENT PLAN (MCP) panel, the LONG TERM PLAN panel, or by using IBM Workload Scheduler for z/OS statements in the job.

Interval origin

For cyclic periods, specify the date of the start of the first interval in the period. For noncyclic periods, specify the start of every interval for, say, the next year. Remember to update the period definition and add more interval dates each year: IBM Workload Scheduler for z/OS issues a warning message when you extend or modify the long-term plan if you have not created intervals beyond the end of the long-term plan.

Interval end

For cyclic periods, leave this blank. For noncyclic periods, specify the end of every interval; the intervals must not overlap. If you leave this blank for noncyclic periods, IBM Workload Scheduler for z/OS assumes that the interval ends the day before the next interval.

When a run cycle specifies a negative offset in the period, or a rule includes the LAST specification, the interval end date is used to base the calculation. If interval end is not specified, IBM Workload Scheduler for z/OS assumes that the interval ends the day before the next interval begins. However, if you have only one interval origin specified and no interval end, a negative offset will be calculated from the day before the interval origin date.

When interval end is specified and a run cycle rule, or period and offset definition, results in a date outside the interval, an occurrence will not be generated. For example, a noncyclic period MYJAN specifies the start and end dates of January in every year. If you create a rule that specifies the 5th Friday in MYJAN and there are not 5 Fridays, the occurrence will not be generated in February. Similarly, if you specify offset 25 excluding free days and there are not 25 work days in a January, the occurrence will not be generated sometime in early February.

Note:

1. If the free day rule causes an occurrence to be moved beyond interval end, or prior to interval start, the long-term planning process issues a warning message. The occurrence will be scheduled by IBM Workload Scheduler for z/OS outside the specified interval.
2. From earlier versions of IBM Workload Scheduler for z/OS, work-days-only cyclic periods are handled differently. If you have defined the interval origin on a free day for a work-days-only cyclic period, a run cycle using that period will not generate the same dates as it did in previous releases of IBM Workload Scheduler for z/OS. To obtain the run dates you are used to in the long-term plan, move the interval origin to the nearest work day before the old interval origin. See "Using work-days-only cyclic periods" on page 105 for more information.
3. If you use a rule-based run cycle with a user-defined noncyclic period and do not specify an explicit end date for the last interval defined, GENDAYS and LTP batch treat the last specified origin date as an end date. Therefore, no occurrences are generated on or after the last specified origin date.
4. If a noncyclic period is defined with more than one interval, that is, with more than one starting date, then to specify offsets you can count days from the starting of each interval and generate dates for the occurrences in the long-term plan.

   If an explicit interval end date is defined for an interval and a specified offset is greater than the number of days in the interval, then the obtained date will not be considered and the message EQQ0527W will be issued.

   However, with open intervals, that is, with intervals which have no explicitly defined end date, offsets greater than the number of days between origin dates will be accepted and run dates might be generated outside the defined intervals.

   Thus, IBM Workload Scheduler for z/OS checks that the generated date is within the period interval only for intervals with explicitly defined end dates.
5. There is a maximum age limit for origins in *noncyclic* periods used with rule-based run cycles. When a *noncyclic* user-defined period is used in a rule run cycle, origin dates more than four years prior to January 1st of the current year do not generate correct run dates. For example, if a period is defined with

a single origin on Monday, December 31st 2007, run cycles using that period generate incorrect run days in GENDAYS displays and LTP batch after January 1st 2012.

Examples of periods

If you use rules with their built-in calendar cycles (days of the week, months of the year, and so on), you probably need to create only special noncyclic periods, such as university semesters and tax years. This section illustrates the concept of periods with some examples.

Cyclic periods

Examples of cyclic periods are a day, a week, and a fortnight, with fixed intervals of 1 day, 7 days, and 14 days, respectively. An academic semester cannot be described as a cyclic period, because spring, summer, and fall semesters have different lengths.

This example shows a lunar calendar month, assumed to be 28 days:

Cyclic period: work days and free days

```
PERIOD NAME     = MOON
PERIOD TYPE     = A
INTERVAL ORIGIN = 7 February 2003 (date of a new moon)
INTERVAL        = 28 days
```

This example shows a period that is useful if you need to take a backup every 4 work days:

Cyclic period: work days only

```
PERIOD NAME     = BACKUP
PERIOD TYPE     = W
INTERVAL ORIGIN = 2 January 2003
INTERVAL        = 4 work days
```

Noncyclic periods

Examples of noncyclic periods are a quarter, and a payroll period. You specify the start of each interval of a noncyclic period with an origin date.

This example shows a period for university semesters, with the interval origin and end specified for each semester:

Noncyclic period

```
PERIOD NAME  = Semester
PERIOD TYPE  = N
INTERVAL ORIGIN   INTERVAL END
26 August   2002  13 December 2002
13 January  2003  16 May      2003
 9 June     2003  28 June     2003
```

Noncyclic periods have a once-a-year maintenance overhead when you must create the intervals for the coming months. For this reason, carefully consider how flexible your period definitions are, and remove potentially duplicate definitions.

How run cycles use periods

To have IBM Workload Scheduler for z/OS automatically schedule an operation, create a run cycle in the application, job, or group definition.

When you create run cycles using the SEMESTER period, for example, you can use either rules or offsets:

Run cycles that use rules

```
First Day in Semester
Last Sunday in Semester
Seventh Sunday in Semester    (This may result in an error)
Last Day in Semester
```

These are the equivalent selections using offsets:

Run cycles that use offsets

```
Semester, offset 1         First day in semester
Semester, offset 105       Last Sunday in semester (for the semester
                              beginning on 26 August 1996)
Semester, offset 38        Seventh Sunday in semester (for the
                              semester beginning on 18 January 1994)
Semester, offset -1        Last day in semester
```

Notice that using offsets is more difficult and makes run cycles harder to maintain.

Note:

1. The start (origin) of each period is offset 1: there is no offset 0.
2. You cannot specify rules or offsets that select a day outside the interval. If the free-day rule causes a selected day to be shifted outside the interval, however, IBM Workload Scheduler for z/OS schedules the occurrence and issues a warning message.
3. If you omit the end date from the interval, the interval extends to the beginning of the next interval, so an offset of -1 (Last Day in Semester) selects the day before the next semester.
4. If you add occurrences to the current plan using ETT (event-triggered tracking), and you want external dependencies to be resolved as though the added occurrence had a fixed input arrival time, create a noncyclic period ETTRCY1 with an interval origin of 71/12/31, 31 December 2071. Run cycles that specify this special period are never scheduled in the long-term plan, but dependencies are resolved using the input arrival time on the run cycle, instead of the actual input arrival time, which is the time when the occurrence is added. See "Adding occurrences by event-triggered tracking" on page 478 for more information.
5. If you add occurrences to the current plan using ETT (event-triggered tracking), and you want to set its deadline by adding an offset to the actual input arrival time, then create a noncyclic period ETTRCY2 with an interval origin of 71/12/31, 31 December 2071. Then, for your ETT application, create a run cycle that specifies this offset period: an input arrival time of 00.00 and, as the deadline, the day and time you want the offset to be added to the actual input arrival time. These run cycles are never scheduled in the long-term plan, but when the occurrence is added to the plan, the occurrence deadline is calculated as the actual input arrival time plus the run cycle deadline. See "Adding occurrences by event-triggered tracking" on page 478 for more information.

Using work-days-only cyclic periods

A work-days-only cyclic period (type W) has only work days. Figure 55 on page 106 shows a 5-day period MYWEEK that starts on a Monday.

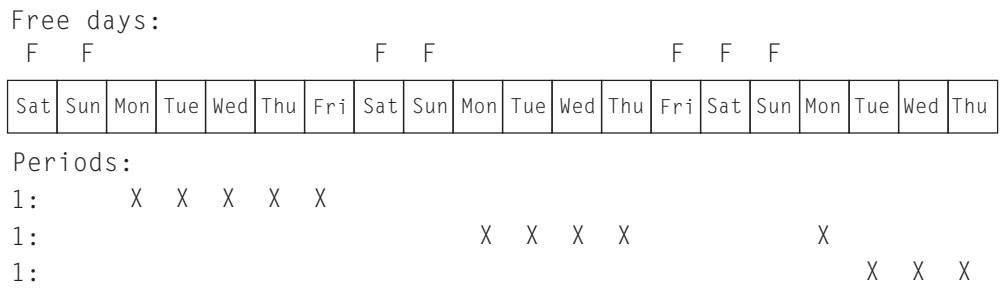


Figure 55. A 5-day work-days-only cyclic period, MYWEEK

As you can see, the period does not always start on the same day of the week, because of public holidays. If you want a fixed day of the week, use a rule such as "Every Monday in the year," using the free-day rule to avoid free days.

Difference between offset-based and rule-based cycles

If you have a work-days-only cyclic period MYWEEK, for example, with a length of 5 days, and specify an offset greater than 1, IBM Workload Scheduler for z/OS can select different days depending on the type of run cycle. Figure 56 shows how offset-based (top of diagram) and rule-based (bottom of diagram) run cycles treat an offset of 3. Day 1 in the period is a Thursday, and Saturdays and Sundays are free days.

When you specify offset 3 in an *offset-based* run cycle, the long-term planning program selects the third calendar day from the period origin and takes action depending on the free-day rule. See "Selecting a free-day rule" on page 139 for information about free-day rules.

This behavior differs from using the same period in the *rule-based* run cycle "Only 3rd day in MYWEEK," which selects Monday. When you specify a rule-based run cycle using a work-days-only cyclic period, IBM Workload Scheduler for z/OS jumps over the free days, counting only the work days in the period.

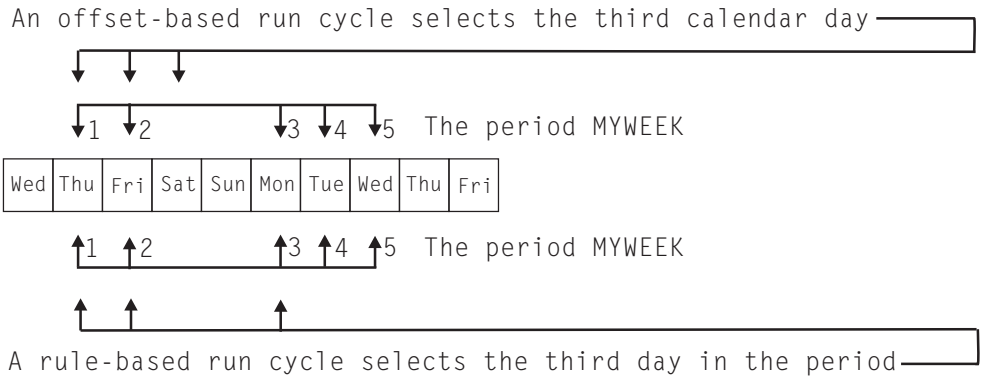


Figure 56. How IBM Workload Scheduler for z/OS counts offsets with work-days-only cyclic periods

Greater consistency

When you create a work-days-only cyclic period where the interval origin is a free day, the long-term planning program ignores this day and starts the first period on the first work day after this.

Figure 57 shows an example of this, where the origin of the 5-day period is a Saturday, and Saturdays and Sundays are free days.

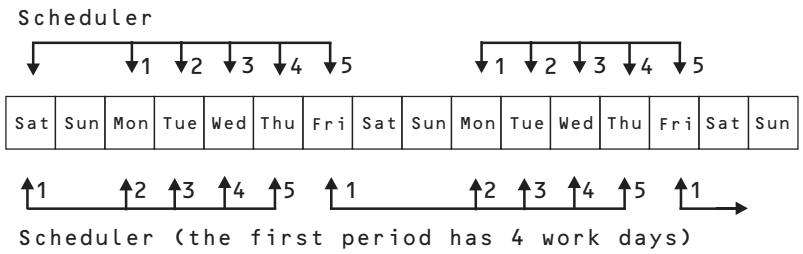


Figure 57. Results when the work-days-only cyclic period origin is a free day

Chapter 7. Defining and managing run cycle groups

You can optionally define a run cycle group for your application instead of - or in addition to - a number of single run cycles.

A run cycle group is simply a list of run cycles that are combined together to produce a set of run dates.

There are multiple advantages in using run cycle groups. They are:

A run cycle group is a distinct database object
It is defined by itself and can be matched with one or more applications. It is not defined as part of a specific application like single run cycles.

The same run cycle group can be used on different applications
This improves the overall usability of the run cycles, since it is possible to specify the same run cycle group in multiple applications avoiding the need to have multiple run cycles definitions for the same scheduling rules.

Run cycle groups enhance the use of negative run cycles
Negative run cycles are used to generate negative occurrences, which identify the days when an application would normally be scheduled but is not required. A negative occurrence always cancels any matching positive occurrences and you can specify a negative occurrence only if the positive equivalent already exists. Run cycle groups add a good deal of flexibility by providing users with the possibility to apply the negative run cycles to a subset of the positive ones rather than to all of them. Thus, users can group their run cycles in *subsets* so that the negative run cycles can be applied only to the positive occurrences generated by the run cycles belonging to the same set.

Run cycle groups allow the use of a logical AND between individual run cycles in the group
This is achieved with the addition of two new run cycle types:

A Rule-based run cycle. Select days when the application is to be run if they belong to all A types of the set of run cycles.

D Exclusion rule-based run cycle. Select days when the application is NOT to be run if they belong to all D types of the set of run cycles.

For example, you can add two conditions together:

```
Run on Wednesday "AND" the 8th workday of the month.
```

In this way, the only scheduled date would be the 8th work day of the month, if it fell on a Wednesday.

Full compatibility with *traditional* run cycles
The *traditional* run cycles specified in the application definition can reference run cycle groups, with the possibility to specify shift or offsets on them (as it happens with periods).

Availability of the GENDAYS command at run cycle group level
In this way, you can check the result of the combination of all the run cycles in the group.

In the long term plan (LTP) run cycle groups are interpreted as non-cyclic periods with open intervals (no end dates) where the generated days are used as start dates for the intervals and where every interval starting from a generated day finishes at the next generated day. To ensure the proper operation of the run cycle group, the last interval should extend beyond the LTP end-date, so that it is closed by this date.

You can use the Dynamic Workload Console or the ISPF panels to define and manage run cycle groups. This guide documents the ISPF interface. The documentation about the equivalent actions on the Dynamic Workload Console is available in the online help of the console.

Creating a run cycle group

About this task

To create a run cycle group in ISPF, follow these steps:

1. In the main IBM Workload Scheduler for z/OS panel select option 1 DATABASE.
2. In the MAINTAINING IWSZ DATA BASES panel, select option 10 RUN CYCLE.

   The SPECIFYING RUN CYCLE GROUP LIST CRITERIA panel is displayed.
3. Press ENTER leaving all fields blank.
4. In the ensuing panel, LIST OF RUN CYCLE GROUPS, type the CREATE command.

   The CREATING A RUN CYCLE GROUP panel is displayed.

```
EQQAMRPL ---------------CREATING A RUN CYCLE GROUP----------------  ROW 1 TO 1 OF 1
Command ===>                                                  Scroll ===> PAGE

Enter/Change data below and in the rows,
and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Specify run days/Modify rule
Enter the GENDAYS command to show the dates generated by this Run cycle group

RUN CYCLE GROUP ID ===> ____________              Run cycle group name
DESCRIPTION        ===> ____________________________________________________________
OWNER ID           ===> ____________________________  Owner name
INPUT HH.MM        ===> 00.00                         Input arrival time
DEADLINE DAY/TIME  ===> __ /_____                     Deadline
CALENDAR ID        ===> ____________________________  Calendar name
VARIABLE TABLE     ===> ____________________________  JCL variable table id



                                                 In       Out of
Row  Name of   Input  Deadline       F day  effect   Effect
cmd  rule      HH.MM  day HH.MM Type rule   YY/MM/DD YY/MM/DD Variable table
.... _________ _____  ___ _____ _    _      ________ ________ ________________
     Description: ____________________________________________________
     Subset ID: _________  Calendar: ________________

******************************** BOTTOM OF DATA ********************************
```

Figure 58. The CREATING A RUN CYCLE GROUP panel

Important: In this panel, fields and row commands in red mean that a value is required.

5. Enter a name for the run cycle group. The name must be from 1 to 8 alphanumeric characters long and must start with a letter or national character. This field is required.

   Attention: If you enter the name of an existing period, this name is checked for in the Periods database first and then among the run cycle groups in the Application Description database.

6. Optionally, for the new run cycle group specify:
   - A description of up to 50 characters
   - The owner's name (from 1 to 16 characters)
   - The default input arrival time that will be generated by this run cycle group in the HH.MM format. This field is optional, but if you do not specify here a value for the whole group, you will have to specify input arrival times for each run cycle of the group in the row commands section.
   - The latest date and time that the occurrences generated by the run cycles of this group should complete. Specify the date in terms of the number of days (1-99) following the date of submission, and the time in the HH.MM format. This value applies to all the run cycles in the group, unless you specify deadline values also in the rows below. In this case, the group value is overruled by the deadline specified for the single run cycle.
   - The name of a calendar used by the entire group (of up to 16 characters). If none is specified, the DEFAULT calendar is used.
   - The name of the JCL variable table associated with the run cycle group (up to 16 characters).

7. Use the row command line to create the individual run cycles as rules. For each run cycle that is part of the group:
   a. Enter the D (delete), I (insert), or R (repeat) commands to add or edit a rule. Use the S (select) command to display a panel where you can specify rule selections or run day offsets.
   b. Specify a name that uniquely identifies this run cycle as a rule. The run cycles within a run cycle group can be defined uniquely as rules, not as periods with offsets.
   c. Specify the input arrival time for the run cycle in the HH.MM format. This time determines when occurrences of the application that use the run cycle group will be included in the current plan. The time you specify here overrules any IA time that was defined at run cycle group level. If no value is entered for either run cycle or group, the default is 00.00.
   d. Enter the latest date and time that the occurrences generated by this run cycle should complete. Specify the date in terms of the number of days (1-99) following the date of submission, and the time in the HH.MM format. If a value is entered here and one was specified for the run cycle group, the run cycle uses the deadline specified in the row.
   e. Specify one of the following values for the run cycle type:

      R Rule-based run cycle. Select days when the application is to be run.

      E Exclusion rule-based run cycle. Select days when the application is not to be run.

      A Rule-based run cycle. Select days when the application is to be run if they belong to all A types of the set of run cycles.

      D Exclusion rule-based run cycle. Select days when the application is not to be run if they belong to all D types of the set of run cycles.

E and D type run cycles generate negative occurrences in the LTP which cancel any positive occurrences for the same date and time generated by R or A type run cycles. Arrange the positive and their matching negative run cycles in subsets within the run cycle group.

f. Specify how the run cycle handles free days defined in the calendar. See "Selecting a free-day rule" on page 139 for a full description.

g. Specify the in-effect and out-of-effect dates. If you leave these blank, IBM Workload Scheduler for z/OS fills them in with today's date and 71/12/31, 31 December 2071. See "Using in-effect/out-of-effect dates" on page 142 for hints on using these dates.

h. Optionally, unless you specified a variable table at run cycle group level, enter the name of the variable table that will be used on the days selected by this run cycle. For information about job tailoring, see Chapter 25, "Job tailoring," on page 487.

i. Type a description of the rule.

j. If the run cycle is part of a subset in the group (this might be convenient to match more run cycles against negative rules or to use the logical AND condition), enter the name of the subset. The name must be from 1 to 8 alphanumeric characters long and must start with a letter or national character.

k. Enter the name of the calendar used, if different from the calendar specified for the group.

l. Enter the S row command to specify the days that the rule will select or deselect and proceed to fill the MODIFYING A RULE panel, as described in "Creating run cycles with rules" on page 133

m. Enter PF3 (End) to return to the RUN CYCLE GROUP panel and repeat the row command until you have added all the run cycles that make up the group.

Listing run cycle groups

About this task

To run any action on defined run cycle groups (such as BROWSE, COPY, DELETE, and MODIFY), you must first list them.

To list run cycle groups, perform the following steps:

1. In the MAINTAINING IWSZ DATA BASES panel, select option 10 RUN CYCLE.

   The SPECIFYING RUN CYCLE GROUP LIST CRITERIA panel is displayed.

2. To get a complete list of defined run cycle groups, leave all fields blank and press ENTER.

   The LIST OF RUN CYCLE GROUPS panel is displayed. It contains a complete list of all the run cycle groups currently defined in the IBM Workload Scheduler for z/OS database.

3. To get a filtered list, enter information that leads to the selection of the run cycle group (or groups) that you are seeking and press ENTER. Entering more specific information produces narrower results.

   To get broader lists, you can also use asterisks as wildcards.

Browsing a run cycle group

About this task

To view the details of a run cycle group in ISPF, follow these steps:

1. In the MAINTAINING IWSZ DATA BASES panel, select option 10 RUN CYCLE.

   The SPECIFYING RUN CYCLE GROUP LIST CRITERIA panel is displayed.
2. Enter the information that leads to the selection of the run cycle group(s) you are seeking and press ENTER.

   The LIST OF RUN CYCLE GROUPS panel lists the run cycle group(s) listed by your selection.
3. Enter **B** in the row command space next to the run cycle group you want to view.

   The RUN CYCLE GROUP IN THE DATABASE panel displays the following details:

   - The run cycle group ID and its description
   - The owner's ID
   - The input arrival time
   - The deadline, in terms of the number of days following the date of submission and a time in the HH.MM format, when the occurrences generated by the run cycle group should be complete.
   - The name of the calendar specified for the group
   - The name of the variable table used by the group
   - The number of run cycles that make up the group
   - The author and the date and time of the last update

   For every run cycle defined in the group, the following values are listed:

   - The name of the rule that identifies the run cycle.
   - The input arrival time, if different from the IA specified for the group.
   - The deadline, if any.
   - The type of run cycle (R, E, A, or D).
   - The free-day rule specified for the run cycle.
   - The in-effect and out-of-effect dates.
   - The variable table name, if different from the variable table specified for the group.
   - The run cycle description.
   - The subset name, if available.

   On each run cycle, you can enter the following commands to browse additional details:

   B or S Shows the frequency, type of day(s), and cycle specification (in terms of weeks, months, year, or period) defined for the rule.

   GENDAYS
   Displays the days generated by the run cycle, including the name of the calendar used, the interval (overlap) period, and the free-day rule type used.

   E Displays the EVERY options specified for the run cycle, which consists in the frequency with which an occurrence is to be repeated within a time interval (hours and minutes).

None of the displayed information can be changed from this panel. Use the MODIFY (**M**) row command on the run cycle group in the LIST OF RUN CYCLE GROUPS panel to do so.

Copying a run cycle group

About this task

At times it may be convenient to create a new run cycle group from an existing one, if the two share a number of similar properties. You can use the COPY command to do this.

To copy an existing run cycle group in ISPF, follow these steps:

1. In the MAINTAINING IWSZ DATA BASES panel, select option 10 RUN CYCLE.

   The SPECIFYING RUN CYCLE GROUP LIST CRITERIA panel is displayed.
2. Enter the information that leads to the selection of the run cycle group(s) you are seeking and press ENTER.

   The LIST OF RUN CYCLE GROUPS panel lists the run cycle group(s) listed by your selection.
3. Enter **c** in the row command space next to the run cycle group you want to copy.

   The COPYING A RUN CYCLE GROUP panel is displayed. This panel looks the same as the Figure 58 on page 110.
4. Enter a new name in the RUN CYCLE GROUP ID field and change any other property as needed.
5. When you are finished, press PF3 to save the new run cycle group.

Deleting a run cycle group

About this task

To delete a run cycle group in ISPF, follow these steps:

1. In the MAINTAINING IWSZ DATA BASES panel, select option 10 RUN CYCLE.

   The SPECIFYING RUN CYCLE GROUP LIST CRITERIA panel is displayed.
2. Enter the information that leads to the selection of the run cycle group(s) you are seeking and press ENTER.

   The LIST OF RUN CYCLE GROUPS panel lists the run cycle group(s) listed by your selection.
3. Enter **d** in the row command space next to the run cycle group you want to delete.

   The CONFIRMING DELETION OF A RUN CYCLE GROUP panel is displayed. It shows the following details of the selected run cycle group:
   - The run cycle group ID and its description
   - The owner's ID
   - The input arrival time
   - The name of the calendar specified for the group
   - The name of the variable table used by the group
   - The number of run cycles that make up the group
   - The author and the date and time of the last update

4. Enter Y in the command field to confirm deletion or N to reject deletion.

Modifying a run cycle group

About this task

To modify an existing run cycle group in ISPF, follow these steps:

1. In the MAINTAINING IWSZ DATA BASES panel, select option 10 RUN CYCLE.

   The SPECIFYING RUN CYCLE GROUP LIST CRITERIA panel is displayed.
2. Enter the information that leads to the selection of the run cycle group(s) you are seeking and press ENTER.

   The LIST OF RUN CYCLE GROUPS panel lists the run cycle group(s) listed by your selection.
3. Enter **m** in the row command space next to the run cycle group you want to modify.

   The MODIFYING A RUN CYCLE GROUP panel is displayed. This panel looks the same as the Figure 58 on page 110. Apart from the RUN CYCLE GROUP ID, which cannot be overwritten, you can modify any of the remaining properties of the selected run cycle group.

Viewing the generated days of a run cycle group

You can view a calendar-type representation of the days generated globally by a run cycle group.

About this task

To view the days generated by a run cycle group:

1. Follow the steps necessary to browse, create, or modify a run cycle group in the database.
2. When you are in one of the ensuing panels, enter the GENDAYS command or, where available, press the PF4 key (Actions), use the TABS key to position your cursor under the `Actions` item, and press ENTER to display a pop-up window where you enter **1** to select the `Display the dates generated by this Run cycle group` menu item.

   The LIST OF GENERATED DATES panel is displayed.

The LIST OF GENERATED DATES panel shows:

- The name of the run cycle group
- The name of the calendar used to display work and free days. If a calendar was not defined for the run cycle group, the calendar defined in the OPTIONS dialog is used. When a calendar is not defined there, a calendar named DEFAULT is used.
- The work-day-end time specified in the calendar.
- The shortest time period that the following periods overlap:
  - Run cycles validity range
  - Four years forward from 1 January of the current year
- The calendar-type representation of the days generated for the run cycle group.

This list of generated dates is calculated globally for the group, putting together the dates generated by the individual run cycles. This process is run based on the

run cycle group subsets. That is, the dates are generated first for the run cycles within each subset (calculating the dates from the positive, the negative, and the AND rules) and ultimately the dates generated for the subsets of the group are converged together. This is the value of grouping the run cycles within a group into subsets. Each subset should contain related positive (R) and negative (E) rules, or AND condition positive (A) and negative (D) rules.

For example, you defined a run cycle group where all the run cycles are in effect for the second half of year 2013 (from 13/07/01 to 13/12/31) and uses a calendar where:

- The work day end time is defined at 06.00
- Only Saturday and Sunday are free days

There are four rules defined with different free-day rules and input arrival times. The run cycles are paired in 2 subsets. The run cycles are:

Rule1 Run every first and 15th day of each month.

Rule2 Do not run on any day of week 46.

Rule3 Run on the last Thursday of every month (AND condition).

Rule4 Run on the last work day of every month (AND condition).

Table 10. an example of how the days of a run cycle group are generated.

Run cycle (subset ID)	Free day rule	Input arrival time	Rule type	Days generated for run cycle	Days generated for subset	Days generated for run cycle group
Rule1 (SS1)	2	10.00	R	Days 1 and 15 in July, August, October, and November. In September and December, days 2 and 16 because the first and the 15th fall on a free day (Sunday).	Days 1 and 15 in July, August, and October. Day 1 in November. Days 2 and 16 in September and December.	July: 1, 15 August: 1, 15 September: 2, 16 October: 1, 15, 31 November: 1 December: 2, 16
Rule2 (SS1)	E	10.00	E	All days spanning from November 11 to November 15.		
Rule3 (SS2)	E	18.00	A	The following Thursdays: July 25, August 29, September 26, October 31, November 28, and December 26.	Thursday October 31 (only this day satisfies the AND condition of the two run cycles in SS2)	
Rule4 (SS2)	1	18.00	A	Wednesday July 31, Friday August 30, Monday September 30, Thursday October 31, Friday November 29, Tuesday December 31.		

The rule-processing order within a subset or a run cycle group without subsets is as follows:

1. A-type rules (AND conditions) are resolved. The end-result eventually is equivalent to an R rule.
2. D-type rules (negative AND conditions) are resolved. The end-result eventually is equivalent to an E rule.
3. R-type rules are resolved.
4. E-type rules are resolved
5. All dates generated from the resolved A and R-type rules are merged together.
6. All dates generated from the resolved D and E-type rules are merged together.
7. The negative dates generated from all D and E-type rules are subtracted from the dates generated from the A and R-type rules.

Note also that if a calendar is specified for a rule, the run days for that rule are generated with that calendar. If no calendar is specified for the rule, the run days are generated using the calendar defined for the run cycle group (or the DEFAULT calendar). In any case, when you run the GENDAYS command to display the overall run days of the run cycle group, the days are displayed using the calendar of the run cycle group (or the DEFAULT calendar).

Submitting a batch job to print a run cycle group

About this task

To submit a batch job to print a run cycle group, follow these steps:

1. In the MAINTAINING IWSZ DATA BASES panel, select option 10 RUN CYCLE.

   The SPECIFYING RUN CYCLE GROUP LIST CRITERIA panel is displayed.
2. Enter the information that leads to the selection of the run cycle group(s) you are seeking and press ENTER.

   The LIST OF RUN CYCLE GROUPS panel lists the run cycle group(s) listed by your selection.
3. Enter **p** in the row command space next to the run cycle group you want to print.

   The GENERATING JCL FOR A BATCH JOB panel (EQQXSUBP) is displayed.

```
EQQXSUBP -------------- GENERATING JCL FOR A BATCH JOB ----------------
Command ===>

Enter/change data below and press ENTER to submit/edit the JCL.

JCL to be generated for:

SYSOUT CLASS       ===> -           (Used only if output to system printer)
LOCAL PRINTER NAME ===> ________    (Used only if output on local printer)
                                    (Used only if CLASS is blank)
DATASET NAME       ===> ____________________________________________
                                    (Used only if CLASS and LOCAL PRINTER
                                    are both blank). If blank default name
                                    used is USER_NAME.SYSTEM_NAME.RGPRT.LIST

SUBMIT/EDIT JOB    ===>             S to submit JOB, E to edit

Job statement    :
 ===> //USER_NAME JOB ,,NOTIFY=USER_NAME_____________________
 ===> ____________________________________________________________________
 ===> ____________________________________________________________________
 ===> ____________________________________________________________________
```

Figure 59. The GENERATING JCL FOR A BATCH JOB panel to print a run cycle group

4. Optionally, enter:
   - The alphanumeric character that defines the output class for the job on the system printer.
   - The name of a local printer where you want to direct the output.

   If you would rather have the output stored in a data set, enter instead the name of the destination data set. A default name is provided for the job output by the system.
5. Optionally, change the job statement displayed at the bottom of the panel.
6. Enter S to submit the job, or E to edit the JCL via the ISPF editor.

   If you select E, an ISPF edit panel containing the JCL is displayed. After editing, enter SUBMIT to run the job directly from the edit panel. If you enter END or use PF3 from the edit panel, the job is not submitted. From the edit panel, you can save the job using the CREATE command. Note that the JCL for the job is *not* saved in the IBM Workload Scheduler for z/OS JCL repository. If the job needs to be rerun, you must re-create the JCL, unless you saved it with the CREATE command.

The job is submitted using TSO submit; as a result, the authority of the submitting user is assigned to the job.

You can also submit a single batch job to print several or all the run cycle groups in the database. Follow these steps:

1. Start from panel SPECIFYING RUN CYCLE GROUP LIST CRITERIA to create a list of the run cycle groups of interest, using the asterisk (*) as a wildcard character
2. Enter PRINTRG on the command line to display the GENERATING JCL FOR A BATCH JOB panel.
3. In the panel, after entering your output-related preferences, enter **E** to edit the JCL.
4. At the bottom of the JCL, after the SYSIN statement, leave the asterisk to print all the run cycle groups or use it in combination with partial run cycle group names to print selected subsets.

Specifying run cycle groups in the Application Descriptions

About this task

There are two ways to specify a run cycle group in an application description (AD). In either way you start by entering the RUN command in the CREATING (or MODIFYING) AN APPLICATION panel to display the RUN CYCLES panel.

Specifying one or more run cycle groups within a rule definition

Enter a rule name (not the run cycle group name), specify R for the rule type and 3 for the freeday rule, and enter the in and out of effect dates. The other fields are optional. Then:

1. Enter the S row command to specify the run days.

   The MODIFYING A RULE panel is displayed. Here, you specify run days with run cycle groups as you would with periods in the Cycle specification column.
2. In the Frequency column, select Only or Every. You can make additional selections (if you do not, First is used as default).
3. In the Day column, make a selection (you must at least select Day).
4. In the Period/RG name field of the Cycle specification column, specify up to four run cycle groups that must have been previously defined in the database.

   Note that you can specify a of mix run cycle groups, periods, and other run dates as long as they are compatible.

   If you plan to use only the run cycle group days to generate occurrences in the application, select ONLY and First Day.
5. Run the GENDAYS command to verify that the specified dates are correctly generated.

   Note that the dates of the run cycle groups are generated based on the calendars defined for the run cycle groups (or eventually for the single run cycles in the group). The calendar defined for the application is used to display the generated dates.

Important: A run cycle group that generates multiple occurrences per day cannot be used in a rule-based run cycle, because:

- If no input arrival time is specified in the run cycle, the run cycle is invalid.
- If the input arrival time is specified in the run cycle, the multiple occurrences are flattened in favour of a single occurrence based on the input arrival time.

Consequently, unless you are willing to relinquish the multiple daily occurrences, specify the run cycle group as a period.

Specifying a run cycle group as you specify a period

Enter the name of a run cycle group that must have been previously defined in the database, specify N for the type and 3 for the freeday rule, and enter the in and out of effect dates. The other fields are optional. Then:

1. Enter the S row command to display the RUN CYCLE GROUPS DAYS panel.
2. Optionally, specify a positive or negative offset from the origin dates of the run cycle group.

After you have added a run cycle group to an Application Description, you can use its name as a filtering criterion in the SPECIFYING APPLICATION LIST CRITERIA panel to list the applications that use it. The criterion is valid for run cycle groups defined within a rule as well as for those defined as type N.

The following table provides hints about defining certain items in the AD panels when run cycle groups are included.

Table 11. Application Description definitions that require attention when run cycle groups are included (either in rules or as periods).

Item definition that requires attention	Reason
Input arrival time, Calendar, deadline, variable table, and all fields present in both AD and run cycle group definitions	When these fields are defined both within a run cycle group and in the AD panels where the run cycle group is specified, the values specified in the AD panels override the ones specified for the run cycle group.
Input Arrival time, Input Arrival time and EVERY option	Does not show as a mandatory (red) field in the AD panels, but the IA time is in fact required for rule-based run cycles. You should always define an IA time for rule-based run cycles in the AD panels, unless they include only run cycle groups that already have their own IA time definition (which is then inherited by the application). However, if in the Cycle Specification section the run cycle: • includes a mix of periods and run cycle groups, it requires that the IA time be specified for the run cycle. This IA time overrules the one(s) specified for the run cycle group(s). • includes more run cycle groups that generate multiple daily occurrences due to juxtaposed IA times of the run cycle groups, only one occurrence is generated per day based on the IA time that comes first. If a run cycle group that generates multiple occurrences per day (due to the use of the EVERY option) is used within a rule-based run cycle, and the IA time is specified in the AD, the multiple daily occurrences are canceled and only one occurrence is generated daily based on the IA time definition in the AD. Run cycle groups that generate multiple occurrences per day work properly only when used as offset-based run cycles. The IA time must be always specified, even if it can be inherited, when you are also making use of the EVERY options. If the IA time is required but omitted, the "INPUT ARR TIME MISSING" message is displayed in the RUN CYCLES panel of the AD.

Table 11. Application Description definitions that require attention when run cycle groups are included (either in rules or as periods). (continued)

Item definition that requires attention	Reason
Calendar	Notwithstanding the run cycle group days are generated based on the calendar specified for the group (or its members), the days generated for the run cycles of an application are calculated based on the calendar specified in the AD panel. To guarantee that the freeday rule is applied consistently when using a run cycle group to schedule an application, specify the same calendar throughout the definitions of run cycle groups and applications, or specify a freeday rule of type 3 when defining the run cycles of an application.
Deadline, deadline and EVERY option	Deadlines are calculated based upon the final IA time of the occurrences. Normally, if you use the EVERY option for a run cycle and you specify a deadline, the LTP occurrences generated with the different IA times by the EVERY specifications have different deadlines as well. But when a run cycle in the AD includes a run cycle group and a deadline is not provided in the run cycle definition but only in the run cycle group, all the occurrences generated with the different IA times by the EVERY definition keep the same deadline defined in the run cycle group. If you want the deadline values to match the changes in the IA times that result from the EVERY definition, you must define the deadline for the run cycle in the AD.

Finding which applications use a run cycle group

About this task

Prior to modifying or deleting a run cycle group in the database, it might be useful to find which applications use the run cycle group.

To get a list of the applications that are defined to use a run cycle group:

1. Follow the same steps necessary to browse a run cycle group in the database.
2. When you are in the RUN CYCLE GROUP IN THE DATABASE panel, press the PF4 key (Actions), use the TABS key to position your cursor under the `Link` item, and press ENTER.

   A pop-up window is displayed, listing the following items:

   - 1. Link Calendar (LINKCAL)
   - 2. Link Application (LINKAD)
3. Write **2** and press ENTER.

   A list of the applications that are scheduled based on the run cycle group is displayed. The following details are provided (you must scroll to the right to view them completely):

- The application ID and its description.
- The dates marking the time interval that the application can run.
- The application type (application or group definition).
- The application status (active or pending), which determines whether or not the application can be selected for processing.
- The name of the application owner.
- The priority.
- The total number of run cycles defined for the application.
- The number of operations defined for the application.
- The date and time the application was last updated and by which user ID.
- The authority group that the application belongs to.
- The name of the calendar used. The DEFAULT calendar is listed if none was specified. No calendar is shown for groups (in this case, the calendar ID is determined in the group description.
- The group definition name where the calendar and run cycle information is stored for the application.
- The smoothing factor (DSF) that controls how actual deadline data is used and determines the level of feedback of the new estimated deadline.
- The feedback limit (DFL) that establishes the limits within which feedback data (actual deadline) is considered normal and acceptable.

Maintaining calendars from a run cycle group

About this task

To get a list of the calendars defined in the database, to run actions on them, and to create additional ones from a run cycle group:

1. Follow the same steps necessary to browse a run cycle group in the database.
2. When you are in the RUN CYCLE GROUP IN THE DATABASE panel, press the PF4 key (Actions), use the TABS key to position your cursor under the `Link` item, and press ENTER.

   A pop-up window is displayed, listing the following items:

   - 1. Link Calendar (LINKCAL)
   - 2. Link Application (LINKAD)
3. Write **1** and press ENTER to display the MAINTAINING THE IWSZ CALENDARS panel.

   In this panel you can run the following options:

   BROWSE CALENDAR
   Displays a list of all the available calendars. You can see the details of a calendar or display a calendar graphically.

   MODIFY CALENDAR
   Displays a list of all the available calendars. You can browse, copy, delete, modify, or graphically display a calendar, or create another one.

   PRINT
   Print all the calendars included from the date of submission to an end date of your choice. This displays the GENERATING JCL FOR A BATCH JOB panel where you can enter your preferences to generate a JCL that prints all the eligible calendars.

Chapter 8. Creating applications and groups

This chapter explains *applications* and *groups*, and shows you how to create and use them.

Things you should consider before creating applications

This section provides general information to consider before creating applications:

- What are applications
- Application types
- Naming standards in applications
- Rules for creating applications
- Subdivision of applications
- Methods for creating applications

Detailed procedures for creating applications are described, with the help of an example payroll application, in "Standard applications and group definitions" on page 127 and "Creating job descriptions" on page 185 (online panels), and in Chapter 9, "Defining applications in batch," on page 203.

What are applications?

The tasks that you want to control, such as running a job, issuing a WTO, or preparing JCL for a job, are called *operations*. An *application* is a group of related operations. The operations in each application are always run together: when an operation in the application is run, all other operations must also be run.

An application contains some or all of these parts:

General data
: Application name, description, and owner representative

Run schedules
: Period references, run time, and deadlines

Operation data
: Job names, workstations, and resources

Dependencies
: Between operations within the application and other applications

All applications contain general data. The requirement for other parts depends on your processing schedules and also on the type of application created. You can create one of three application types:

- Standard application descriptions
- Job descriptions
- Group definitions

Standard application descriptions

Use the APPLICATION DESCRIPTION panel to create and modify standard applications. Standard applications can contain more than one job.

Job descriptions

If you want only one main processor operation (job) in an application, you can create it with the Job Description dialog box, which compresses most of the function of the APPLICATION DESCRIPTION panel into one panel by making some assumptions about the application that you are creating. An application that is created using the JOB DESCRIPTION dialog box, or that has the restrictions enforced by that panel, is called a *job description*.

You can browse or modify job descriptions using both the JOB DESCRIPTION and the APPLICATION DESCRIPTION panels, but if you change a job description using the APPLICATION DESCRIPTION panel so that it no longer obeys the rules for job descriptions, it becomes a standard application description.

Standard applications and group definitions can be viewed or modified only with the APPLICATION DESCRIPTION panel.

To be a job description, an application description must satisfy the following conditions:

- It consists of no more than three operations.
  - One of the operations is a computer workstation operation, or a general workstation WTO operation. This operation is called the *main operation* of the description.
  - The other two operations, if present, are immediate predecessors of the main operation, and run on general workstations, either as manual operations or as JCL preparation operations.
- The job name of the main operation is the same as the job description ID and the same as its two general workstation predecessors, if present.
- The operation is ready to be included in the schedule: you cannot specify pending status for job descriptions.
- The application ID and owner ID should not be specified in double-byte character set (DBCS) bracketed format.

If you create an application that meets these rules, IBM Workload Scheduler for z/OS classes it as a job description, whether you create it with the APPLICATION DESCRIPTION panel, the JOB DESCRIPTION dialog box, the batch loader, or a program interface (PIF) application.

Like standard applications, you can specify a run cycle for the job description, or make it part of a group, in which case IBM Workload Scheduler for z/OS uses the calendar and run cycles associated with the group definition.

Group definitions

You can group applications and job descriptions that are always scheduled together by creating them as members of an *application group*. With an application group, the description of the application is recorded in a *group definition*, and not in individual applications. By doing this, you avoid having to specify the same calendar and run policy information for each application.

The use of application groups can save you time, in the initial specification of your work to IBM Workload Scheduler for z/OS and in ongoing maintenance to the applications. You can also use groups in the MODIFY CURRENT PLAN panel, to add, delete, and complete all or part of an application group in the current plan.

Having applications in a group also gives some protection against unintentional deletion or modification of individual group members in the plans. For example, to delete an application occurrence that is part of a group in the current plan, you must first remove it from the group.

Naming standards in applications

Naming standards are important when you are creating application descriptions. A sensible standard at the beginning of the application-definition process can save you time later.

The major factor that will influence your naming conventions is the ability to use generic names in IBM Workload Scheduler for z/OS panels and security products such as RACF®. Consider naming standards for these items:

- Application group IDs
- Application IDs
- Job names
- Operation numbers
- Owner IDs
- Authority group IDs

Note: Job descriptions are identified by their associated job or started-task procedure name.

Application IDs

Related applications should have the same application ID prefix. For example, all payroll applications could begin with P. If you use group definitions, you might consider using a unique prefix, like GRP, to identify all group definitions. The application ID field is 16 characters.

Avoid numbering application IDs. For example, HOUSEKEEP£1, HOUSEKEEP£2, and so on, because you might need a HOUSEKEEP£1.5.

Job names

Try to make each job name unique when you specify a job or started task. Ideally, the names of IBM Workload Scheduler for z/OS jobs should also be different from those of jobs not in IBM Workload Scheduler for z/OS.

IBM Workload Scheduler for z/OS imposes some restrictions on your choice of job names:

- Print operations must have the same job name as the job operations to which the refer.
- An operation on a job setup workstation must have the same job name as the succeeding computer workstation operation.

Operation numbers

Give each operation in an application a number in the range 1 to 255. Consider reserving number ranges for specific types of operations. For example, job setup operations could be from 1 to 9, computer processing operations from 10 to 240, and print operations from 241 to 255. When specifying operation numbers within these ranges, leave gaps for growth. For example, the first operation could be 05, the second operation 15, and so on.

Owner IDs

An owner ID must be specified for each application. The owner ID is a convenient label under which you can identify applications. This ID can then be used as a

search argument. For example, all Paymore applications have an owner ID of SAMPLE. The owner ID of SAMPLE can be used as selection criteria in the panels and reports.

Rules for creating applications

This section outlines the basic rules that govern standard applications and group definitions. The panels prevent you from breaking these rules.

A *group definition* is the central member in an *application group*. It groups related applications as a unit, holding common run cycles and calendar information for all applications in the group. The benefits are that you:

- Can perform modify actions on the group as a single unit within the plan instead of having to perform actions on many individual applications. This makes it simpler to add, delete, and complete many applications at once.
- Maintain only a single source for run cycle and calendar information. Maintaining your application description database is simpler and less prone to error.

Table 12. Differences between applications and group definitions

Specifications	Standard application	Group definition
How many operations can it have?	From 1 to 255, each with an operation number in the range 001 to 255, all directly or indirectly linked to each other, and in such a way that they do not form a loop.	None directly, but it has applications, each of which can have 255 operations
How do you get IBM Workload Scheduler for z/OS to schedule it?	Specify the calendar name (if you are not using the default calendar) and the run cycles	Specify the calendar name (if you are not using the default calendar) and the run cycles. The applications that belong to the group must not specify these.
What fields must you specify? (Values for type, priority, valid-from date, and status are stored in your ISPF profile and are used as default values when you next use the panel.)	• Application ID • Type, which must be A • Owner ID • Valid-from date • Status • Priority • At least one operation	• Application ID (the group ID) • Type, which must be G • Owner ID • Valid-from date • Status

Subdivision of applications

If possible, divide large applications that might run over several days—or even months—into smaller applications that run daily. You can link these smaller applications with a network of *external dependencies* to provide a more meaningful picture of the overall run plan for an extended period. See “Specifying dependencies” on page 175.

Do not subdivide applications too finely. If you do, you will have to access many applications descriptions, instead of just a few, to make changes.

You can split large jobs consisting of many steps into smaller, interrelated jobs. This lets you use your installation resources more efficiently. For example, assume

that job steps A, B, C, and D are all in the same job to ensure that B, C, and D run after A. IBM Workload Scheduler for z/OS can schedule the steps in the correct order and let B, C, and D run at the same time. This lets more work run in parallel and can give you more spare time in your batch window.

Also consider using dummy workstations to serialize operations. See "Dummy workstations" on page 55 for more details.

Methods of creating applications

You can use any of these methods to create your application:

- **APPLICATION DESCRIPTION panel**

  You enter this panel by selecting the AD option from the MAINTAINING IWSz DATA BASES panel. See "Standard applications and group definitions."

- **JOB DESCRIPTION panel**

  The JOB DESCRIPTION panel compresses most of the function of the APPLICATION DESCRIPTION panel into one panel by making some assumptions about the application that you are creating. See "Creating job descriptions" on page 185.

- **Batch loader**

  This program lets you enter your application descriptions in batch. See Chapter 9, "Defining applications in batch," on page 203 for details.

- **Program interface**

  This standard interface lets you write your own programs to update information held by IBM Workload Scheduler for z/OS. For details, see *Developer's Guide: Driving IBM Workload Scheduler for z/OS*.

- **LIST OF APPLICATIONS panel**

  If you are using the advanced panels (see Panels Style) in the LIST OF APPLICATIONS panel choose **Action > Create** (see Figure 108 on page 194).

Standard applications and group definitions

This section describes how you use the APPLICATION DESCRIPTIONS panel to create standard applications and group definitions.

It covers these topics:

- Creating an application and its operations
- Specifying when your application should be scheduled
- Creating operations
- Specifying operation details
- Associating job statements with operations
- Using print operations
- Using WTO operations
- Creating started-task operations
- Scheduling the closedown of online systems and started tasks
- Creating time-dependent operations

Creating an application and its operations

Procedure

1. From the main menu, select option 1.4. You see the MAINTAINING APPLICATION DESCRIPTIONS panel, shown in Figure 60 on page 128.

```
EQQASUBP ----------- MAINTAINING APPLICATION DESCRIPTIONS ---------------------
Option ===>

Select one of the following:

1 BROWSE          - Browse applications
2 CREATE          - Create an application
3 LIST            - List applications for further processing
                    (browse, modify, copy, delete, print,
                    calculate and print run days, modify LTP)
4 PRINT           - Perform printing of applications
5 MASS UPDATE     - Perform mass updating of applications
6 EXPORT-IMPORT   - Perform exporting and importing of applications
```

Figure 60. EQQASUBP- Maintaining application descriptions

2. Select option 2 to show the CREATING AN APPLICATION panel, shown in Figure 61.

   Note: If you are using the advanced panels (see Panels Style), select Create in the **Action** menu of the LIST OF APPLICATIONS panel (EQQNALSL).

```
EQQACGPP ------------------ CREATING AN APPLICATION --------------------------
Command ===>

Enter/Change data below:
Enter the RUN command above to select run cycles, the DEP command to select
dependencies at applicaton level, or the OPER command to select operations.

Application:
 ID                ===> PAYDAILY________
 TEXT              ===> Daily PAYROLL backup___    Descriptive text
 TYPE              ===> A           A - Application, G - Group definition
Owner:
 ID                ===> SAMPLE_________
 TEXT              ===> Pay Office_____________
                                    Descriptive text of application owner
PRIORITY           ===> 5           A digit 1 to 9 , 1=low, 8=high, 9=urgent
VALID FROM         ===> 97/01/30    Date in the format YY/MM/DD
STATUS             ===> A           A - Active, P - Pending
AUTHORITY GROUP ID ===> ________    Authorization group ID
CALENDAR ID        ===> ________________   For calculation of work and free days
GROUP DEFINITION   ===> ________________   Group definition id
SMOOTHING FACTOR   ===> ____   LIMIT ===> ____  Deadline Feedback options
```

Figure 61. EQQACGPP - Creating an application

3. Specify the Application ID (for details, see "Specifying the application ID" on page 129) and, optionally, specify a description of the application (up to 24 characters) in the TEXT field.
4. Specify A or G in the TYPE field and a group definition ID in the GROUP DEFINITION field as required, according to the table in Table 13.

Table 13. How to use the RUN and OPER commands and the GROUP DEFINITION field

If you are creating	RUN command	OPER command	Group Definition field
A group definition TYPE = G	Use the RUN command if you want to schedule the group definition.	Do not use the OPER command to specify operations: specify these when you create the applications in the group.	Leave blank. Specify the name of the group in the ID field (Application ID).

Table 13. How to use the RUN and OPER commands and the GROUP DEFINITION field (continued)

If you are creating	RUN command	OPER command	Group Definition field
An application that is part of a group TYPE = A	Do not use the RUN command, because IBM Workload Scheduler for z/OS uses the run cycles that are part of the group definition.	Use the OPER command to specify the operations in the group.	Set to the name of the group that this application belongs to.
An application that stands alone TYPE = A	Use the RUN command if you want to schedule the application.	Use the OPER command to specify the operations in the application.	Leave blank.
For detailed information about run cycles and the RUN command, see "Specifying when your application should be scheduled" on page 131.			
For detailed information about operations and the OPER command, see "Monthly run cycle examples" on page 147.			

5. Specify the name of the application owner (1-16 characters) in the Owner ID field and, optionally, a description of the application owner (up to 24 characters) in the Owner TEXT field.
6. For non-group definitions, specify the priority in the PRIORITY field, where
   1 Low
   2-7 Medium
   8 High
   9 Urgent
7. Specify a VALID FROM date (for details, see "Specifying the valid-from date" on page 130).
8. Specify A or P in the STATUS field as required (for details, see "Specifying the status" on page 130).
9. Optionally, specify the name of the authority group for the application (1-8 characters, where the first character is alphabetic or national) in the AUTHORITY GROUP ID field.
10. Optionally, specify the name of a calendar (1-16 characters, where the first character is alphabetic or national) in the CALENDAR ID field. If a calendar name is not specified, the name DEFAULT is used. A calendar ID cannot be specified for an application in an application group.
11. Optionally, specify the SMOOTHING FACTOR and FEEDBACK LIMIT options for the deadline. For details, see "Using deadline feedback options" on page 130.

Results

Specifying the application ID

The name of the application, the date to which it is valid, and the status uniquely identify each application. The application ID can be from 1 to 16 characters, the first of which must be either an alphabetic or national character. All other characters must be alphanumeric. For example, these are valid application IDs:

```
MYAPPLICATION£1, §MYAPPL, A
```

while these are invalid application IDs;

```
MYAPPLICATION*1, 1MYAPPL, &
```

Specifying the valid-from date

You can create several applications with the same ID but with different *valid-from* dates. IBM Workload Scheduler for z/OS picks the correct version for the day it is planning.

For example, suppose that your LTP covers 98/01/01 to 98/01/10, that you have an application APPL1 with a valid-from date of 98/01/01, and that you have an amended version of APPL1 with a valid-from date of 98/01/05. When creating the LTP, IBM Workload Scheduler for z/OS uses the first version for the period 98/01/01 to 98/01/04 and the second version from 98/01/05.

Note:

1. You can tailor the date format in the panel to suit your installation. The default format is used here.
2. When listing applications with a filter by date, do not confuse the *lower boundary in the specified range* with the valid-from date. For example, listing with 01/01/2008 and 01/01/2009 as filter boundaries, the output correctly includes an application with 01/01/2001 as valid-from date.

You specify a valid-from date when you create or copy an application. The application is automatically assigned a valid-to date of 71/12/31, 31 December 2071. When you copy an application, the valid-to date of the old version is automatically set to the day before the valid-from date of the new version. If the new version is valid only for dates earlier than other versions, its valid-to date is set to one day earlier than the valid-from date of the earliest old version.

Specifying the status

You can create an application or group as *active* or *pending*. An active application or group can be included in the plans, whereas a pending application or group cannot.

When you are creating a complicated application, it is useful to give it a status of pending. You can then change the status to active when you have completed the application description. If you follow this procedure, there is no risk that your uncompleted application will be included in the plans.

If you change a status from active to pending, consider deleting any occurrences in the LTP before extending the current plan, because the daily plan program tries to find a valid version of an application when processing an occurrence in the LTP. If the latest version is pending, and therefore not valid, IBM Workload Scheduler for z/OS uses the previous version, if there is one. If an application description that is active at the input arrival date is not found during daily planning, message EQQ0317W is issued and the occurrence is not included in the plan: instead it is marked as deleted in the LTP.

Using deadline feedback options

IBM Workload Scheduler for z/OS automatically monitors the actual deadline of operations. It can use these deadlines to modify the estimates in the application description database.

Two parameters, the smoothing factor and the limit for feedback, control how measured deadlines are used. Any value you specify here overrides the installation default specified on the JTOPTS keyword.

Deadline smoothing factor: The deadline smoothing factor is a value, 0 to 999, that determines how much a measured deadline will change existing values in the application description database, both at run cycle and at operation level.

Note: If the measured deadline is outside the limits established by the limit for feedback, the smoothing factor will not be applied and the AD data set is not updated.

The new estimated deadline is calculated as follows:

```
NDL = ODL + ((ADL - ODL) * DSF/100)
```

Where:

NDL The new estimated deadline for the occurrence or operation, considered as offset in minutes from the IA to be stored in the AD database.

ODL The old estimated deadline for the occurrence or operation, considered as offset in minutes from the IA stored there.

ADL The actual deadline, considered as the elapsed minutes between the IA and the occurrence or operation completion time.

DSF The deadline smoothing factor.

Limit for deadline feedback: The limit for deadline feedback is a value, 100 through 999, that establishes the limits within which measured values are regarded as normal and acceptable. A measured value outside the limits is ignored; that is, no smoothing factor is applied and the application description database is not updated.

The limits are calculated as follows:

```
Lower limit = ODL * 100/DLF
Upper limit = ODL * DLF/100
```

Where:

ODL The old estimated deadline for the run cycle or operation, considered as offset in minutes from the IA currently stored in the application description database.

ADL The actual deadline, considered as the elapsed minutes between the IA and the occurrence or operation completion time.

DLF The limit for deadline feedback.

Specifying when your application should be scheduled

When you create an application that is not part of a group, and when you create a group, specify when IBM Workload Scheduler for z/OS is to schedule the application or group by creating one or more run cycles. If you do not create a run cycle, the application can still be run on demand, and added to the plans by:

- Panel users (ISPF or Dynamic Workload Console)
- The program interface (PIF)
- Event-triggered tracking (ETT), or
- Automatic recovery, which adds only to the current plan

For example, an application to recover a database is added to the current plan only when required.

To add and run a group on demand through the panel:

1. Add a member to it.
2. Specify option **G** on panel EQQMAADL.

For details, see “Adding an application group to the current plan” on page 600.

Creating run cycles

Run cycles use the calendar and periods that are described in Chapter 6, "Creating calendars and periods," on page 97. Run cycles have one of these forms:

1. A *rule* with a format such as `The SECOND TUESDAY of every MONTH`, where the words in capitals are selected from lists of ordinal numbers, types of day, and cycle or period names, respectively.
2. A combination of period and offset. For example, an offset of 1 in a weekly period specifies Monday. An offset of 10 in a monthly period specifies the tenth day of each month.
3. A run cycle group that was previously defined in the database with the RUN CYCLE option in the MAINTAINING TWSZ DATA BASES panel.

Run cycles can also be *negative*, when they specify the days that the application must not run. You can specify many run cycles, both positive and negative, when you create an application. Add positive run cycles to generate more days, or to have multiple occurrences on the same day, and add negative run cycles to exclude days already generated. You can mix run cycles that use offsets and run cycles that use rules.

A negative run cycle prevents any positive run cycle from generating an occurrence with an input arrival date and time that matches any date/time combination that the negative run cycle generates.

If you run work at fixed days of the week, month, or year, and take one of the standard IBM Workload Scheduler for z/OS actions when this day falls on a free day (holiday), you do not need to create any periods. These are examples of rules:

Table 14. Examples of rules

Rule	Interpretation and notes
Only first Sunday in June	The first Sunday in June every year.
Only work day in the week	The (first) work day (specified by the calendar) in every week. First is default.
Only last Friday in the year	The last Friday in every year.
Only second Friday in the year and in April	The second Friday in the year and the second Friday in April. This is a complex rule specifying two cycles (year and April) that could equally well be split into two simple rules: "Only second Friday in year," and "Only second Friday in April."
Only second free day in semester	The second free day (specified by the calendar) in every interval of the period called semester.
Every second Monday in the month	The first, third, and fifth (if present) Monday in every month. Be careful not to specify this when you mean "Only the second Monday in the month." When you specify "Every second x," IBM Workload Scheduler for z/OS starts at the origin of x and builds a series 1, 3, 5, and so on.
Every first work day in the year	Every work day in every year. The "first" means that the series has an interval of one. Do not confuse this with "Only (first) work day in the year."
Only 2nd last work day in the month	The last work day but one (second to last) in every month.
Every third fourth day in the year	Every third day gives January 1, 4, 7, 10, 13 etc. Every fourth day gives January 1, 5, 9, 13, 17 etc. The rule combines these and removes duplicates, giving January 1, 4, 5, 7, 9, 10, 13, 17 etc.
Every last Monday in the month	This generates every Monday, because IBM Workload Scheduler for z/OS generates a series of Mondays starting from the last Monday. If you want only the last Monday in the month, specify Only last Monday.

Table 14. Examples of rules (continued)

Rule	Interpretation and notes
Every 3rd last work day in the month shift origin 1	This generates a series from the last day but 1 of each month. For July, for example, July 31 is not selected, but the first work day before July 31 is selected. The next two work days are skipped, then the next work day is selected, and so on (the free day rule is not relevant here).
Every third last free day in the month shift origin 1	This also generates a series from the last day but 1 of each month. For July, for example, July 31 is not selected, but the first free day before July 31 is selected. The next two free days are skipped, then the next free day is selected, and so on. The actual days generated, however, depend on the free-day rule. The result can be confusing unless you use rule 3 when selecting free days.
Note: The only period that you need for the above examples is semester. Words such as week, month, year, April, June, and July are part of the cycle definition, and you do not have to create periods with these names.	

For an application to be automatically selected by the planning process, it must contain a run cycle, specified either in the application itself or in its group definition, if it belongs to a group. The run cycle must also be in effect for the duration of the plan (that is, the *in-effect dates* of the run cycle must fall within the range covered by the plan).

Creating run cycles with rules:
About this task

Follow these steps to create run cycles using rules:

1. In the CREATING AN APPLICATION panel (Figure 61 on page 128), enter the RUN command. You see the RUN CYCLES panel, shown in Figure 62.

```
EQQAMRPL ------------------------ RUN CYCLES ----------------  ROW 1 TO 1 OF 1
Command ===>                                                  Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Specify run days/Modify rule

Application            : PAYTAXYR         YEARLY PAYROLL RUN
     Name of rg/                            In       Out of
Row  period/rule Input Deadline       F day effect   Effect   Variable table
cmd              HH.MM day HH.MM Type rule  YY/MM/DD YY/MM/DD
'''' TAXYEAR_    12.00 00  23.59 R    1     97/01/30 71/12/31 PAY_____________
     Text: Run on the third Thursday in July_____________________
     Shift: ___0  Shift Type: _

****************************** BOTTOM OF DATA ******************************
```

Figure 62. EQQAMRPL - Run cycles

2. Specify the name of the rule, for example TAXYEAR. The name should be unique within the application or group, and it is less confusing if you do not use the name of a period; choose a naming convention, perhaps with the rule type as the first character.

   If you intend to use a run cycle group to specify the run days in this rule, do not enter here the name of the run cycle group, but enter a name that uniquely identifies the run cycle.
3. Specify the *input arrival time* in HH.MM format for the days specified by the rule. This time determines when occurrences of the application will be included in the current plan, with regard to the current planning period. This

time is also used by the scheduler when external dependencies are established. For additional information, see "Specifying the input arrival time" on page 142.

This information is optional unless you plan to specify the EVERY options for the run cycle.

Note: For details on the effect of specifying an input arrival time earlier than the workday end time, see "How days are generated using rules" on page 137.

4. Specify the *deadline day and time*, which is the latest time that all operations in any occurrence of the application should be completed by. The deadline day is relative to the input arrival date for the occurrence. Specify a number from 0 to 99, where 0 means that the deadline date is also the input arrival date. When the deadline day is greater than 0, IBM Workload Scheduler for z/OS considers only work days when calculating the deadline date. For example, if day is 1, the deadline date is the first *work day* (as specified by the calendar) after the input arrival date.

   The deadline day and time that you specify is also the default for all operations in the application.

   This value is optional. If no value is specified, when the long term plan is created, the deadline of the occurrence is made to coincide approximately with the end of the LTP (which is derived from the `tail end` value of the current plan).
5. Specify the type of run cycle, which can be:

   R Regular rule.

   E Exclusion rule. Specify one or more of these ONLY after you specify an R or N type run cycle.

   N Normal run cycle using periods and offsets. See "Creating run cycles with offsets" on page 138 for more information about offset-based run cycles.

   X Exclusion run cycle using periods and offsets. Specify one or more of these ONLY after you specify an R or N type run cycle.

   Note: Enter R if you plan to specify the run days with a run cycle group.
6. Specify the free-day rule. See "Selecting a free-day rule" on page 139 for a full description.

   If you are going to specify the run days with a run cycle group, specify rule 3 (count work and free days) to ensure that the dates generated by the run cycle group are matched correctly also in case a different calendar is used.
7. Specify the in-effect and out-of-effect dates. If you leave these blank, IBM Workload Scheduler for z/OS fills them in with today's date and 71/12/31, 31 December 2071. For hints on using these dates, see "Using in-effect/out-of-effect dates" on page 142.
8. Specify the variable table that are to be used on the days selected by this run cycle. For information about job tailoring, see Chapter 25, "Job tailoring," on page 487.

   Note: When you use rule-based run cycles with periods that you have created, IBM Workload Scheduler for z/OS ignores any variable table associated with the period, so you must specify any table name here, unless:

   - The occurrence operations do not use variable substitution.

- You specify the table name on the LONG TERM PLAN panel.
- You specify the table name on the MODIFY CURRENT PLAN (MCP) panel when you add the occurrence manually to the plan.
- You specify the table name in the job itself.
- The operations use the global variable table.

9. Type a description of the rule in the line below the other fields.
10. Optionally, enter the number of days to shift the rule dates. This field provides the means to define a run cycle relative to another, where the run cycle without the *shifting* offset is used to schedule an application in relation to which - using the same rule with a negative or positive shift of days - another application is scheduled.
11. If you entered a value for `Shift`, specify the type of days that are to be counted for the shift. W implies work days, while D implies any day in the calendar.

    Note: When the long term plan is generated, the `shift` value is applied first and the free-day rule is applied next.
12. Enter the S row command to specify the days that this rule will select (type R) or deselect (type E). You see the MODIFYING A RULE panel, shown in Figure 63.

```
EQQRULEP ---------------------- MODIFYING A RULE -------------------------------
Command ===>

Enter the GENDAYS command to display the dates generated by this rule
Enter the E command to specify EVERY options
Enter S and user data in the fields below to define a rule

Application   : PAYTAXYR                  YEARLY PAYROLL RUN
Rule          : TAXYEAR    Run on the third Thursday in July

 --- Frequency ---         --- Day ---    --- Cycle Specification ---
------------------------------------------------------------------------------
        S Only          | _ Day        | _ Week       _ January    S July
        _ Every         | _ Free day   | _ Month      _ February   _ August
                        | _ Work day   | _ Year       _ March      _ September
 _ First     _ Last     | _ Monday     |              _ April      _ October
 _ Second    _ 2nd Last | _ Tuesday    |              _ May        _ November
 S Third     _ 3rd Last | _ Wednesday  |              _ June       _ December
 _ Fourth    _ 4th Last | S Thursday   | Week number  __ __ __ __ __ __
 _ Fifth     _ 5th Last | _ Friday     | Period/RG    ________ ________
   ___ ___     ___ ___  | _ Saturday   | name         ________ ________
   ___ ___     ___ ___  | _ Sunday     |
   ___ ___     ___ ___  |              | Shift default origin by  ___ days
------------------------------------------------------------------------------
```

Figure 63. EQQRULEP - Modifying a rule

13. In the Frequency column, select Only or Every.
14. Also in the Frequency column, select an ordinal number from First to Fifth and 6 to 999 or its Last equivalent. Type numbers higher than 5th in the blanks below Fifth or 5th Last, and use numerics here not ordinals (for example, 6 instead of 6th). You can select more than one number.
15. In the Day column, select the type of day. You can select more than one type.
16. In the Cycle Specification column, select the type of cycle, period, or run cycle group. You can make multiple selections. You can enter up to four periods and run cycle groups. You can shift the origin of any cycles or periods that

you specify by 1 to 999 days, if you are using EVERY. The default origin of each week is Monday. Week 1 is specified as the first week with at least 4 days of the new year.

You can also specify a shifted origin together with EVERY LAST: the origin is shifted from the end, so that EVERY 2nd LAST DAY in JANUARY with shifted origin 1 means January 30, 28, 26, and so on. You cannot specify a shifted origin with ONLY, and do not need to, because ONLY FIRST with shifted origin 1 is equivalent to ONLY SECOND.

EVERY SECOND DAY in YEAR, with no origin shift specified, means January 1, 3, 5, and so on: the series always starts on the first day of the cycle or period unless you shift the origin.

Note: If you select July, for example, the rule does not look for a period called JULY; the cycle is predefined and not alterable. If you really need to use your own JULY period, type the name JULY in the Period name field.

17. Enter the GENDAYS command to check that the rule causes the days' selection that you expect. This is especially important for selections with Every, Last, and multiple selections in the Day and Cycle columns. You see the LIST OF GENERATED DATES panel:

```
EQQRULSL ------------------ LIST OF GENERATED DATES --------------------------
Command ===>                                                 Scroll ===> PAGE
                                                           Goto Year ===>
Rule        : THIRDTHU   Third Thursday of the Month
Calendar    : DEFAULT            Work day end time: 00.00
Interval    : 97/01/30 - 99/12/29    Free day rule: 1

      January          1997  February         1997  March            1997
      Mo Tu We Th Fr Sa Su  Mo Tu We Th Fr Sa Su  Mo Tu We Th Fr Sa Su
            01 02 03 04 05                  01 02                  01 02
      06 07 08 09 10 11 12  03 04 05 06 07 08 09  03 04 05 06 07 08 09
      13 14 15 16 17 18 19  10 11 12 13 14 15 16  10 11 12 13 14 15 16
      20 21 22 23 24 25 26  17 18 19 20 21 22 23  17 18 19 20  21 22 23
      27 28 29 30 31        24 25 26 27 28        24 25 26 27 28 29 30
                                                  31
      April            1997  May              1997  June             1997
      Mo Tu We Th Fr Sa Su  Mo Tu We Th Fr Sa Su  Mo Tu We Th Fr Sa Su
         01 02 03 04 05 06           01 02 03 04                     01
      07 08 09 10 11 12 13  05 06 07 08 09 10 11  02 03 04 05 06 07 08
      14 15 16 17 18 19 20  12 13 14 15 16 17 18  09 10 11 12 13 14 15
      21 22 23 24 25 26 27  19 20 21 22 23 24 25  16 17 18 19 20 21 22
      28 29 30              26 27 28 29 30 31     23 24 25 26 27 28 29
                                                  30
```

Figure 64. EQQRULSL - List of generated dates

Attention:

a. If you have not specified a calendar for the application or for the run cycle group, GENDAYS uses the calendar specified under the OPTIONS panel (0.2 from the main menu), or the calendar named DEFAULT if no calendar is specified. If the DEFAULT calendar does not exist, all days are considered work days. For long-term plan batch jobs, however, IBM Workload Scheduler for z/OS uses the calendar specified on the CALENDAR keyword of the BATCHOPT initialization statement, or the DEFAULT calendar. Make sure that you specify the same calendar in the panel and BATCHOPT (if you do not specify the calendar for the application in the CREATING AN APPLICATION - EQQACGPP panel) or you might find that GENDAYS shows you different days to those generated when you extend the long-term plan.

b. The interval displayed by the GENDAYS command is defined as the shortest time period that these dates overlap:
   - Application validity range
   - Run cycle validity range
   - Four years forward from 1 January current year

18. Enter PF3 (End) to return to the RUN CYCLES panel.
19. Repeat steps 2 on page 133 to 18 for regular (R) and exception (E) rules, until you have completely specified when the application should be scheduled.

How days are generated using rules: IBM Workload Scheduler for z/OS uses both the free-day rule and the workday end time (specified in the calendar) when generating days from a rule.

When you enter the rule on the MODIFYING A RULE panel, IBM Workload Scheduler for z/OS:

1. First generates the days regardless of the free-day rule and workday end time.
2. Adds one day to the generated dates, if the application input arrival time is before the workday end time. (If an application input arrival time is 02.00 and the workday end time is 03.00; when you specify that the application runs on Monday, IBM Workload Scheduler for z/OS assumes you mean Tuesday at 02.00, because 02.00 on Monday belongs to Sunday.)
3. Takes the workday end time and free-day rule into account. Days can be moved outside the interval because of the free-day rule, although the long-term planning process generates a warning message when this happens.
4. Shows the days resulting from this, if you use the GENDAYS command.

Examples: These examples assume that only Saturday and Sunday are free days, and the workday end time in the calendar is 06.00. You have specified EVERY DAY in WEEK 21 on the MODIFYING A RULE panel. Table 15 shows the generated days for different combinations of free-day rule and input arrival time.

Table 15. Effect of the input arrival time and the free-day rule

Free-day rule	Input arrival time	Days generated
3 (schedule on the free day)	08.00	Monday Tuesday Wednesday Thursday Friday Saturday Sunday
1 (closest work day before)	08.00	Monday Tuesday Wednesday Thursday Friday

Table 15. Effect of the input arrival time and the free-day rule (continued)

Free-day rule	Input arrival time	Days generated
3 (schedule on the free day)	04.00 (before the workday end time)	Tuesday Wednesday Thursday Friday Saturday Sunday Monday
1 (closest work day before)	04.00	Tuesday Wednesday Thursday Friday Saturday (considered part of Friday, which is not a free day)
2 (closest work day after)	04.00	Tuesday Wednesday Thursday Friday Saturday Tuesday (Saturday and Sunday are transferred to Tuesday at 04.00, considered part of Monday)

For details about the workday end time, see "Creating the default calendar" on page 98.

Selecting the last work day before a free day: Use the rule EVERY FREE DAY of the MONTH, which selects all free days. But use free-day rule 1, so that all the selected free day occurrences are moved to the closest work day before. For example, the Saturday and Sunday occurrences of a normal week are both moved back to Friday. IBM Workload Scheduler for z/OS does not allow run cycles to schedule multiple occurrences with the same date and time, so the effect is that one occurrence is generated each Friday (or Thursday, if Friday is also free).

Creating run cycles with offsets:
About this task

You can specify run cycles also by specifying periods or run cycle groups, and offsets from the start of the period. This is convenient for some run cycles, where the period is cyclic (a daily or weekly job), but is less convenient for cycles based on calendar months and particular dates in the year, because the period is noncyclic and its origin must therefore be manually maintained from time to time. So you are recommended to use rule-based run cycles (the recommendation does not apply to run cycle groups).

Follow this process to create run cycles that use offsets:

1. On the RUN CYCLES panel (Figure 62 on page 133), complete the fields as described in "Creating run cycles with rules" on page 133. In the `Name of rg/period/rule` field, however, specify the name of a period or of a run cycle group that you have created, and:
   - If you specified a period, enter N or X in the `Type` field.
   - If you specified a run cycle group, enter N in the `Type` field, and 3 in the `F day rule` field (to avoid conflicts with the freeday rules specified for the run cycles in the group, which have overruling power).

   You can specify that an application be associated with more than one period or run cycle group by creating more than one run cycle for the application. For example, if your inventory application runs monthly *and* quarterly, you can associate it with both the monthly and quarterly periods by creating two run cycles for the application, each specifying one of the periods.

   If you want a job to run more than once a day, specify two run cycles using the same period or run cycle group and offset, but with a different input arrival time.
2. Enter the S row command to specify the offsets to the start of the period or of the run cycle group.

You see the RUN DAYS panel, shown below, if you specified a period.

```
EQQAMRNL ------------------------ RUN DAYS ---------------------  ROW 1 OF 2
Command ===>                                                  Scroll ===> PAGE

Enter the E command to specify EVERY options
Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete

Application            : CLASSLST         Class lists
Period name            : SEMESTER
Type                   : Normal
Free day rule          : Schedule on free days

    Offsets
''  _1
''  _-1
 ****************************** BOTTOM OF DATA ********************************
```

Figure 65. EQQAMRNL - Run days

or the RUN CYCLE GROUPS DAYS panel, shown below, if you specified a run cycle group.

```
 ------------------------ RUN CYCLE GROUPS DAYS ---------------------  ROW 1 OF 2
Command ===>                                                  Scroll ===> PAGE

Enter the E command to specify EVERY options
Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete

Application            :
Period name            :
Type                   : Normal
Free day rule          : Run on the free day

    Offsets
''  _1
 ****************************** BOTTOM OF DATA ********************************
```

Figure 66. Run Cycle Groups Days panel

3. Specify a positive or negative offset from the origin dates of the period or run cycle group.

   For example, using the SEMESTER period on page "How run cycles use periods" on page 104, you can specify that application CLASSLST will be scheduled on the first and last day of each semester by specifying offsets of 1 and -1.

Using work-days-only cyclic periods with offsets: If you have a work-days-only cyclic period, be careful when you specify offsets greater than 1. For details, see "Using work-days-only cyclic periods" on page 105.

Selecting a free-day rule

Specify whether the rule or offset-based run cycle selects work days only or calendar days (that is, work days *and* free days). IBM Workload Scheduler for z/OS must know what action to take if a selected day results in a date that is a free day. You do this by specifying a *free-day rule* on the RUN CYCLES panel (Figure 62 on page 133).

The possible values of the free-day rule are:

E Count only work days when using the rule or offset. That is, free days are excluded. This option ensures that the scheduled day will always be a work day. This is the default for offset-based run cycles.

1 Count work days and free days when using the rule or offset. If this gives a free day, schedule the application on the closest work day *before* the free day.

2 Count work days and free days when using the rule or offset. If this gives a free day, schedule the application on the closest work day *after* the free day.

3 Count work days and free days when using the rule or offset. If this gives a free day, schedule the application *on* the free day. This is the default for rule-based run cycles.

4 Count work days and free days when using the rule or offset. If this gives a free day, *do not* schedule the application at all.

The free-day rule provides the flexibility to schedule your applications precisely when they are required. Sometimes you will find that you must work out on paper which free-day rule you should select. When you do this, consider what would happen if a normal work day is declared a holiday and, therefore, is specified in the calendar as a free day.

When an application is normally due to run but the calendar definition identifies the day as free, the free-day rule in the run cycle for that application determines the effect.

Figure 67 shows what happens for each free-day rule if you specify July with offsets 1, 6, 11, 16, and so on, or the equivalent rule, every fifth day in July.

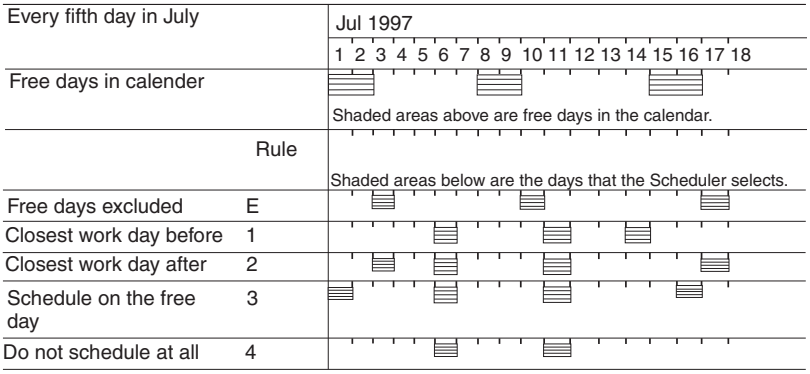


Figure 67. The effect of the free-day rule

Note that for the purpose of generating the long term plan, if you specified a value for the Shift field, the free-day rule is applied AFTER the shift is calculated.

Specifying when your application should not run

You might want to prevent IBM Workload Scheduler for z/OS from scheduling occurrences of an application on a particular day or set of dates.

There are two ways of using run cycles to prevent IBM Workload Scheduler for z/OS from scheduling an application on particular days:

- Negative run cycles
- In-effect/out-of-effect dates

Using negative run cycles: A *normal* run cycle specifies the day on which an application occurrence should be generated, relative to the dates of a period. Suppose you have an application INVENTORY, which runs on the first day of each month. You might not want INVENTORY to run every calendar month, for example, because an inventory is not taken in December. You can specify this by creating a *negative* run cycle for the application INVENTORY. A negative run cycle specifies the days that you do not want an application to run, even though the application normal run cycle has specified these days as run days.

Negative run cycles are types E and X, as opposed to normal run cycles, which are types R and N. When the long-term planning process finds a run cycle of type E or X, it generates a negative occurrence. To stop an occurrence generated by a run cycle of type R or N, the input arrival times on the normal and negative run cycles must be identical.

```
EQQAMRPL ------------------------ RUN CYCLES ---------------------  ROW 1 OF 5
Command ===>                                                  Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Specify run days/rules

Application            : WEEKLYJOB        Weekly processing
     Name of                                In       Out of
Row  period/rule Input Deadline       F day effect   Effect
cmd  Text        HH.MM day HH.MM Type rule  YY/
MM/DD YY/MM/DD Variable table
'' WEEKFRI     21.00 01  04.00 R    1     97/01/01 71/12/31 JOBCARD________
     Run on Friday, or day before if free_____________

'' LASTDAY     21.00 01  04.00 E    1     97/01/01 71/12/31 _________________
     But not if that is also the last proc day of month
```

Figure 68. Negative run cycles

Figure 68 shows a common example of negative run cycles. In this example, an application that normally runs weekly, on Friday, is not required if Friday is also the last work day of the month. The regular rule specifies:

```
Only first FRIDAY in the WEEK
```

and the exception or negative rule specifies:

```
Only LAST WORK DAY in the MONTH.
```

The selected keywords are shown in capitals; the other words in the rules are implied or defaulted.

Stopping a normal job if the following day is free: Suppose you run a daily job from Monday to Thursday, and a weekly job on Friday. If Friday is free, you need to run the weekly job on Thursday instead of the daily job. For the daily job, you need run cycles that suppress the job when the following day is free, so use these run cycles:

Type	Rule	Free day rule
Daily job run cycles:		
R	EVERY (or ONLY) MONDAY TUESDAY WEDNESDAY THURSDAY of WEEK	4
E	EVERY (or ONLY) FRIDAY of WEEK	1

Type	Rule	Free day rule
Weekly job run cycles:		
R	EVERY (or ONLY) FRIDAY of WEEK	1

The run cycles with free-day rule 1 ensure that the weekly job is brought forward, and the daily job is cancelled, when the Friday is a holiday.

Using in-effect/out-of-effect dates: You can use run cycles that have *in-effect/out-of-effect* dates to cause an automatic change after a certain date, such as changing the frequency of an application from daily to weekly, as shown in Figure 69.

```
EQQAMRPL ------------------------ RUN CYCLES --------------------  ROW 1 OF 5
Command ===>                                                    Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Specify run days

Application            : SAMPLEA          An application_desc
                                            In       Out of
Row  Period name Input Deadline       F day effect   Effect
cmd  Text        HH.MM day HH.MM Type rule YY/MM/
DD  YY/MM/DD Variable table
'' DAILY___    21.01 01  08.00 N    4    97/01/
01  97/06/30 JOBCARD_________
     business inventory, run every day___

'' WEEK___     21.01 01  08.00 N    4    97/07/
01  71/12/31 JOBCARD_________
     business inventory, run every week__
```

Figure 69. Using in-effect dates to switch between run cycles

Specifying the input arrival time

When you specify a run cycle for an application (or within a run cycle group), you specify an *input arrival time* for each occurrence of the application; that is, a time of day to be associated with each run of the application. The input arrival time forms part of the key that uniquely identifies each occurrence of the application in the LTP and current plan; it is not the time that IBM Workload Scheduler for z/OS attempts to start the occurrence, unless you specify the first operation as time-dependent (for details, see "Creating time-dependent operations" on page 184). IBM Workload Scheduler for z/OS also uses the input arrival time to resolve external dependencies. See "External dependencies between multiple occurrences" on page 177.

The input arrival time of the occurrence is the default input arrival time for operations making up that occurrence. The input arrival time is also used by the daily planning process to calculate the planned start time of an operation. A planned start time cannot be earlier than the input arrival time.

When the daily planning process is selecting occurrences from the long-term plan, it selects only those occurrences whose input arrival times fall within the planning period.

Particular attention is required with the generation of the run days (GENDAYS) when the work day end time specified in the definition of the calendar used is

after the midnight. If the work day end time and the input arrival time are specified at a later time than 24.00, the resulting run days may not be the expected ones.

For example, if:

- The work day end time in the calendar is 05.59
- The input arrival time for the run cycle is 04.00
- The rule is EVERY TUESDAY OF THE YEAR

The dates displayed when you run the GENDAYS command will fall on Wednesdays. This is because Tuesday as a work day runs from 06.00 to 5.59. In fact, when you specify the work day end time in the calendar definition, this defines also the work day start time, which is equal to the work day end time plus one minute (the work day being of 24 hours in the calendar). In this example, the IA time does fall within the work day defined in your calendar and selected as Every Tuesday of the Year in the MODIFYING A RULE panel, but if the GENDAYS command uses the Western calendar to calculate and display the run days, the run days will result as Wednesday (at 4 in the morning).

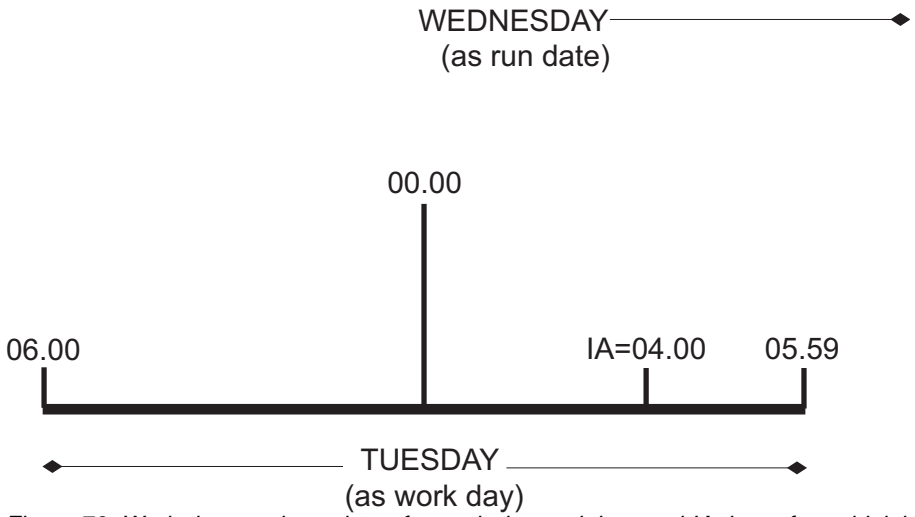


Figure 70. Work days and run dates for work day end time and IA time after midnight.

This can be further complicated by your free-day rule selection, so make sure to use GENDAYS to test your selections.

Specifying the EVERY options for a run cycle

About this task

To specify how frequently an application must be scheduled, use the EVERY options. To set the EVERY options:

1. In the RUN CYCLES panel (Figure 62 on page 133), enter the **S** row command next to the run cycle you want.
2. In the MODIFYING A RULE (Figure 63 on page 135) or RUN DAYS (Figure 65 on page 139) panel, enter the **E** command to set the EVERY options. You see the EVERY OPTIONS panel, shown in Figure 71 on page 144.

   You must have specified an input arrival time for the run cycle to be able to configure the EVERY options. You are denied access to the EQQAMREP panel if there is no input arrival time.

```
EQQAMREP ----------------------- EVERY OPTIONS -------------------------
Command ===>


REPEAT EVERY ===> 00.30         Repeat every HH.MM

FROM         ===> 21.00         Input Arrival time

UNTIL        ===> 23.30         Repeat end time in the HH.MM format
```

Figure 71. EQQAMREP - Every options

3. In this panel, the FROM field is already set with the input arrival time of the run cycle. Specify the following settings:

   REPEAT EVERY
   The frequency at which the application is to be scheduled, in the format HH.MM. For example, 00.30 means that the application is run every 30 minutes.

   UNTIL
   The end time until which the application is to be scheduled, in the format HH.MM. It must be a value between the IA time of the run cycle and the calendar work day end time of the application.

Attention: Normally, if you use the EVERY option for a run cycle and you specify a deadline, the LTP occurrences generated with the different IA times by the EVERY specifications have different deadlines as well. But when a run cycle in the AD includes a run cycle group and a deadline is not provided in the run cycle definition but only in the run cycle group, all the occurrences generated with the different IA times by the EVERY definition keep the same deadline defined in the run cycle group. If you want the deadline values to match the changes in the IA times that result from the EVERY definition, you must define the deadline for the run cycle in the AD.

Examples specifying the EVERY option: Consider you have an application whose calendar work day end time is 00.00, run cycle IA time 10:00, and deadline time 22.00. If you set REPEAT EVERY to 01.00 and REPEAT END TIME to 13.00, the long-term plan batch job adds to the long-term plan four occurrences for each day generated:

- IA time 10.00 - deadline time 22.00
- IA time 11.00 - deadline time 23.00
- IA time 12.00 - deadline time 24.00
- IA time 13.00 - deadline time 01.00 - deadline day offset 01

As shown in the example, the deadline time and day offset proceed at the same rate as the input arrival time.

Note: If you specified an operation deadline and input arrival time, these values are used unchanged.

As another example, consider you have an application with a calendar work day end time 05.00 and a run cycle whose input arrival time is 11.00. In this case, the EVERY end time must be a value between the IA time 11.00 and the work day end time 05.00, meaning that it must be either a value between 11.01 and 23.59 or between 00.00 and 4.59.

The EVERY options take effect at long-term plan level. Therefore, depending on the current plan end time, the EVERY options might generate occurrences in the current calendar day. For example, suppose that:

- An application scheduled to run every day has the REPEAT EVERY set to 01.00 and REPEAT END TIME to 15.00
- The application IA time is 10:00
- The current plan end date is 31 October, at 12:30

the current plan contains three occurrences of this application, with IA date 31 October and IA time 10:00, 11:00, and 12:00. If you extend the current plan by 24 hours, the new current plan will contain:

- The application occurrences with IA date 31 October and IA time 13:00, 14:00, 15:00. These are the remaining occurrences set by the long-term plan for the date 31 October.
- The application occurrences with IA date 1 November and IA time 10:00, 11:00, and 12:00.

Note: The EVERY options are not considered when an application is dynamically added to the current plan.

If the application description does not specify a calendar, the default calendar is used to check whether the REPEAT END TIME is valid, according to the tool or function used:

Panels The default calendar can be set in the SETTING DATE AND TIME FORMAT panel (Figure 20 on page 33). If the calendar ID is set to DEFAULT and a calendar named DEFAULT does not exist, the default work day end time 00.00 is used.

Mass Update
The default calendar can be set in the CALENDAR parameter of the BATCHOPT statement. If this parameter is not set, a calendar named DEFAULT is used. If a calendar named DEFAULT does not exist, the default work day end time 00.00 is used.

If the calendar that is set does not exist, Mass Update does not perform any check on the REPEAT END TIME.

PIF, BCIT, batch loader, Dynamic Workload Console
The default calendar can be set in the CALENDAR parameter of the INIT statement. If this parameter is not set or the default calendar that is specified does not exist, no check on the REPEAT END TIME is performed. If the calendar is set to DEFAULT, the default work day end time 00.00 is used.

The long-term plan batch job checks whether the REPEAT END TIME is consistent with the work day end time; if not, the LTP batch job resets the REPEAT END TIME to the latest valid time possible (which is one minute before the calendar work day end time) and issues a warning message. The job completes with a return code of 4, at least. For example, if the application has a calendar work day end time 00.00, IA time 10.00, and REPEAT END TIME 09.00, the long-term plan batch job resets the REPEAT END TIME to 23.59 and calculates the occurrences according to this time.

When you create a run cycle with rules, you can check the generated days by issuing the GENDAYS command. These days are generated according to the input arrival of the run cycle. If you set the EVERY options, the LIST OF GENERATED

DATES panel shows the number of occurrences that are run on each generated day. Note that if the calendar work day end time is not 00.00, the REPEAT END TIME could be later than midnight; in this case, the LIST OF GENERATED DATES panel also shows the occurrences that is run on the following days.

Specifying run cycles with offsets

Four processing cycles are required to schedule the Paymore system:

- Daily processing-Monday to Friday
- Weekly processing-Thursday
- Monthly processing-third Thursday of the month
- Yearly processing-third Thursday in July

It is easiest to implement these using rules, but this section shows how you can use offsets instead.

Assume that the calendar specifies Monday to Friday as work days, and public holidays are specified as free days. The PAYROLL system requires three period definitions; one cyclic and two noncyclic. Although monthly processing is required on the third Thursday of the month, you should specify the first Thursday as the period origin, because this ensures that you get maximum benefit from the period definition. When the period is created with an origin of the first Thursday, you can easily specify offsets to select the second, third, fourth, or last Thursday of the month.

Periods should not be created for individual business systems; instead, a period should have a processing cycle that can be used by any run cycle in your applications database. Noncyclic periods incur a yearly overhead when you must enter the origin dates for the following year. For this reason you should make the definition as flexible as possible.

Table 16 shows the period definitions that you need, if you specify the Paymore run cycles using periods with offsets.

Table 16. Period definitions required for offset examples

Name	Type	Origin dates
WEEK	All-days cyclic	970102 with an interval of 007 days
FIRSTTHU	Noncyclic	970102 970206 970306 970403 970501 and so on
FSTTHU7	Noncyclic	970703

Daily run cycle example: The payroll jobs required daily (PAYDAILY and PAYBACKP) can use this run cycle:

```
Type = NORMAL     Period = WEEK      Offset = 1,2,3,4,5
Free-day rule = 4  Input arrival = 17.00 Deadline = 01 06.00
Description = Run Monday to Friday except public holidays
```

Weekly run cycle example: The weekly group GPAYW runs on Thursday. Include the negative run cycle if you want to omit the GPAYW applications on the day that the monthly GPAYM group runs.

```
Type = NORMAL     Period = WEEK      Offset = 4
Free-day rule = 1  Input arrival = 17.00 Deadline = 01 06.00
Description = Run Thursday or day before if Thursday is free

Type = NEGATIVE   Period = FIRSTTHU  Offset = 14
Free-day rule = 1  Input arrival = 17.00 Deadline = 01 06.00
Description = Exclude third Thursday of the month
```

The monthly group GPAYM runs on the third Thursday of the month. If you already have a monthly period with an origin date of the first of each month, you can specify a series of offsets and a negative run cycle to avoid the need for a separate period. For example, you could specify a normal run cycle MONTH with offsets 15, 16, 17, 18, 19, 20, 21 with a negative run cycle of WEEK with offsets 1, 2, 3, 5, 6, 7. The normal run cycle is selecting all days in the third week of the month, and the negative run cycle excludes all of those occurrences except the one generated for the third Thursday. This is a correct, if tedious, way of creating run cycles; however, these run cycles cannot reschedule the application to any other day because the negative run cycle always cancels the generated occurrence.

Monthly run cycle examples: GPAYM is required to run on the Wednesday if the third Thursday is a public holiday; so a period is created and offset calculated that will enable the application to be rescheduled correctly when there are public holidays.

```
Type = NORMAL     Period = FIRSTTHU   Offset = 14
Free-day rule = 1  Input arrival = 17.00 Deadline = 01 06.00
Description = Run third Thursday of the month or day before if free
```

The yearly processing PAYTAXYR also requires a unique period definition to be sure the application is always scheduled correctly.

```
Type = NORMAL     Period = FSTTHU7   Offset = 14
Free-day rule = 1  Input arrival = 17.00 Deadline = 01 06.00
Description = Run third Thursday in July or day before if free
```

In the sample run cycles for the Paymore system, identical input arrival and deadline times are specified. This can be the most effective method to handle several applications that share a service level but cannot be specified as a group definition. In any case, you need not consider individual operation execution times. The daily planning process handles this for you and assigns latest-out times for each operation based upon the deadline time of the last operation in the dependency chain.

Creating operations

About this task

The type of operation determines the type of workstation you use:

- Job operations run on computer workstations.
- Started-task operations run on computer workstations that have the STC attribute.
- Operations on distributed agents run on IBM Workload Scheduler for z/OS Agents, dynamic domain managers, or fault-tolerant agents.
- Job setup operations for jobs and started tasks run on general workstations that have the SETUP attribute.
- Print operations run on printer workstations.
- WTO operations run on a general workstation that has the WTO attribute.
- Shadow jobs run on remote engine workstations.
- Operations that have events reported by EQQUSIN or OPSTAT can run on any workstation type except one that specifies no reporting.
- Dummy operations, which are used to simplify dependencies, run on nonreporting general workstations.
- Other tasks that you want to be represented by operations usually run on general workstations.

Follow these steps to specify the operations in an application:

1. In the CREATING AN APPLICATION panel (Figure 61 on page 128), enter the OPER command. You see the OPERATIONS panel, shown in Figure 72.

```
EQQAMOPL ------------------------ OPERATIONS ----------------  ROW 1 TO 3 OF 3
Command ===>                                                  Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Select operation details, J - Edit JCL
Enter the PRED command above to include predecessors in this list, or,
enter the GRAPH command to view the list graphically.

Application            : PAYDAILY         daily payroll jobs

Row  Oper      Duration   Job name    Operation text            Number of
cmd  ws   no.  HH.MM.SS                                        Conds
'' WTO1  005   00.01.00    PAYDAILY  PAYX CLOSE DATASET______    0
'' SETP  010   00.03.00    PAYDAILY  Job setup for paydaily__    0
'' CPU1  020   00.05.00    PAYDAILY  Runs pay04 and pay06____    0
****************************** BOTTOM OF DATA ************************
```

Figure 72. EQQAMOPL - Operations

2. For each operation, type the workstation and operation number in the **Oper ws** and **no.** fields.
3. Estimate the duration of each operation, or use the default that you specified for the workstation. When an operation runs, the real duration is fed back to the application description database. The minimum value of planned duration is 1 second, and the maximum value is 99 hours 59 minute 00 seconds. If you specify 99 hours 59 minutes 01 seconds, you do not receive an alert message if the actual duration is greater than the planned duration. For details about the duration feedback, see "Options that apply to all operations" on page 165.

   If the operation is defined on a general non reporting workstation, in the current plan the estimated duration of the instance is automatically set to 1 second, regardless of the value that is set in the operation definition. This rule applies for all general non reporting workstations, except the WAIT workstations.
4. If the workstation is a job setup, computer, or printer workstation, specify the name of the job or started task that the operation represents. IBM Workload Scheduler for z/OS uses this to find the JCL for job or started-task operations. See "Associating job statements with operations" on page 181. The job name for setup and print operations must be the same as the associated job or started-task operation.
5. Type, in the Operation text field, a line of text to be associated with the operation. This text forms part of any WTO message that is issued for an operation. For more details, see "Using WTO operations" on page 183 and the description of the DEADLINE WTO option on page DEADLINE WTO (default: N). The operation text can be used to further document the processing; it can also direct operators to perform certain functions. For example, you could have an operation on a general workstation to remind the day-shift operators to collect the office supplies.
6. Enter the PRED command to specify any internal and non conditional predecessors to the operation you are creating. For more details of operation predecessors and successors, see "Specifying dependencies" on page 175.

7. Specify the details of each operation by entering S next to the operation you want to specify. For details, see “Specifying operation details” on page 152.
8. Check the JCL of the associated job name by entering **J** next to the operation you want to specify. This is only possible if you have a tool for editing JCL, and you have specified it in the 0.6 OPTION panel. For details, see “Specifying operator instructions” on page 169. This option applies only to jobs running in z/OS environments.

Examples of operations

There is no need to restrict operations to those relating to batch processing. If you rely on people remembering to perform a certain task, consider specifying the task as an operation.

The operations in the example for Figure 72 on page 148 are in the PAYDAILY application for the Paymore system. At the specified time, operation 005 will automatically be set to ready status. When that occurs, the product builds a WTO message and sends the message to the destination specified on the WTO1 workstation definition. The resulting status of the operation depends on the reporting attribute of the workstation. If the workstation reporting attribute is completion-only, the application sets the WTO operation to complete as soon as it is sent, but if the successor operation depends on some action, as in this case, it is better to give the WTO workstation the automatic reporting attribute, so that the product waits for some event (such as an OPSTAT command) to complete the operation.

NetView can be used to intercept the WTO, issue the appropriate CICS commands and check for successful deallocation of the online application. When NetView has determined the online system has successfully shut down, it can execute the EQQEVPGM program specifying this input:

```
OPSTAT JOBNAME(PAYDAILY) STATUS(C) WSNAME(WTO1)
```

The EQQEVPGM program creates a job-tracking event that is communicated to IBM Workload Scheduler for z/OS by the same means that job start and job end events are. When the controller receives the event, operation 005 is set to completed status, allowing the PAYDAILY job to be submitted.

This process can be very quick, and it ensures that the online application is shut down at the correct time and without delay. It further ensures that the batch processing does not start until the online application has completely shut down.

Specifying cross dependencies and shadow jobs

About this task

A cross dependency is a dependency of a local job, for example `Job_A` from another job, `Job_B` running in a different scheduling environment. The cross dependency indicates that `Job_A` cannot start until the remote job `Job_B` is completed.

To define a cross dependency, perform the following steps:

1. Make sure that a remote engine workstation referring to the remote scheduling environment is defined, as described in“Specifying remote engine workstations” on page 66.
2. Define the *shadow job*, which runs on the remote engine workstation, that is used to identify the remote job `Job_B`. For detailed information, see “Specifying remote job information in shadow jobs” on page 174.
3. Add a dependency for `Job_A` , either internal or external, on the shadow job.

Shadow jobs can be added to the plan by the plan creation process or dynamically at run time. The shadow job input arrival time is used to identify the job instance in the remote engine plan. The matching criteria, regardless whether the remote engine is z/OS or distributed, is *closest preceding*.

The resolution of the cross dependency depends on the status of the shadow job, which reflects at any time the status of the remote job instance. For more information about the possible values of the shadow job status, see "Monitoring a cross dependency resolution in the current plan" on page 456.

Setting an operation as a critical path target

If an operation is critical for your business and must complete by the deadline set, you can specify that the operation be considered as the target of a *critical path*. In this way, during daily planning processing, a critical path including the internal and external predecessors of the target operation is calculated, and a specific dependency network is created. While the plan is running, the scheduler monitors the critical paths that are consuming their slack time, becoming more critical than the paths calculated at plan generation.

You set the operation as critical in the JOB, WTO, AND PRINT OPTIONS panel (EQQAMJBP), shown in Figure 82 on page 161. You can also specify the WLM policy and service class that will be applied to promote the target operation, together with all the operations belonging to the critical path (unless otherwise stated at operation level).

Calculating and monitoring critical paths: For each operation defined as critical, a specific critical path is calculated in the dependency network during daily planning processing. Starting from the target operation, for each level of predecessors, the process chooses the most critical one and includes it in the critical path. Among all of the internal and external predecessors, the most critical one is planned to be the predecessor with the latest end time. Calculating the critical path starts from the target operation and moves backward among its predecessors; it ends when an operation without predecessor is reached.

The deadline of a critical operation should not be later than the deadline of the application to which the operation belongs. If this is not the case, message EQQA124I `SPECIFIED OP DEADLINE LATER THAN APPLICATION DEADLINE` is issued, along with the short message `TIME INCONSISTENT`.

The planned end time is calculated as the output of the IBM Workload Scheduler for z/OS planning processing, which is based on the information you set for the operation or occurrence (for example the IA time, duration, and deadline). The workstation parallel servers, open intervals, special resources and their availability are also taken into account. For this reason, the more accurate the application definition, the more accurate the critical path calculation.

To reduce the performance effort to a minimum, the estimated start and end times are updated only in a limited number of cases:

- When a late condition occurs and the accumulated delay determines the need for a critical path recalculation, the estimated times of the entire branch in the critical network identified by the late operation are updated.
- When an operation located on a critical path completes, the completion time is compared with the estimated end time and a delay or an advance is propagated among the successors on the critical path.

- When an occurrence belonging to a critical network is dynamically added to the current plan, all its internal operations will have their estimated times updated to consider the internal dependencies.

In all other cases, to update the estimated times in the critical network you must run a daily planning job EXTEND or REPLAN.

For each critical job, you are provided with a percentage that indicates the confidence that the critical job will meet its deadline. The confidence factor is calculated as the normal cumulative density function: it is the probability that the job will end within its deadline, calculated by using a Gaussian function, where the estimated end time is the mean and the estimated end variance is the standard deviation.

To reduce the performance effort to a minimum, the confidence factor is calculated only when the estimated times are updated. Consequently, the value of the confidence factor always corresponds to the latest calculation.

When a critical job becomes late, its confidence factor is automatically set to 0. When you dynamically set a job as critical, the value for its confidence factor is set to 50.

Note: Keep in mind that for shadow jobs involved in a critical path, the estimated duration is always calculated as one minute.

To have IBM Workload Scheduler for z/OS update your estimates in the application description database with actual run values, see "Using duration feedback options" on page 166.

While the plan is running, the scheduler checks if any predecessor of a critical job is starting to delay and monitors the critical paths that are consuming their slack time. In particular:

- The scheduler maintains a *hot list* for critical jobs, monitoring any critical job predecessor that starts to delay in one of the following conditions:
  - It is late, meaning that it did not start by its latest start time
  - It is long running, meaning that it is running longer than its estimated duration
  - It ends in error
  - It is suppressed by condition

  To do this, the scheduler applies the same internal logic that is used to monitor alert conditions.

  Before recalculating a critical path, the scheduler estimates new start and end times for all the successors of the job that started to delay.
- When any job in a critical path completes or a dynamic update changes the path, before recalculating the critical path the scheduler estimates new start and end times for the successors of the changed job.
- When the estimated start and end times determine a critical path change, the scheduler updates the current plan.

The deadlines of the operations in a critical job network affect the accuracy of the dynamic critical path handling, To optimize this, set these deadlines to the same or later than the critical job deadlines.

You can monitor critical paths by selecting option 7 (Critical Jobs) from the CURRENT PLAN AND STATUS INQUIRY panel. You get a list of all the critical target operations included in the current plan. Select the operation you want, to display the list of operations belonging to the corresponding critical path in BROWSING THE CRITICAL PATH . For details about option 7 (Critical Jobs), see "CRITICAL JOBS" on page 582.

You can monitor critical paths also through the TEP monitor. For details, see "Enabling monitoring on IBM Workload Scheduler for z/OS" on page 686.

Managing critical paths at plan execution: While the plan is running, to increase the possibility of having the target critical job completed by the specified deadline, the scheduler takes the following actions on operations in the critical path:

z/OS and end-to-end
: If a ready operation is about to miss its latest start time, the scheduler raises its internal scheduling priority to the highest possible value. In this way, the Workstation Analyzer subtask submits the operation as soon as possible.

z/OS only
: According to the specified policy, a started operation which is becoming late is promoted to the WLM service class even if the CRITICAL field is not set to W, if the following conditions apply:

  - The WLM keyword of the OPCOPTS statement is set
  - The operation is in execution state (started status)
  - The requirements of the WLM policy to be applied are met

  At run time, the current plan can be modified in a way that impacts the critical paths. If, for example, you remove a dependency between two operations belonging to a critical path, the path is no longer valid and the scheduler automatically recalculates it.

  When you run a daily planning job, the scheduler completely replans the entire network, considering also database updates and removing all completed operations. This means that the critical paths that are recalculated at planning time might differ from the last dynamic updates.

Specifying operation details

In the OPERATIONS panel (Figure 72 on page 148 or Figure 94 on page 177) enter the row command **S** to select an operation. You see the OPERATION DETAILS panel (Figure 73 on page 153).

This section describes the following operation details, in the order they are shown in the OPERATION DETAILS panel.

1. External predecessors, additional internal predecessors, conditional predecessors, and resolution criteria for dependencies.
2. Workstation resources and servers (operations on z/OS only)
3. Special resources
4. Automation options
5. Feedback options
6. Time specifications
7. Operator instructions
8. Edit JCL
9. Restart and cleanup options (operations on z/OS only)

10. Extended information about the operation
11. System automation information
12. User fields
13. Remote job information

```
EQQAMSDP --------------------- OPERATION DETAILS -----------------------
Option ===>

Select one of the following:

 1 PREDECESSORS        - List of predecessors
 2 WS RES AND SERVERS  - Work station resources and servers
 3 SPECIAL RESOURCES   - List of special resources
 4 AUTOMATIC OPTIONS   - Job, WTO, and print options
 5 FEEDBACK            - Feedback options
 6 TIME                - Time specifications
 7 OP INSTRUCTIONS     - Operator instructions
 8 JCL EDIT            - Edit JCL
 9 CLEANUP OPTIONS     - Cleanup Options
10 EXTENDED INFO       - Operation Extended Info
11 AUTOMATION INFO     - System Automation operation info
12 USER FIELDS         - User Fields operation info
13 REMOTE JOB INFO     - Remote job information

Application            : PAYM2           MONTHLY PAYROLL TRANSFER
Operation              : CPU1 040
Jobname                :                 Number of int preds    : 0
Duration               : 00.01.00        Number of ext preds    : 0
                                         Number of conditions   : 2
```

Figure 73. EQQAMSDP - Operation details

Specifying predecessors to condition the processing of operations

You specify external predecessors, additional internal predecessors, conditional predecessors, and the criteria for resolving the dependencies, by selecting option 1 in the OPERATION DETAILS panel. The PREDECESSORS panel is displayed:

```
EQQAMPDL ----------------------- PREDECESSORS ---------------  ROW 1 TO 3 OF 3
Command ===>                                                 Scroll ===> PAGE

Enter the COND command to view the list of conditions, enter/change
data in the rows, and/or enter any of the following row commands:

I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Description of external dependency, T - Dependency resolution criteria

Application      : PAYM2                       MONTHLY PAYROLL TRANSFER
Operation        : CPU1 040    PAYTRANS
No. of conditions: 0
Row  Pre Dependency   Oper         Transport time   Application id          Jobname
cmd  Typ Resl Mand    ws   no.       HH.MM          (for ext pred only)
''   O   C    N       SETP 010       _____          ____________________    PAYTRANS
''   A   A    N       CPU1 040       _____          PAYM1_____________      PAYMONTH
''   _   _    _       CPU1 020       _____          PAYW______________      PAYWEEK_
****************************** BOTTOM OF DATA ************************
```

Figure 74. EQQAMPDL - Predecessors

For details about how IBM Workload Scheduler for z/OS resolves external dependencies, see "External dependencies between multiple occurrences" on page 177.

To specify the criteria under which the predecessor dependency is to be resolved, see "Specifying dependency resolution criteria" on page 178.

Specifying conditional dependencies: From the PREDECESSORS panel (Figure 74 on page 153), enter the COND command to define a set of *conditions*. The CONDITIONS LIST panel (Figure 75) is displayed:

```
EQQAMCCL ------------------ CONDITIONS LIST ------------------ Row 1 to 2 of 2

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Specify the condition details

Application     : PAYM2
Operation       : CPU1 040    PAYTRANS

Row  Condition Text                     Cond     Rule
cmd  no.                                Deps
'''  003       Check on RC range        1        all
'''  005       Alternative checks       3        specified number of
```

Figure 75. EQQAMCCL - Conditions list

Each row corresponds to a list of *condition dependencies* and is identified by a condition number. The scheduler evaluates the set of conditions according to the Boolean logic of the AND operator.

To define each list of condition dependencies, enter the S row command. The CONDITION DEPENDENCIES DEFINITIONS panel is displayed (Figure 76):

```
EQQAMCCP ------------- CONDITION DEPENDENCIES DEFINITION ----- Row 1 to 1 of 1

To define a condition dependency enter/change data in the rows, using any
of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete, T - Dependency
resolution criteria

Application     : PAYM2
Operation       : CPU1 040    PAYTRANS

Rule:
  Specify the number of condition dependencies that need to be verified
  to make the condition true 000 . Leave 0 for all of them.

Row Oper     Application Id   Jobname  StepName ProcStep Co Co St  Ret.Code
cmd ws.  no. (ext Adid only)                              Ty OP Val Val1 Val2
''' CPU1 001 APPLX___________ JOBX____ ________ ________ RC RG     0000 0004
```

Figure 76. EQQAMCCP - Condition dependencies definitions

You can specify one of the following condition rules:

- All the condition dependencies in the list must be true. It corresponds to the AND operator in the Boolean logic.
- At least *n* out of all the condition dependencies must be true. In this case set the rule input field to *n*. It corresponds to the OR operator in the Boolean logic.

To specify a step dependency, use:

- ProcStep field if the step is not in a procedure.
- Both StepName and ProcStep fields if the step is in a procedure.

ProcStep must correspond to a step specifying the `EXEC PGM=` statement.

Depending on the type of check that you require on the predecessor, enter one of the following values in the CoTy column:

RC To check the predecessor return code.

ST To check the predecessor status. It does not apply to step dependencies.

In the CoOP column, specify one of the following logical operators for the required check:

GE Greater than or equal to. Valid only for RC condition type.

GT Greater than. Valid only for RC condition type.

LE Less than or equal to. Valid only for RC condition type.

LT Less than. Valid only for RC condition type.

EQ Equal to.

NE Not equal to. Use it to specify conditions on final statuses only.

RG Range.

To set the value fields, specify:

- An error code, if you set CoTy to RC. You can specify a 4-digit number or one of the supported error codes, listed in "Error codes" on page 839.
- An operation status, if you set CoTy to ST. Allowed values are:

  C Complete.

  E Ended-in-error.

  S Started, according to the job-start event reported by the tracker component. If CONDSUB (YES) is specified in JTOPTS, the condition dependency is evaluated when the operation status becomes S (started) without waiting for the job-start event.

  X Suppressed by condition, meaning that the operation did not run because any condition is false.

For more information on how the scheduler evaluates condition dependencies at run time, see "Evaluating conditions and conditional successor status" on page 422.

Note:

1. If you use the NE operator, specify a final status (C, E, or X).
2. If you use the NOERROR or highest return code capabilities, the scheduler saves the original return code when setting an operation to complete, because of the NOERROR or highest return code processing. It then uses the original return code to evaluate a condition dependency.

Specifying resolution criteria for conditional dependencies: The resolution criteria for conditional dependencies can be specified on the single condition, not on the aggregated condition number. When you specify or modify the resolution criterion of a condition on a given predecessor, also the other existing conditions on the same predecessor are automatically aligned with that criterion.

To specify the resolution criteria for a condition, using the conditions previously defined for job PAYTRANS as an example:

1. In the CONDITIONS LIST panel enter the S command in the row of condition number 005 to view the condition definitions.

```
EQQAMCCL ------------------ CONDITIONS LIST ------------------ Row 1 to 2 of 2

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Specify the condition details

Application     : PAYM2
Operation       : CPU1 040    PAYTRANS

Row  Condition Text                      Cond     Rule
cmd  no.                                 Deps
'''  003       Check on RC range         1        all
S'   005       Alternative checks        3        specified number of
```

Figure 77. Specifying the conditions details in the Conditions List panel.

The CONDITION DEPENDENCIES DEFINITIONS panel is displayed.

2. Enter the T command in the row of the first condition to specify the resolution criteria for the dependency on job GETHRS

```
EQQAMCCP ------------- CONDITION DEPENDENCIES DEFINITION ----- Row 1 to 1 of 1

To define a condition dependency enter/change data in the rows, using any
of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete, T - Dependency
resolution criteria

Application     : PAYM2
Operation       : CPU1 040    PAYTRANS

Rule:
  Specify the number of condition dependencies that need to be verified
  to make the condition true 000. Leave 0 for all of them.

Row Oper     Application Id   Jobname  StepName ProcStep Co Co St  Ret.Code
cmd ws.  no. (ext Adid only)                            Ty OP Val Val1 Val2
T   CPU1 001 PAYREV_____________ GETHRS__ ________ ________ RC RG     0000 0004
''' CPU1 001 PAYREV_____________ GETHRS__ ________ ________ ST EQ  C  0000 0000
''' CPU3 012 ACCREC24___________ PAYMECH_ ________ ________ RC LT     0008 0000
```

Figure 78. Specifying the dependency resolution criteria for a dependency in the Condition Dependencies Definitions panel.

The DEPENDENCY RESOLUTION CRITERIA panel is displayed.

```
EQQAMMAC---------------- DEPENDENCY RESOLUTION CRITERIA ----------------
Command ===>
Application:          PAYM2                   Operation : CPU1 040    PAYTRANS
Ext Pred Application: PAYREV                  Operation : CPU1  1     GETHRS

Resolution criteria chosen is:            C  (C/S/R/A)

 -(C) Closest preceding

 -(S) Same scheduled date

 -(R) Within a relative interval
  FROM:
  hours (HHH):   ___  minutes (MM):  __   when (B/A before/after IA): _
  TO:
  hours (HHH):   ___  minutes (MM):  __   when (B/A before/after IA): _

 -(A) Within an absolute interval
  FROM:
  time (HH.MM):   _____  for days (D):  _   when (B/A before/after IA): _
  TO:
  time (HH.MM):   _____  for days (D):  _   when (B/A before/after IA): _
```

Figure 79. The Dependency Resolution Criteria panel for conditional predecessor GETHRS.

See "Specifying dependency resolution criteria" on page 178 for a detailed field description.

It is not possible to specify mandatory resolution criteria on conditional predecessors, so that the related fields are excluded from the panel.

Specifying operation resource usage

An operation can use these types of resources:

- Special resources
- Workstation fixed resources
- Parallel servers

Using these resource types, you can avoid allocation failures and other problems caused by contention for resources.

Using special resources: In the application description, you can specify the resources that are used by each operation in your application. You also specify whether the operation requires the resource exclusively or whether it can share the resources with other operations. For information about resources, see Chapter 5, "Creating special resources," on page 75.

The resource name you choose can be any character string up to 44 characters. For documentation purposes, the string should be a meaningful name. If the resource represents a data set, it is good practice to make the resource name the data set name.

When you create an operation that uses a special resource, select option 3 (SPECIAL RESOURCES) in the OPERATION DETAILS menu. You see the SPECIAL RESOURCES panel, shown in Figure 80 on page 158.

```
EQQAMSRL ---------------------- SPECIAL RESOURCES ------------  ROW 1 TO 1 OF 1
Command ===>                                                  Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete

Operation             : CPU1 030

Row  Special                                      Qty    Shr Keep On  Avail On
Cmd  Resource                                             Ex  Error    Complete
'' payroll.database_____________________________   1___   x   _        _

****************************** BOTTOM OF DATA ******************************
```

Figure 80. EQQAMSRL - Special resources

Type values in the fields on the SPECIAL RESOURCES panel:

Special Resource
The name of the resource, up to 44 characters. You can use the global search characters % and * if you are unsure of the name: IBM Workload Scheduler for z/OS will display a list of matching names. For example, if you specify PAY*, IBM Workload Scheduler for z/OS displays all special resources beginning with PAY, and you can select PAYROLL.DATABASE.

Qty The number of resources that the operation allocates. If you leave this field blank, the operation is allocated the whole quantity currently available (the adjust quantity), unless this value is not greater than 0, in which case the operation cannot start until the adjust quantity becomes greater than 0. This adjust value is the difference between the current and global values. Once started, the operation allocates the whole quantity available, even if this value later increases.

Shr Ex
Whether the operation needs shared or exclusive access to the resource:
S (shared)
X (exclusive)

A resource unit allocated to an operation as shared can be used by other sharing operations at the same time, but is unavailable to operations that need exclusive allocation. Resource units allocated as exclusive can be used only by that operation. IBM Workload Scheduler for z/OS does not start another operation that requires the allocated units until the first operation ends.

This is like data set disposition. However, if a resource unit is allocated as shared by an operation and an operation requiring exclusive use becomes ready, further shared requests are not delayed behind the waiting exclusive operation. Waiting operations, in other words, have no allocated resources (unless they are failed operations that have the keep-on-error attribute for some resources).

Keep on error
Whether the operation keeps the resource when it fails:

Y The resource is kept

N The resource is freed

Blank The default value set for the resource is taken

Avail on complete
Whether the global availability of the resource is to be changed when the operation completes.

Y The global availability is changed to Yes.

N The global availability is changed to No.

R The global availability is changed to blank.

Blank Uses the system default, according to the following order:

1. The On Complete value set at operation definition level, if not blank.
2. The On Complete value set at special resource definition level, if not blank.
3. The ONCOMPLETE or DYNONCOMPLETE keyword value, respectively set for the not dynamically added resources or the dynamically added resources, in all the other cases.

Use the SPECIAL RESOURCE panel to create and modify special resources (option 1.6 from the main menu).

Using workstation fixed resources: When you specify an operation on a workstation, you can specify how many of the workstation fixed resources the operation will use. IBM Workload Scheduler for z/OS knows how many of each resource is available on that workstation; for more information, see "Specifying workstation fixed resources" on page 73. When deciding whether to start the operation, it considers the available workstation resources and the resources required for this operation. Normally, IBM Workload Scheduler for z/OS starts an operation only if the needed quantity of a resource is available at the workstation. In case of virtual workstations, the scheduler considers the fixed resources as a criterion to select the submission destination: the next destination to be selected, as part of the round-robin algorithm, is checked for fixed resources. If the check fails, it moves on the next destination in the list.

However, when creating the workstation, you can specify that resource usage will not be considered when IBM Workload Scheduler for z/OS is either producing its schedule or starting operations. Fixed resources do not apply for jobs on fault-tolerant agents and remote engine workstations.

When you create workstations (for details, see "What types of workstation are there?" on page 47), you specify the quantity of workstation resources available. IBM Workload Scheduler for z/OS recognizes two workstation resource types, by default called R1 and R2, although you can choose other names. You decide what these resources represent. They are commonly used to represent tape or cartridge drives.

For example, assume that workstation CPU1 has an R1 value of 10. This means that, for all operations started at any one time on this workstation, the total use of R1 by these operations cannot exceed 10.

Note that although workstation resources represent some resource pool, IBM Workload Scheduler for z/OS has no knowledge of the actual state of the resources. That is, IBM Workload Scheduler for z/OS can only keep track of resource users that are operations in the current plan. In addition, IBM Workload Scheduler for z/OS is only aware of the total value specified on the workstation definition, or the modified amount in the current plan. IBM Workload Scheduler for z/OS also has no way of checking that the actual resource usage of an operation matches the planned resource usage.

Suppose, for example, that R1 on CPU1 represents tape drives. Your system has 6 tape drives, so in the workstation description you have specified a value of 6 for

R1. You have specified in the application description that operations A, B, and C (all jobs) use 2 tape drives each. IBM Workload Scheduler for z/OS submits the operations to JES. There is no contention for resources, so they can all run at the same time. However, the JCL for operation B has been changed since the application description for B was set up, so that it now uses 3 tape drives. If the jobs are submitted by IBM Workload Scheduler for z/OS in the order A, B, C, this means that C is waiting for a tape drive.

IBM Workload Scheduler for z/OS bases its decisions on the operation resource usage, as recorded in the application database, so the change to the JCL did not affect its planning or starting of the operations. Because IBM Workload Scheduler for z/OS cannot tell whether the tape drives are being used by jobs outside its control, it might submit jobs on the assumption that the resources represented by the workstation resources are available, even though the real resources are all in use.

If some resources become unavailable, for example, because of a hardware problem, IBM Workload Scheduler for z/OS continues to schedule according to the original amount until the current plan is modified with a revised amount.

You can specify workstation resource usage for an operation on the WORK STATION RESOURCES AND SERVERS panel (Figure 81), displayed by selecting option 2 on the OPERATION DETAILS panel (Figure 73 on page 153).

```
EQQAMWRP ------------ WORK STATION RESOURCES AND SERVERS ----------------
Command ===>

Enter/Change data below:

Operation              : CPU1 020         Runs pay04 and pay06

Work station resource:
 Resource 1        ===> _0          Amount of ws resource
 Resource 2        ===> _0          Amount of ws resource

SERVERS            ===> _1          Number of parallel servers
```

Figure 81. EQQAMWRP - Work station resources and servers

Using parallel servers: Parallel servers work like workstation fixed resources: the number of servers required by an operation must be available before IBM Workload Scheduler for z/OS will start the operation. Operations on non-virtual workstations use each one server; so, the number of parallel servers available on a workstation at any time is equal to the maximum number of operations that can be started simultaneously.

In case of virtual workstations, the scheduler considers the parallel servers as a criterion to select the submission destination: the next destination to be selected, as part of the round-robin algorithm, is checked for the number of parallel servers. If the check fails, it moves on the next destination in the list. Parallel servers do not apply for jobs on fault-tolerant agents.

You can choose whether IBM Workload Scheduler for z/OS takes parallel servers into consideration when it plans the schedule, when it starts an operation, at both times or at neither. This is the *server usage*, specified as P, C, B, or N on the workstation definition. See "Specifying workstation fixed resources" on page 73.

IBM Workload Scheduler for z/OS assumes that operations on computer workstations always use a single server. The maximum number of servers that can be specified on a single workstation is 65535.

Specify the number of servers for an operation on the WORK STATION RESOURCES AND SERVERS panel (Figure 81 on page 160). You can display this panel by selecting option 2 on the OPERATION DETAILS panel (Figure 73 on page 153).

Specifying options for automation

Selecting AUTOMATIC OPTIONS, option 4, in the OPERATION DETAILS panel takes you to the JOB, WTO, AND PRINT OPTIONS panel (Figure 82).

```
EQQAMJBP ---------------- JOB, WTO, AND PRINT OPTIONS -------------------
Command ===>

Enter/Change data below:
Application            : PAYDAILY
Operation              : WTO1 005
 JOB CLASS          ===> _            ERROR TRACKING     ===> Y
 HIGHEST RETURNCODE ===> ____         EXTERNAL MONITOR   ===> N
 CENTRALIZED SCRIPT ===> N            COND RECOVERY JOB  ===> N
 CRITICAL           ===> P            POLICY             ===> _
 CLASS              ===> _______
Job release options:
 SUBMIT             ===> Y            HOLD/RELEASE       ===> Y
 TIME DEPENDENT     ===> N            SUPPRESS IF LATE   ===> N
 NOP                ===> _            MANUALLY HOLD      ===> _
 DEADLINE WTO       ===> N
WS fail options:
 RESTARTABLE        ===> _            REROUTEABLE        ===> _
Print options:
 FORM NUMBER        ===> ________     SYSOUT CLASS       ===> _
```

Figure 82. EQQAMJBP - Job, WTO, and print options

The following sections describe options that apply to:

- Jobs and started tasks
- Jobs only
- Print operations only
- All operations

Options that apply to jobs and started tasks:
These options apply to jobs and started tasks:

ERROR TRACKING (default: Y)

If you specify Y, an error in the job or started task (for example, an abend or JCL error) causes the operation representing the job or started task to be marked E (ended-in-error).

If you specify N, the operation is marked C (complete) when the operation ends, regardless of the outcome except for restarted jobs failing in the EQQCLEAN step, that is a step inserted into the job by the Restart and Cleanup function. In this case, the operation is marked E (Ended in Error).

For fault-tolerant agents and automation workstations, the only valid value is Y.

The error tracking option is applied only to error conditions reported by job tracking events. An operation which specifies N for error tracking can be set to error status manually by a panel user or the OPSTAT command. Errors reported during job submission; for example missing JCL, job card

inconsistencies, JCL variable errors and the installation policy for suppress-if-late option can all result in an E status for an operation which specifies error tracking N.

HIGHEST RETURNCODE (default: value of HIGHRC on JTOPTS)
This field specifies the highest acceptable return code from any step in the job or started task. It is not applicable to the EQQCLEAN step in a restarted JCL.

For fault-tolerant workstations and automation workstations, the valid value is either zero or blank.If a return code for a step in the job or started task exceeds this value, the operation is set to E (ended-in-error) status, unless there is a match with a statement in the NOERROR initialization statement. If you must specify an acceptable nonzero return code for a particular step, or steps, use the NOERROR statement.

For more details, see "Using error codes to set operations to ended-in-error" on page 361.

CRITICAL (default: N)
This field specifies if the operation must be considered a critical path target, meaning that at DP processing a critical path is calculated for the job to complete by its deadline. You can specify:

P The operation is to be considered a critical path target.

W The operation is eligible for WLM assistance.

N The operation is not eligible for WLM assistance.

For details about the critical path, see "Setting an operation as a critical path target" on page 150.

POLICY (default: ' ') and CLASS
The Workload Manager (WLM) policy and service class. If an operation is defined as a critical path target or eligible for WLM assistance, the scheduler automatically sends a request to promote the job or started task to the high-performance service class, when the conditions of the specified assistance policy are met. You can specify the following policies:

L Long duration. The job is assisted if it runs beyond its estimated duration time.

D Deadline. The job is assisted if it has not finished when its deadline time is reached.

S Latest start time. The job is assisted if it is submitted after the latest start time.

C Conditional. An algorithm calculates whether to apply the Deadline or the Latest start time policy.

' ' Default. WLM uses the policy specified in the OPCOPTS statement.

This option does not apply to fault-tolerant agents. For a description of WLM, see Chapter 26, "Job scheduling and WLM," on page 533.

SUBMIT (default: Y)
If you specify Y, IBM Workload Scheduler for z/OS automatically starts the job or started task or issues the WTO message when all predecessors have been satisfied and all required resources are available. Usually, this is the

option you choose. However, if the JCL for the job is not under IBM Workload Scheduler for z/OS control, for example, when the job arrives via a RJE link, specify N.

Note: For jobs and started tasks to be automatically submitted, the JOBSUBMIT parameter on the JTOPTS initialization statement must be set to YES, and job submission must not be deactivated using the SERVICE FUNCTIONS panel (see Chapter 14, "Using service and optional functions," on page 327).

The N option does not apply to fault-tolerant agents.

RESTARTABLE (default: take the installation default)
This option determines what the status of the operation will be if its workstation becomes inactive (failed or offline). This option applies to the operation only while it has status S (started). This option does not apply to fault-tolerant workstations.

Y The operation is reset to status R (ready) if its workstation becomes inactive. That is, the operation is restarted from the beginning on the alternate workstation, or on this workstation when it becomes active again. The operation is reset to ready status only when:

1. You specify this in the MCP panel when you manually set the workstation failed or offline.

   or,

2. You specify this in the WSSTAT or EQQUSIN subroutine when you set the workstation failed or offline.

   and, if not otherwise specified in the panel, command, or subroutine,

3. The first parameter of the installation default on the WSFAILURE or WSOFFLINE keyword on the JTOPTS initialization statement allows operations to be restarted.

N This operation will not be restarted even if the installation default, as specified in the WSFAILURE or WSOFFLINE parameter on the JTOPTS initialization statement, is to restart started operations on workstations that become inactive.

If the installation default is to put started operations into error status on workstations that become inactive, the operation is given status code E (ended-in-error).

blank The operation takes the installation default action on the OPRESTARTDEFAULT keyword of the JTOPTS statement if the workstation that it is started on becomes inactive.

REROUTABLE (default: take the installation default)
This option specifies what action IBM Workload Scheduler for z/OS should take for this particular operation if the computer workstation that it is scheduled to run on is inactive and an alternate workstation has been specified. This option applies to the operation only when it is in status R (ready) or W (waiting). Once the operation is in status S (started), the RESTARTABLE option determines the action. This option does not apply to fault-tolerant workstations.

Y The operation is eligible to be rerouted if the workstation becomes inactive, and:

1. You specify this in the MCP panel when you manually set the workstation failed or offline.

   or,

2. You specify this in the WSSTAT or EQQUSIN subroutine when you set the workstation failed or offline.

   and, if not otherwise specified in the panel, command, or subroutine,

3. The second parameter of the installation default on the WSFAILURE or WSOFFLINE keyword on the JTOPTS initialization statement allows operations to be rerouted.

N The operation is not rerouted, even when the workstation has an alternate destination. For more information about directing work to alternate workstations, see "Redirecting work to alternate workstations" on page 628.

blank The operation takes the installation default action on the OPREROUTEDEFAULT keyword of the JTOPTS statement if the workstation becomes inactive.

Options that apply only to jobs:
These options apply only to operations that represent jobs:

JOB CLASS (no default)
Specify the JES input class of the job that the operation represents. The job class that you specify here is only for documentation purposes. It need not correspond to the actual class of your job, although it is good practice if it does. This option does not apply to fault-tolerant agents.

HOLD/RELEASE (default: Y)
Use this option to control held jobs that are not submitted by IBM Workload Scheduler for z/OS.

If you place jobs that are not submitted by IBM Workload Scheduler for z/OS in HOLD status (for example, by specifying TYPRUN=HOLD on the job card), and HOLD/RELEASE is set to Y, IBM Workload Scheduler for z/OS releases them according to its schedule when all dependencies are satisfied and when the requested resources are available.

If HOLD/RELEASE is set to N, IBM Workload Scheduler for z/OS releases a held job immediately without reference to its schedule. You cannot set this option to N for fault-tolerant workstations.

Note: Specifying a HOLD/RELEASE value Y for a job operation does not cause IBM Workload Scheduler for z/OS to put the job into HOLD status. If the job is already in HOLD status, however, IBM Workload Scheduler for z/OS releases it at the scheduled time.

Options that apply to print operations:
The FORM NUMBER and SYSOUT CLASS fields in the operation options, combined with the job or started-task name, identify the JES output group that you want to track. The operation is marked as complete when an output group with a matching job name, form number, and SYSOUT class has either completed printing or been purged from the spool.

Ensure that the combination of job or started-task name, form number, and SYSOUT class is unique to the print data set that you want to monitor. If this is

not the case, the print operation might be marked as complete when another print data set, which matches the selection criteria, is printed or purged. These options do not apply to fault-tolerant agents.

If some of your jobs or started tasks conditionally create output, or if FREE=CLOSE is specified on the SYSOUT DD statement, consider specifying PRTCOMPLETE(YES) in the JTOPTS initialization statement. For more information about the PRTCOMPLETE keyword, see *Customization and Tuning*.

Options that apply to all operations:
These options apply to all operations:

TIME-DEPENDENT (default: N)
If you specify Y, the operation becomes time-dependent. That is, IBM Workload Scheduler for z/OS will not start the operation until the operation input arrival time is reached. If IBM Workload Scheduler for z/OS cannot start the operation at the input arrival time, the operation is considered late. This can happen if your system has been unavailable for some period or when the operation also has predecessors that do not finish in time. See "Creating time-dependent operations" on page 184.

If you specify N, the operation will not be time-dependent. IBM Workload Scheduler for z/OS will start the operation as soon as its predecessors are completed and resources are available. If there are no predecessors, and resources are available, IBM Workload Scheduler for z/OS starts the operation immediately as it is added to the current plan.

SUPPRESS IF LATE (default: N)
Specify Y to stop this time-dependent operation being started if it is late. See "Creating time-dependent operations" on page 184 for details of what happens to late time-dependent operations.

If you specify N, IBM Workload Scheduler for z/OS ignores the fact that the operation is late and tries to start it as soon as possible.

Attention: If an operation that is used as a mandatory dependency is also suppress-if-late, it might be suppressed before the required mandatory action is taken and this could potentially cause a problem or unexpected results. There is nothing to prevent an operation from being suppress-if-late and a mandatory dependency although it might not make sense to define it in this manner.

DEADLINE WTO (default: N)
If you specify Y for this option, IBM Workload Scheduler for z/OS issues the operator message EQQW776I when a z/OS operation passes its deadline and the operation is in started status (that is, the operation has been started but has not been marked as completed within the deadline time). The message is routed to the operator console of the workstation that the operation runs on. The message is also written to the message log (EQQMLOG). The WTO is issued only for z/OS operations that have status S (started).

Besides the standard message, the user-defined text that you specified on the OPERATIONS panel, using the TEXT command , is issued as part of the WTO (Figure 72 on page 148).

You can use this to stop a job or started task automatically at a certain time. See "Scheduling the closedown of online systems and started tasks" on page 184 for details.

Specifying Y for an operation on a workstation that is not a z/OS destination will have no effect. That is, a deadline WTO will not be routed to the workstation destination.

EXTERNAL MONITOR (default: N)
Specifies if the operation is monitored by an external product (for example, Tivoli Business Systems Manager or Tivoli Enterprise Portal). If you specify Y for this option, then monitoring is enabled. For more information about external monitoring, see Chapter 33, "Using Tivoli Business Service Manager," on page 675 and Chapter 34, "Using IBM Tivoli Monitoring," on page 685.

Centralized Script (default: N)
By default, the script is not centralized and therefore is stored locally on the agent and a job definition is added to the SCRPTLIB. In contrast, a centralized script is stored in the JOBLIB. Using a centralized script implies loss of fault tolerance, because an operation might depend on a script that can be released only by the IBM Workload Scheduler for z/OS controller. Extra processing is needed because the script must be taken from the JOBLIB and sent to the agent.

Specify Y to use a centralized script. This option applies to fault-tolerant workstations only. If you specify Y for workstations that are not fault-tolerant, the value is forced to Y when you generate the daily plan.

COND RECOVERY JOB (default: N)

Specify Y if you use this operation as recovery job, meaning that it might recover a conditional predecessor. For details, see "Handling recovery using conditional dependencies" on page 440.

Using duration feedback options

IBM Workload Scheduler for z/OS automatically monitors the actual duration of operations. It can use these durations to modify the estimates in the application description database.

For example, if a job processes a data set that is getting bigger, the job is likely to take longer each time it runs. Using the feedback option helps to ensure that the job is started soon enough to process any new records and to still meet its deadline.

Two parameters, the smoothing factor and the limit for feedback, control how measured durations are used. Any value you specify here overrides the installation default specified in the JTOPTS statement.

Note:

1. For shadow jobs, the smoothing factor and limit for feedback are ignored.
2. If you have set FIRSTFDBK(YES) in the JTOPTS statement, every new job that you define is updated with the actual duration at its first run, even if you have set the smoothing factor to 0 or the limit for feedback to 100. Hence, if you want to keep a specific duration that you set in the database, review the duration value after the first run has occurred.
3. The value used to select the operations for which a long duration alert must be issued, is set with the ALEACTION keyword of JTOPTS. If ALEACTION is not set, the LIMFDBK value is used instead. In this case, the value for the feedback limit that you can optionally enter in the application description is ignored.
4. The feedback limit value applies also to the WLM policy DURATION.

Select option 5 in the OPERATION DETAILS panel. Specify the feedback options in the panel shown in Figure 83 to automatically adjust the estimated duration in the database after the job completes.

```
EQQAMFBP ---------------------- FEEDBACK OPTIONS -------------------------------
Command ===>

Enter/Change data below:

Operation              : CPU1 020

SMOOTHING FACTOR   ===> 050           A value 0 to 999 where 0=no smoothing

FEEDBACK LIMIT     ===> 200           A value 100 to 999 where 100=no feedback
```

Figure 83. EQQAMFBP - Feedback options

Duration smoothing factor: The duration smoothing factor is a number, 0 to 999, that determines how much a measured duration will change existing values in the application description database. Note that if the measured duration is outside the limits established by the limit for feedback, the smoothing factor will not be applied and the AD data set will not be updated.

The new estimated duration is calculated as follows:

```
ND = OD + ((AD - OD) * SF/100)
```

Where:
ND The new estimated duration to be stored in the AD database.
OD The old estimated duration stored there.
AD The measured duration.
SF The smoothing factor.

Table 17 shows some examples of how the smoothing factor algorithm works.

Table 17. Examples of smoothing factors

Factor	Result
0	There will be no feedback, unless you have set FIRSTFDBK(YES) in the JTOPTS statement.
10	The new estimated duration will be the old estimated duration, plus one-tenth the difference between the measured and old estimated duration.
50	The new estimated duration will be the old estimated duration, plus one-half the difference between the measured and old estimated duration.
100	The measured duration replaces the old estimated duration.
999	The new estimated duration will be the old estimated duration, plus 10 times the difference between the measured and old estimated duration.

Limit for duration feedback: The limit for duration feedback is a number, 100 through 999, that establishes the limits within which measured values are regarded as normal and acceptable. A measured value outside the limits is ignored; that is, no smoothing factor is applied and the application description database is not updated.

The limits are calculated as follows:

```
Lower limit = OD * 100/LF
Upper limit = OD * LF/100
```

Where:
OD The old estimated duration stored in the application description database.
LF The limit for duration feedback.

Table 18 shows some examples of how the limit for feedback algorithm works.

Table 18. Examples of limits for feedback

LF value	Result
100	No new estimated duration will be stored in the application description database, unless you have set FIRSTFDBK(YES) in the JTOPTS statement.
110	The new estimated duration will be stored if the measured duration is approximately between 90% and 110% of the old estimated duration.
200	The new estimated duration will be stored if the measured duration is between half and double the old estimated duration.
500	The new estimated duration will be stored if the measured duration is between one-fifth and five times the old estimated duration.
999	The new estimated duration will be stored if the measured duration is between one-tenth and 10 times the old estimated duration.

Specifying input arrival times, deadlines, and durations for operations

For each operation making up an application, on the TIME SPECIFICATIONS panel (Figure 84), which you can reach by selecting option 6 in the OPERATION DETAILS panel (Figure 73 on page 153), you can specify:

- An input arrival time and deadline. If you do not specify them, the input arrival time and deadline for the application are used.
- Variable durations and variable deadlines.

```
EQQAMTMP -------------------- TIME SPECIFICATIONS ----------------------------
Command ===>

Enter/Change data below:

Application time specifications:
 Input arrival time             :     10.00
 Default deadline day/time      : 00  20.00
 Default duration               :     00.02.00

Operation time specifications   :   CPUA 015
 Input arrival                  :   DAY   00    TIME 10:22
 Default operation deadline     :   DAY   00    TIME 18:00

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn   - Insert, R(nn,RR(nn)  - Repeat, D(nn),DD  - Delete

Row    External run cycle group Variable Duration  Variable Deadline Var  Var Var
cmd    or application run cycle HH.MM.SS           day HH.MM         NOP  MH  Crit. Ind
''''   MONTHLY                  00.40.00           00  22.00         _    _   _
''''   WEEKLY                   00.30.00           00  21.00         _    _   _
```

Figure 84. EQQAMTMP - Time specifications

The input arrival and deadline day are relative to the input arrival date for the occurrence. Specify a number from 0 to 99, where 0 means that the day is also the input arrival day. When the specified day is greater than 0, IBM Workload Scheduler for z/OS by default considers only work days when calculating the date. For example, if day is 1, this specifies the first *work day* (as specified by the

calendar) after the input arrival date. You can change IBM Workload Scheduler for z/OS to include free days when calculating deadline dates.

Note: For a description of the OPERIALL and OPERDALL parameters of the BATCHOPT statement, see *Customization and Tuning*.

Specify variable durations and variable deadlines when your operation, in specific days, needs durations and deadlines different from the default. You then associate each variable duration and deadline with a specific application run cycle or with a run cycle group.

For example, you have an operation that runs every day with the same duration, except on Fridays and on the last day of month. You can do either of the following actions:

- In the application definition, define three run cycles in this order: for the last day of month, for Friday only, for every day (the order is important because in case of time overlapping, the run cycles are applied in the order they are listed). In the TIME SPECIFICATIONS (EQQAMTMP) panel , associate the required variable duration with each run cycle that you defined for the application.
- In the application definition define only one run cycle, which is related to the every day run. Then define two run cycle groups, which you reference in the AD database, related to occurrences running on Fridays and occurrences running on the last day of month. According to the time needed by the specific occurrences, in the TIME SPECIFICATIONS (EQQAMTMP) panel associate a variable duration with each of the two run cycle groups.

Specifying operator instructions

You can specify an *operator instruction* to be associated with an operation in an application. This could be, for example, special running instructions for a job operation.

The instruction can be permanent or temporary. A temporary instruction has VALID FROM and VALID TO dates associated with it, which specify when the instruction is valid.

Operator instructions can be handled from either the APPLICATION DESCRIPTION panel or the OPERATOR INSTRUCTION panel.

Note: When you delete an application, a confirmation panel is displayed, on which you can choose whether to retain or delete the associated operator instructions (see Figure 87 on page 171).

If you select option 7 in the OPERATION DETAILS panel, (Figure 73 on page 153), then the LIST OF OPERATOR INSTRUCTIONS panel (Figure 85 on page 170) is displayed.

```
EQQALSML ----------- LIST OF OPERATOR INSTRUCTIONS ----------- Row 1 to 3 of 3
Command ===>                                                  Scroll ===> CSR

Enter the CREATE command to create a new instruction, or
enter any of the row commands below:

B - Browse, M - Modify, C - Copy, D - Delete

Row   Application id   Operation Valid from       Valid to        Lines

cmd                    number    date     time    date     time


      PAYINOUT         010       20030101 10.00   20030131 10.00  003

      PAYINOUT         010                                        006

      PAYINOUT         010       20030301 10.00   20030331 10.00  002


******************************** BOTTOM OF DATA ***************************
```

Figure 85. EQQALSML - List of operator instructions

From here it is possible to create, update, delete, browse operator instructions in the same way as in the OPERATOR INSTRUCTION panel (option 1.5 from the main menu), except that the operator instruction key (application name and operation number) cannot be changed.

You can specify up to 443 lines of operator instructions for an operation in the CREATING AN OPERATOR INSTRUCTION panel (Figure 86).

```
EQQKCRTE ---------- CREATING AN OPERATOR INSTRUCTION --------- Row 1 to 3 of 3
Command ===>                                                  Scroll ===> CSR

Edit instruction text below:

APPLICATION ID     ===> PAYINPUT

OPERATION          ===> 010

VALID FROM         ===> 19981130 10.00    Format:  CCYYMMDD HH.MM

VALID TO           ===> 19981231 10.00    Format:  CCYYMMDD HH.MM
----------------------------- TEXT -----------------------------------
***************************** TOP OF DATA ****************************

In the unlikely event that this job should fail, please refer to the

call roster for PAYROLL systems and page as soon as possible.

************************** BOTTOM OF DATA ****************************
```

Figure 86. EQQKCRTE - Creating an operator instruction

While handling operator instructions in the APPLICATION DESCRIPTION panel menu, and returning from the LIST OF OPERATOR INSTRUCTIONS panel, the operator instruction might have been modified (with a *create operator instruction*, for example) while the Application Description has yet to be confirmed.

This might lead to inconsistencies, such as having an operator instruction referring to a nonexistent application. For this reason, optional consistency checks have been added each time an application is deleted, created, or modified. These checks look

for operator instructions having no match in the application description database (at least one application with the same name and operation number). If any are found, they are deleted.

You can specify (option 0.5) whether to perform these checks and whether to display a confirmation panel (Figure 87).

```
EQQAOIDP ---------------- CONFIRM THE DELETION OF OI -------------------------
Command ===>                                                Scroll ===> CSR

Enter Y in the command field to confirm deletion, or
enter N to reject deletion.

Application id   Operation Valid From      Valid To        Lines
Id               Number    Date     Time   Date     Time

PAYINOUT         010       19980101 10.00  19980131 10.00  003

PAYINOUT         010                                       006

********************************** BOTTOM OF DATA ****************************
```

Figure 87. EQQAOIDP - Confirm the deletion of OI

Editing JCL operations

You can edit the JCL of an operation if a job name exists, and if you have a tool for editing JCL and have specified its name in the 0.6 OPTION panel. This function applies to fault-tolerant workstations *only* if they use the centralized script.

Restart and cleanup of operations

You can specify the cleanup action to be taken on computer workstations for operations running on z/OS. Also, you can specify if IBM Workload Scheduler for z/OS will use the JCL extracted from the JESJCL sysout. If necessary, you can specify if user sysout support is needed (Figure 88).

```
EQQAMRCL------------ RESTART AND CLEANUP OPERATION DETAILS --------------------
Command ===>
Enter/Change data below:
Application            : PAYDAILY    daily payroll jobs
Operation              : CPU1 020
Job name               : PAYDAILY

Clean Up Type      ===> N    Clean up Type (A/I/M/N)

Expanded JCL       ===> N    Use expanded JCL for Restart (Y/N)

User Sysout        ===> N    Log user sysout too (Y/N)
```

Figure 88. EQQAMRCL - Restart and cleanup of operation details

The cleanup type can be set to one of the following values:

A Automatic. When the operation is ready to be submitted and the controller selects it for submissions, the controller automatically finds the cleanup actions to be taken and also inserts them as the first step in the JCL of the restarted job. Whenever the operation is started from the panels, the cleanup actions are shown to the user for confirmation, only if the CLEANUP CHECK option was set to YES through the DEFINING PARAMETERS AND OPTIONS panel.

I Immediate. data set cleanup is immediately performed if the operation ends in error. The operation is treated as if it had the automatic option when it is rerun.

M Manual. data set cleanup actions are deferred for the operation. They are performed when initiated manually from the panel.

N None. No data set cleanup actions are performed.

These options apply to expanded JCL:

Y Use the fully expanded JCL.

N Use the JCL contained in the libraries of IBM Workload Scheduler for z/OS.

These options apply to user sysout support:

Y Data store logs user sysout.

N Data store does not log user sysout.

For more information, see Chapter 17, "Planning for recovery and restart," on page 343 and Chapter 20, "Restart and cleanup," on page 363.

Specifying extended information

You can specify additional information in the operation description. You can also use the strings to filter queries of operations.

```
EQQAMXDP------------------ OPERATION EXTENDED INFO ---------------------------
Command ===>

Application    : PAYDAILY daily payroll jobs
Operation      : CPU1 020 runs pay04 and pay06
Job name       : PAYDAILY

Enter change data below:

Use extended info: Y      Y or N

Operation Extended Name:

daily payroll data for accounting_____________________________________

Use SE name: Y      Y or N

Scheduling Environment Name:

DB2ACTIVE_____________________________________
```

Figure 89. EQQAMXDP - Operation extended info

Specify Y to have the Extended Name field appear for the operation in the current plan after you generate the daily plan or perform a dynamic addition.

Specify Y to have the Scheduling Environment Name field appear for the operation in the current plan after you generate the daily plan or perform a dynamic addition.

After it is added to the plan, the Scheduling Environment name is used at job submission time to check if the job can be submitted and if so, to appropriately tailor the JCL (by adding the JOB keyword SCHENV=SE name).

For more information, see Chapter 26, "Job scheduling and WLM," on page 533.

Specifying system automation information

For operations running on Automation workstations, you must specify at least the command text to be run by System Automation for z/OS. All the other system automation information is optional.

```
EQQAMAIP------------ MODIFYING AUTOMATION INFO IN THE APPLICATION --------------

Application            : SAAPPLICATION    SA INTEGRATION APPL
Input Arrival          :
Operation              : SAWS 001
Jobname                :

Enter/change data below:

Command Text:
 ____________________________________________________________________
 ____________________________________________________________________
 ____________________________________________________________________
 ____________________________________________________________________

Automated Function:                  Security Element:
 __________                           __________

Completion Info:
 ____________________________________________________________________




Command ===>
```

Figure 90. EQQAMAIP - Modifying automation info in the application

Command Text

Text of the command to be routed to System Automation. It is free format and you can specify IBM Workload Scheduler for z/OS variables, which are replaced before the command is passed to System Automation for z/OS. If an error occurs during this phase, the operation is set to E with code OJCV. No syntax checking on text content is performed on the IBM Workload Scheduler for z/OS side. You can specify a System Automation command, NetView command, or z/OS system command (it must be issued within a NetView PIPE command), or any user-defined command (such as, for example, CLIST or REXX exec).

Completion Info

Completion information. You can optionally specify the following information, in the following order, separated by a comma:

- Maximum wait time, in NetView notation (for example, hh:mm:ss). If specified, System Automation for z/OS waits for the completion of the command for the specified time interval. If the command does not complete, System Automation for z/OS posts the operation in error. For INGREQ and INGMOVE commands the following rules apply:
  - The command is considered complete when the specified resource has reached or is already in the requested state.
  - If more than one resource is specified in the INGREQ or INGMOVE command, all resources must be in the requested state before the command is considered complete.
- Maximum return code accepted as successful execution.
- Name of an optional user-supplied completion checking routine. The completion checking routine ensures that the command achieved the expected results, before posting the operation as complete.

Automated Function
Automated function (for operation). This parameter is optional. If specified, the command is run on the NetView task associated with this automated function in System Automation for z/OS. You can use this parameter to serialize commands. If this parameter is not specified, the command is run by any of the local NetView tasks available.

Security Element
Security element. It is an optional parameter used for security tracking of the operation. You can use it in alternative to or in conjunction with the job name, for security validation of the operation on the System Automation side.

For additional details about how to set and use these parameters, see *IBM Workload Scheduler Automation Reference and Operator's Guide*.

Creating user fields to specify additional information

You can create your own fields to specify additional information that you find useful to store about the operation. This information is stored in the Application Definition and Current Plan. It is not processed by IBM Workload Scheduler for z/OS and does not affect the operation execution, however it is read by the following user exits:

- EQQUX001
- EQQUX002
- EQQUX007
- EQQJVXIT

```
EQQAMUFL ------------------- OPERATION USER FIELDS ----------- Row 1 to 2 of 2
Command ===>                                                  Scroll ===> CSR

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete

Application     : EJBDIR                     EJBDIR su SSL ws
Operation       : SSL  001
Jobname         : EJBDIR

Row  User Field Name  User Field Value
cmd                   ----+----1----+----2----+----3----+----4----+----5----
'''  Path             /TWS/local/zcentric
'''  Workstation name Lab1328
'''  System level     Windows 200 server and up
'''  User permission  System Administrator
```

Figure 91. EQQAMUFL - User fields

For each user field you want to create, specify both a user field name (up to 16 characters) and a user field value (up to 54 characters). For each operation, you can specify up to a maximum of 120 user fields. You cannot use the same user field name twice in the same operation.

The user fields that you create are not checked by any process, and are kept exactly as you type them. You cannot set the user field name to blank.

Specifying remote job information in shadow jobs

The operations that you run on a remote engine workstation are named shadow jobs. A shadow job is used to identify the job, in the remote engine plan, to which

the processing must point. To identify the remote engine job, you must specify the appropriate information in the panel that opens according to the type of remote engine:

z/OS remote engine
The z/OS REMOTE JOB INFO panel opens. To identify the remote job, specify the application ID and operation number.

Distributed remote engine
The DISTRIBUTED REMOTE JOB INFO panel opens. To identify the remote job, specify the job stream workstation, job stream name, and job name.

In the `COMPLETE IF BIND FAILS` field, specify how to set the shadow job status if the matching with the remote job instance in the remote engine plan fails. The allowed values are:

Y The operation status is set to Complete and the successor starts.

N The successor is not started until you delete the dependency manually or complete the operation manually. This is the default.

Specifying dependencies

You can specify that operations and applications are dependent on other operations and applications as follows:

- An operation depends on another operation.
- An operation depends on an application.
- An application depends on another application.
- An application depends on an operation of another application.

For example, you can define that operation Oper1 in application Appl1 must complete before application Appl2 can start; in this case, operation Oper1 is a *predecessor* of application Appl2. Appl2 is a *successor* of Oper1. An application or operation can have many predecessors and successors.

From the CREATING AN APPLICATION (EQQACGPP) panel (fast path 1.4.2 from the main menu), you can:

- Define dependencies at application level by issuing the DEP command. The APPLICATION PREDECESSORS (EQQAMDPL) panel is displayed:

```
EQQAMDPL -------------------APPLICATION PREDECESSORS ---------------  ROW 1 TO 3 OF 3
Command ===>                                                            Scroll ===> PAGE

Predecessors can be operations or applications (op.no. can be in the
range 1-255 or blank). To search for application predecessors, set the
PreTyp column to A, othwerwise set it to O. Allowed row commands
are: I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Description of external dependency, T - Dependency resolution criteria

Application      : PAYM2

Row  Pre Dependency   Application id          Jobname         Operation
cmd  Typ Resl Mand                                           ws   no.
''   O   C    N       APPLDEP1               JOBAR           CPU1 003
''   A   C    N       CPU1 020               ______
****************************** BOTTOM OF DATA ***************************
```

Figure 92. EQQAMDPL - Application Predecessors

In the Pre Typ field:

1. Type A to set an application as predecessor, then specify the application ID.
2. Type O to set an operation as predecessor, then specify the application ID, Job name, and Operation ws and no.

- Define Dependencies at operation level by:
  1. Issuing the OPER command to select an operation.
  2. From the OPERATION DETAILS panel issue 1 (Predecessors) to show the PREDECESSORS (EQQAMPDL) panel:

```
EQQAMPDL ----------------------- PREDECESSORS ---------------  ROW 1 TO 3 OF 3
Command ===>                                                 Scroll ===> PAGE

Enter the COND command to view the list of conditions, enter/change
data in the rows, and/or enter any of the following row commands:

I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Description of external dependency, T - Dependency resolution criteria

Application      : PAYM2                        MONTHLY PAYROLL TRANSFER
Operation        : CPU1 040    PAYTRANS
No. of conditions: 0
Row  Pre Dependency   Oper         Transport time   Application id          Jobname
cmd  Typ Resl Mand    ws   no.       HH.MM          (for ext pred only)
''   O   C    N       SETP 010       _____          ________________        PAYTRANS
''   A   A    N       CPU1 040       _____          PAYM1___________        PAYMONTH
''   _   _    _       CPU1 020       _____          PAYW____________        PAYWEEK_
****************************** BOTTOM OF DATA ************************
```

Figure 93. EQQAMPDL - Predecessors

3. In the Pre Typ field
   a. Type A to set an application as predecessor, then specify the application ID.
   b. Type O to set an operation as predecessor, then specify the application ID, Job name, and Operation ws and no.

Only when an operation depends on another operation, you can define dependencies based on the status or return code of other jobs or on the return code of other jobs' steps. These dependencies are named *conditional dependencies*. For detailed information, see Chapter 22, “Conditioning the processing of operations,” on page 421.

You can create dependencies between occurrences with the LONG TERM PLAN panel, but these occurrences are converted to operation dependencies when the occurrences become part of the current plan.

A job setup operation must be an immediate predecessor of the related computer workstation operation. This means that there is a direct dependency between the two operations; it does not mean that the operation number of the job operation is next in sequence to the operation of the setup operation. This dependency is automatically generated when you create job descriptions using the JOB DESCRIPTION panel, but you must specify it yourself when creating a standard application description.

Operations 040 and 050 are in the same occurrence of the PAYM1 application, the dependency is called *internal*. Operation 040 depends on an operation in the PAYDAILY application, the dependency is called *external*.

You can have an external dependency even between two operations in the same application description. For instance, suppose you have an application SYSLOG,

which runs every day and consists of two operations, X and Y. You can make X dependent on Y of the SYSLOG occurrence of the previous day. That is, a SYSLOG occurrence will not start until the previous SYSLOG occurrence has completed.

Enter the PRED command to enter up to eight internal predecessors for an operation on the OPERATIONS panel, shown in Figure 94.

```
EQQAMOSL ------------------------ OPERATIONS ----------------  ROW 1 TO 3 OF 3
Command ===>                                                  Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Select operation details, J - Edit JCL
Enter the TEXT command above to include operation text in this list, or,
enter the GRAPH command to view the list graphically.

Application            : PAYM1            MONTHLY PAYROLL JOBS

Row  Oper     Duration  Job name  Internal predecessors           More preds  No. of
cmd  ws   no. HH.MM.SS                                             -Int-Ext- Conds
''   CPU1 040 00.05.00  PAYMONTH  ___ ___ ___ ___ ___ ___ ___ ___   0   1    0
''   CPU1 050 00.05.00  PAYMSLIP  040 ___ ___ ___ ___ ___ ___ ___   0   0    0
''   PRT1 250 00.30.00  PAYMSLIP  050 ___ ___ ___ ___ ___ ___ ___   0   0    0
******************************* BOTTOM OF DATA ***********************************
```

Figure 94. EQQAMOSL - Operations

You can specify external predecessors, additional internal predecessors, or conditional predecessors by selecting an operation using the S row command. For details, see "Specifying predecessors to condition the processing of operations" on page 153.

If predecessors are added (or other changes are made) to an application in the AD database, this does not take effect in the current plan until both the long-term plan and the current plan batch programs have run, or until they are manually added using the panels.

The following rules apply:

- When an operation runs on a fault-tolerant agent and it does not use a centralized script, the operation cannot have a predecessor of job setup and a print successor. In this situation, the fault-tolerant agent jobs are not in the z/OS environment. For the same reason, you cannot edit the JCL.
- When an operation runs on a fault-tolerant agent or a remote engine workstation, the operation cannot have an application as a predecessor.
- You cannot create redundant dependencies. For example, if operation Oper1 of application Appl1 has a dependency from operation Oper2 of application Appl2, you cannot create a dependency between application Appl1 and application Appl2.

External dependencies between multiple occurrences

If you specified an external dependency, IBM Workload Scheduler for z/OS must decide which occurrences of the applications should be linked by the dependency relationship. This is not always obvious, because there might be several occurrences of each application in the LTP and current plan. The relationship is set up (in other words, the dependency is resolved) by IBM Workload Scheduler for z/OS during the LTP planning process.

To resolve an external dependency, IBM Workload Scheduler for z/OS uses the input arrival times of the occurrences or, if they have been specified, the input arrival times of the individual operations. For an explanation of input arrival times, see “Specifying the input arrival time” on page 142 and “Specifying input arrival times, deadlines, and durations for operations” on page 168. The criterion followed to pick the predecessor input arrival time which resolves the dependency is defined in the DEPENDENCY RESOLUTION CRITERIA panel described in the next section.

Note: When the LTP selects the predecessor occurrence to resolve a dependency, the input arrival time of the occurrence is always used. Input arrival time specified at operation level is not considered when identifying the predecessor.

IBM Workload Scheduler for z/OS resolves external dependencies during the LTP planning process. If you manually change the input arrival time of an occurrence, or an individual operation, in the LTP or current plan (for example, using the panels), this change does not affect dependencies that have already been resolved. To change the dependency relationships for occurrences that are already scheduled, you must explicitly modify them.

Specifying dependency resolution criteria

To specify under which criteria the predecessor dependency is to be resolved, in the PREDECESSORS panel (see Figure 93 on page 176) or APPLICATION PREDECESSORS panel (see Figure 92 on page 175) enter the T command on the row of the selected external predecessor job (for example, PAYWEEK) as shown hereafter.

```
EQQAMPDL ----------------------- PREDECESSORS ---------------  ROW 1 TO 3 OF 3
Command ===>                                                  Scroll ===> PAGE

Enter the COND command to view the list of conditions, enter/change
data in the rows, and/or enter any of the following row commands:

I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Description of external dependency, T - Dependency resolution criteria

Application      : PAYM2                        MONTHLY PAYROLL TRANSFER
Operation        : CPU1 040    PAYTRANS
No. of conditions: 0
Row  Pre Dependency   Oper         Transport time   Application id          Jobname
cmd  Typ Resl Mand    ws   no.       HH.MM          (for ext pred only)
''   O   _    _       SETP 010       _____          ________________        PAYTRANS
''   A   _    _       CPU1 040       _____          PAYM1___________        PAYMONTH
T    _   _    _       CPU1 020       _____          PAYW____________        PAYWEEK_
****************************** BOTTOM OF DATA ************************
```

Figure 95. EQQAMPDL - Predecessors

The DEPENDENCY RESOLUTION CRITERIA panel (Figure 96 on page 179) is displayed:

```
EQQAMMAT---------------- DEPENDENCY RESOLUTION CRITERIA ----------------
Command ===>
Application :          PAYM2
Pred Application : PAYW                       Operation : CPU1  20     PAYWEEK

Resolution is mandatory:                  N  (P/C/N)
Resolution criteria chosen is:            C  (C/S/R/A)

 -(C) Closest preceding

 -(S) Same scheduled date

 -(R) Within a relative interval
  FROM:
  hours (HHH):   ___  minutes (MM):  __   when (B/A before/after IA): _
  TO:
  hours (HHH):   ___  minutes (MM):  __   when (B/A before/after IA): _

 -(A) Within an absolute interval
  FROM:
  time (HH.MM):   _____  for days (D):  _   when (B/A before/after IA): _
  TO:
  time (HH.MM):   _____  for days (D):  _   when (B/A before/after IA): _
```

Figure 96. EQQAMMAT - DEPENDENCY RESOLUTION CRITERIA

The panel displays the name of the predecessor and of the application to which it refers. The resolution criteria is based on the input arrival times. Proceed as follows:

1. The `Resolution is mandatory` field applies *only* to dependencies between one operation and another operation. Specify if it is required that the dependency with the predecessor (the job named PAYWEEK in this example) be resolved according to the resolution criteria specified thereafter before the operation (the job named PAYTRANS in this example) can be started. Choose among the following values:

   P (plan)

   The dependency is mandatory at plan level. The predecessor is expected to exist at the time the occurrence that includes the successor is dynamically added into the current plan (via the MCP panel). If it does not, the addition of the occurrence fails. Also LTP and DP batch will fail if the predecessor is not found when they run.

   C (control)

   The dependency is mandatory at *ad hoc* add level. The predecessor is required, but may not be in the plan at the time the occurrence that includes the successor is added and may be made available later via ETT, PIF, or manual intervention. This means that if the predecessor is not found when an occurrence is added to the current plan, a `pending mandatory predecessor` entry is created and the occurrence is added in the `waiting` status. The `pending mandatory predecessor` entry is created also when LTP and DP batch start running and the predecessor is not found.

   N (no)

   The dependency is not mandatory. This means that, if the predecessor is not found, the dependency is considered resolved unless failure is required (within the dynamic addition of a dependency in the Modify Current Plan panel). This is the default value.

Attention: If an operation that is used as a mandatory dependency is also suppress-if-late, it might be suppressed before the required mandatory action is taken and this could potentially cause a problem or unexpected results. There is nothing to prevent an operation from being suppress-if-late and a mandatory dependency although it might not make sense to define it in this manner.

2. In the `Resolution criteria chosen` field specify the criteria that are to be followed to find a matching predecessor occurrence with which to resolve the dependency between PAYWEEK and PAYTRANS.

   The resolution criteria are based on the input arrival times of a predecessor and of the successor. These times are usually those of the respective application occurrences, unless the operations were defined with different IA times than those of their applications. To search for a matching predecessor, the scheduler starts from the IA time of the successor and then moves backwards (for the nearest preceding), or forward (for the nearest following) until it finds the IA time of the closest predecessor.

   Choose one of the following values:

   C (Closest preceding)
   The matching predecessor is the one with the nearest preceding input arrival time. This is the default.

   S (Same scheduled date)
   The matching predecessor is the one with the nearest input arrival time within the same day of the operation (occurrence) under consideration. A matching predecessor is first searched before the IA time of the operation. Then, if not found, it is searched after the IA time of the operation.

   R (Within a relative interval)
   The matching predecessor is the one with the closest input arrival time in the interval specified below. The interval boundaries are calculated using an offset expressed in hours and minutes before or after the IA time of the successor operation - PAYTRANS in this example. The interval can be timed entirely before, entirely after, or across the IA time of PAYTRANS.

   Specify the start of the relative interval in the fields under the FROM label:

   a. Enter a number of hours from 0 to 167
   b. Enter a number of minutes from 0 to 59
   c. Enter B or A to specify that the interval starts before or after the IA time of the successor job (PAYTRANS)

   You can set the interval to start at an indefinite time before the IA by leaving the `hours` and `minutes` fields blank and specifying B in the `when` field.

   Specify the end of the relative interval in the fields under the TO label:

   a. Enter a number of hours from 0 to 167
   b. Enter a number of minutes from 0 to 59
   c. Enter B or A to specify that the interval ends before or after the IA time of the successor job (PAYTRANS)

   A (Within an absolute interval)
   The matching predecessor is the one with the closest input arrival time in the interval specified below. The interval boundaries are specified by a time and a number of days before or after the IA time of the

successor operation - PAYTRANS in this example. The interval can be timed entirely before, entirely after, or across the IA time of PAYTRANS. For example, an interval can start at 12.30 of 3 days before the IA of PAYTRANS (or of the PAYM2 occurrence) and end 1 day after the IA at 14.30.

Specify the start of the absolute interval in the fields under the FROM label:

a. Enter a time value from 00.00 to 23.59
b. Enter a number of days from 0 to 7
c. Enter B or A to specify that the interval starts before or after the IA time of the successor job (PAYTRANS)

Specify the end of the absolute interval in the fields under the TO label:

a. Enter a time value from 00.00 to 23.59
b. Enter a number of days from 0 to 7
c. Enter B or A to specify that the interval ends before or after the IA time of the successor job (PAYTRANS)

Associating job statements with operations

The main purpose of IBM Workload Scheduler for z/OS is to start work according to a predefined schedule, the current plan. The current plan is produced from information in the IBM Workload Scheduler for z/OS database and LTP. Before IBM Workload Scheduler for z/OS can submit a job or start a started task, it must have job statements (JCL in the case of the z/OS operating system). IBM Workload Scheduler for z/OS offers some powerful facilities for tailoring JCL (or the equivalent for other operating systems) to fit each run of your operations.

Job statements and computer workstation operations

For jobs on z/OS systems, store job statements for submitted jobs in the partitioned data sets that are allocated to the ddname EQQJBLIB. IBM Workload Scheduler for z/OS associates an operation with a member of one of these libraries, using the JOB NAME field of the OPERATIONS panel, shown in Figure 94 on page 177. That is, the job statements for a job or started task are stored in the member identified by the JOB NAME field. For jobs on distributed agents, EQQSCLIB is used. The members of EQQSCLIB contain a JOBREC statement that describes the job to be executed. The rest of this section addresses the details of jobs on z/OS systems.

IBM Workload Scheduler for z/OS submits the job statements if the operation is a job, or starts it as a procedure if the operation is a started task. So the job name of each job or started task operation must be unique to ensure that the correct job is picked up. Each time an operation is run, its job statements are picked up from EQQJBLIB, and are then stored in the job repository (a cycle of VSAM data sets with the ddname EQQJSnDS). The job statements remain there until the successful completion of the next occurrence of the application, and are then deleted. So the job repository should contain the job statements for the most recent completed run of any application in the current plan. IBM Workload Scheduler for z/OS always uses the job from the repository for reruns; this job is modified by the variable substitution and recovery functions. The original job, in EQQJBLIB, is always used for the first run of operations in an occurrence.

Variable substitution can be automatically invoked at job or started-task submission time, if you require. Alternatively, operators can be prompted for the values of variables before submission. See Chapter 25, "Job tailoring," on page 487 for more details.

Note:

1. IBM Workload Scheduler for z/OS checks the JCL for a valid job card if you specify JOBCHECK(YES) on the JTOPTS initialization statement. This applies only to jobs destined for z/OS. If you specify JOBCHECK(SAME), it also checks that the job name is the same as the operation name.
2. It is not recommended that you have several jobs in the same member. If you do this, put the job that matches the operation (member) name last, or IBM Workload Scheduler for z/OS cannot track the job. You must not specify JOBCHECK(SAME). This applies only to jobs destined for z/OS.
3. Do not use JCL that has been packed by ISPF in EQQJBLIB, because IBM Workload Scheduler for z/OS does not use ISPF routines to read it.
4. Do not include JCL with TYPRUN=SCAN in EQQJBLIB. IBM Workload Scheduler for z/OS does not track these jobs. To test JCL, do this outside IBM Workload Scheduler for z/OS, or add TYPRUN=SCAN using the MCP panel and type the SUBMIT command; then remove TYPRUN=SCAN or cancel the edit. This applies only to jobs destined for z/OS.

If you use IBM Workload Scheduler for z/OS to submit jobs to non-z/OS operating systems, you need not store the JCL equivalent information in the EQQJBLIB. The operation-initiation exit, EQQUX009, which handles submission for operations at workstations that specify a user-defined destination ID, can be used to locate job statements from another file, or you can request the receiving operating environment to locate them. If the job statements are in EQQJBLIB, you can use the job tailoring and automatic recovery functions for these operations.

Note: Started task operations on workstations that specify a user-defined destination ID will be treated in the same manner as normal computer operations on user-defined destinations. That is, all job-statement information is passed to the operation-initiation exit, EQQUX009. You decide how the exit chooses to handle the information.

JCL and job setup operations

When manual tailoring of job statements is necessary, specify a setup operation to precede a job or started task operation. By using a setup operation you can ensure that jobs and started tasks are not submitted until the job statements have been suitably tailored.

A setup operation is an operation that is specified on a general workstation that has the JCL setup attribute. The setup operation is associated with the subsequent submission operation by two factors:

1. The job name of the setup operation is the same as the job name of the submission operation.
2. The setup operation is an immediate predecessor of the submission operation. This does not mean that the setup operation must immediately precede the submission operation in operation number order.

The setup operation should not itself have predecessors, because it is started manually and is therefore under control of the operator.

Using print operations

If the time that a SYSOUT data set is printed or purged is important at your installation, consider using print operations. A print operation must complete before the occurrence that it is part of is considered complete.

A print operation does not require any action by IBM Workload Scheduler for z/OS. IBM Workload Scheduler for z/OS monitors the print and reports on the status, but the handling of print operations is still under the control of the JES subsystem.

A print operation must be a successor of a job or started-task operation and must have the same job name as its predecessor operation. If the job or started task produces more than one SYSOUT data set, you can create a print operation for each unique combination of job and started-task name, form number, and SYSOUT class that is produced to track the print output accurately. See "Options that apply to print operations" on page 164.

Using WTO operations

A WTO operation is created on a general workstation that has the WTO option. This causes message EQQW775I to be sent to the workstation destination and from there the message is issued as a WTO to the system console. Besides the standard message, the user-defined text that you specified on the OPERATIONS panel, using the TEXT command (Figure 72 on page 148), is also issued as part of the WTO.

You can schedule a WTO operation like any other operation: it can have predecessors, specify resources, and be time-dependent. The WTO is issued only if the operation is automatically started by IBM Workload Scheduler for z/OS, so the submit option of a WTO operation must be set to Yes, and job submission must be active. Then, for example, NetView can intercept this operation and take action.

If the workstation is nonreporting, the operation is marked complete but no WTO is issued. The reporting attribute of the workstation affects the way in which the operation is tracked. See "General workstations" on page 50 for details.

Consider using WTO operations to trigger your console automation software. Although most console automation systems include some scheduling capabilities, these are normally limited to AT and EVERY type constructs. Many of the tasks performed by the console automation software must be coordinated with batch processing or online systems, and IBM Workload Scheduler for z/OS can manage this effectively.

Started-task operations

Started-task operations are created and scheduled like job operations, except that they run on workstations that have the *STC* option.

The procedure that will be used to invoke the started task is specified in the JOB NAME field for the operation. The JCL for the started task is stored like the JCL for jobs (see "Job statements and computer workstation operations" on page 181). Instead of the JCL being submitted to the internal reader on the destination system, however, it is temporarily placed in the JES procedure library that is allocated to the EQQSTC ddname in the IBM Workload Scheduler for z/OS procedure, and a START command is issued to invoke it. For details about the required procedure libraries, see *Planning and Installation*.

Scheduling the closedown of online systems and started tasks

About this task

IBM Workload Scheduler for z/OS can initiate and track a job or started task but cannot directly stop it. The recommended method for scheduling the stop of a z/OS job or started task is to:

1. Specify the time that you want the task to be stopped as the DEADLINE TIME for the operation. You specify this under Time Specifications, which you can select from Operation Details (see "Specifying input arrival times, deadlines, and durations for operations" on page 168).
2. Enter text identifying the started-task in the OPERATION TEXT field for the operation. The text could be the command required to stop the task.
3. Specify a DEADLINE WTO for the operation. You specify this on the JOB, WTO, AND PRINT OPTIONS panel (see "Options that apply to all operations" on page 165).

   After the operation is started, it will reach its deadline for completion, and IBM Workload Scheduler for z/OS issues message EQQW776I as a WTO (if the workstation is a z/OS system). In this way, the system operator is automatically informed that the started task should be ended. The message can be intercepted by NetView, which can then automatically stop the task.
4. Add code in NetView to intercept the EQQW766I message and stop the job or started task. Refer to the member EQQNETW1 sample library for an example in the REXX language.

When the started task has terminated normally, IBM Workload Scheduler for z/OS sets the operation to complete.

Creating time-dependent operations

The input arrival time of an operation is usually not the time that IBM Workload Scheduler for z/OS will start an operation. IBM Workload Scheduler for z/OS seeks to maximize the throughput of work in your system by starting as many operations as quickly as possible on any one day. Some operations cannot be started because the resources they require are not available, they have a predecessor that has not completed, or the workstation they run on is closed. If an operation can run (that is, if all its predecessors are complete and resources are available), IBM Workload Scheduler for z/OS will usually start the operation regardless of its input arrival time or the time of day.

For example, when you run jobs on distributed agents, the SUPPRESSPOLICY keyword also affects the actual start time. If you specify the suppress if late option, the value of the SUPPRESSPOLICY keyword also impacts the start of late operations. For more information about the SUPPRESSPOLICY keyword in the JTOPTS statement, see *Customization and Tuning*.

For most operations, this is exactly what you want. However, you often need to run jobs or started tasks at a particular time of day or at regular intervals throughout the day. To do this, make the job operation time-dependent on the MVS™ JOB OPTIONS panel (Figure 82 on page 161). The following steps describe what happens when IBM Workload Scheduler for z/OS starts a time-dependent operation, and what happens if it is late:

1. Is the operation time-dependent?
   a. Yes: continue with step 2.

b. No: IBM Workload Scheduler for z/OS starts the operation as soon as it is added to the current plan or as soon as its dependencies are met.

2. Is it the input arrival time?
   a. Yes: continue with step 3.
   b. No: wait for the input arrival time. Continue at step 2.
3. Is the operation ready?
   a. Yes: continue with step 4.
   b. No: wait until the operation is ready. Continue at step 3.
4. Does the operation have the suppress-if-late attribute (see "Options that apply to all operations" on page 165)?
   a. Yes: continue with step 5.
   b. No: IBM Workload Scheduler for z/OS starts the operation.
5. Does the SUPPRESSPOLICY allow more time for this operation?
   a. Yes: IBM Workload Scheduler for z/OS starts the operation.
   b. No: give the operation a status according to the SUPPRESSACTION option (C, E, or RL).

An operation with the status RL can be started only after manual intervention. For details of the SUPPRESSPOLICY and SUPPRESSACTION keywords of the JTOPTS statement, see *Customization and Tuning*.

Creating job descriptions

This section describes the JOB DESCRIPTION panel, which lets you create job, started-task, and WTO operations using a faster path than the one available with the APPLICATION DESCRIPTION panel.

A job description is an application consisting of a job, started task, or WTO *main operation* that can have an internal predecessor job preparation or a manual preparation operation, or both, but no other operations. Applications with more operations are standard applications, which are described in "Standard applications and group definitions" on page 127. The Job Description dialog automatically specifies the internal dependencies between its operations; there is no need to specify them as you would if you were creating a standard application using the APPLICATION DESCRIPTION panel.

You can change a job description with the APPLICATION DESCRIPTION panel, but if you add operations so that it is no longer eligible for the Job Description dialog, it becomes a standard application. On the other hand, if you remove operations from a standard application until it meets the criteria for a job description (and it has operations with the standard numbers 005, 010, and 015), you can change it using the Job Description dialog.

Using the Job Description panel

About this task

The information that you must provide to create a job description is described more fully in "Standard applications and group definitions" on page 127, and you should read that chapter if you have never created applications. The JOB DESCRIPTION dialog compresses the fields onto one panel, and makes some assumptions about the application that you creating.

Follow these steps to create a job description:

1. Enter the JOB DESCRIPTION dialog by selecting option 8 (JD) from the MAINTAINING IWSz DATA BASES panel, or by entering 1.8 from the main menu. You see the MAINTAINING JOB DESCRIPTIONS panel:

```
EQQJSUBP ------------ MAINTAINING JOB DESCRIPTIONS ---------------------
Option ===>

Select one of the following:

1 BROWSE          - Browse jobs
2 CREATE          - Create a job
3 LIST            - List jobs for further processing
                    (browse, modify, copy, delete, print,
                    calculate and print rundays, modify LTP)
4 PRINT           - Perform printing of jobs
5 MASS UPDATE     - Perform mass updating of jobs
```

Figure 97. EQQJSUBP - Maintaining job descriptions

2. Select option 2 (CREATE) from the MAINTAINING JOB DESCRIPTIONS panel. You see the CREATING A JOB panel with the settings from the previous job description that you worked with:

```
EQQJCGPP ---------------------- CREATING A JOB --------------------------
Command ===>

Edit data below:
Enter the RUN command above to select run cycles or enter the DETAILS
command to specify job details.

JOBNAME - TEXT     ===> payrecov         - _____________________________
OWNER: ID - TEXT   ===> SAMPLE__________ - payroll application_____
CALENDAR ID        ===> _________________    AUTHORITY GROUP ID  ===> ____
VALID FROM - TO    ===> 97/01/30 - 71/12/31 DURATION            ===> 0005.00
RUN TIME FROM - TO ===> _____ - _____       TIME DEPENDENT      ===> N
WORK STATION       ===> CPU1                PRIORITY            ===> 5
JCL PREPARATION    ===> Y JCL WS ===> SETP  HIGHEST RETURN CODE ===> 0000
MANUAL INTERACTION ===> ______________________________  MANUAL WS ===> ____
RUN CYCLES         ===> ________ - ____   ________ - ____   ________ - __
                        ________ - ____   ________ - ____   ________ - __
PREDECESSORS       ===> ________ ________  ________  ________  ________
SPECIAL         ===> PAYROLL.DATABASE_____________________________ 000001 X Y
RESOURCES              ____________________________________________ ______ _ _ _
                       ____________________________________________ ______ _ _ _
GROUP DEFINITION ===> _________________
SMOOTHING FACTOR ===> __0     LIMIT ===> 100  Deadline Feedback options
```

Figure 98. EQQJCGPP - Creating a job

3. On the CREATING A JOB panel, specify the characteristics of your main operation and up to two predecessor operations:

   JOBNAME – TEXT

   The name of the main operation. This is also the name of the job description, and this operation is assigned number 015. You can add operator text.

   You cannot use the JOB DESCRIPTION panel if the APPLID keyword of the DBCSOPTS initialization statement specifies DBCS input, because the job name cannot be entered in DBCS bracketed format: use the APPLICATION DESCRIPTION panel instead if you need a double-byte character set application ID.

OWNER: ID – TEXT
The owner ID and a description.

CALENDAR ID
If you leave this blank, IBM Workload Scheduler for z/OS uses the calendar in the CALENDAR keyword of the BATCHOPT initialization statement, for batch services such as extending the long-term plan, or the calendar specified under the OPTIONS panel (0.2 from the main menu), for online services such as testing a rule with GENDAYS. If no calendar is specified, or the specified calendar does not exist, a calendar with the name DEFAULT will be used. If the DEFAULT calendar does not exist, all days are considered work days. You might have several calendars, but always call your default calendar DEFAULT, and specify the same calendar name on BATCHOPT and in the panel.

AUTHORITY GROUP ID
This field can be used for security grouping and for reporting.

VALID FROM – TO
The date range that this job description is valid.

DURATION
The estimated duration of the main operation.

RUN TIME FROM – TO
The input arrival time of the main operation (the FROM time) and the deadline time of the main operation (the TO time). If the TO time is less than the FROM time, the TO time is considered to be for the day following the run day of the operation.

Note: IBM Workload Scheduler for z/OS attempts to start an operation at the FROM time only if you specify that the operation should be time-dependent.

TIME DEPENDENT
See "Creating time-dependent operations" on page 184 for details of time-dependent operations.

WORK STATION
The workstation of the main operation.

PRIORITY
The priority of the main operation, from 1 (lowest) to 9 (urgent).

JCL PREPARATION and JCL WS
Specifies whether a JCL preparation operation will precede the main operation and specifies its workstation. If you complete this field, a JCL preparation operation is created and is assigned operation number 005. This option applies for main operations on fault-tolerant workstations *only* if they use the centralized script.

HIGHEST RETURN CODE
The highest acceptable return code from any step in the main operation. If a return code for a step in the job or started task exceeds this value, the operation is set to E (ended-in-error) status, unless there is a match against a statement in the NOERROR initialization statement. If you must specify an acceptable nonzero return code for a particular step, or steps, use the NOERROR statement.

See "Using error codes to set operations to ended-in-error" on page 361 for more details.

MANUAL INTERACTION and MANUAL WS
The text for a manual operation that precedes this computer operation, and its workstation. If you complete these fields, a manual operation is created and is assigned operation number 010.

RUN CYCLES
Specifies up to six offset-based run cycles. See "Creating run cycles for job descriptions" on page 189 for more information.

PREDECESSORS
Names of other job descriptions that are made *external* predecessors of the main operation. You can specify a generic name in this field: if there is more than one job description with this job name, you get a list from which to choose the predecessor you need. If the plus sign (+) is displayed to the right of the list, one of these is true:

- Some of the predecessors are standard application descriptions.
- There are more than five job-description predecessors.
- The external dependency is not to the main operation of a job description.

The external dependency that is set up between the job descriptions is between their main operations. See "Specifying dependencies" on page 175 for details of the predecessor relationship between operations.

Enter the DETAILS command if you need to specify other predecessors.

SPECIAL RESOURCES
Specifies up to three resource names, with a quantity from 1 to 999 999 or blank (blank means allocate the whole quantity available), allocation type S (shared) or X (exclusive), keep-on-error N (free), Y (keep), or blank (default), and on complete N (no), Y (yes), or blank (use system default).

If you specify more than three special resources for a job description, the plus sign (+) is shown to the right of the last resource:

```
PREDECESSORS       ===> ________  ________  ________  ________  ________
SPECIAL         ===> PAYROLL.DATABASE_____________________________ 000001 X Y N
RESOURCES            LINES.TO.LONDON___________________________ 000025 X N N
                     TAPES_____________________________________ 000002 X Y Y +
GROUP DEFINITION  ===> ________________
```

Figure 99. Specifying special resources for a job description

GROUP DEFINITION
The group name, if this job description is to be part of a group.

SMOOTHING FACTOR
A value, from 0 to 999, that determines how much a measured deadline will change existing values in the application description database, both at run cycle and at operation level. For more details about deadline feedback options, see "Using deadline feedback options" on page 130.

LIMIT
The limit for deadline feedback. You can specify a value from 100 to 999 that establishes the limits within which measured values are regarded as normal and acceptable. A measured value outside the limits is ignored. For more details about deadline feedback options, see "Using deadline feedback options" on page 130.

See “Standard applications and group definitions” on page 127 for further information on these fields.

Creating run cycles for job descriptions

You can specify up to six run cycles on the CREATING A JOB panel:

```
RUN CYCLES        ===> MON_____ - _001   TUE_____ - _001   WED_____ - _001
                       THU_____ - _001   FRI_____ - _001   SAT_____ - _001  +
```

Figure 100. Specifying run cycles for a job description

If you are not familiar with run cycles, see “Specifying when your application should be scheduled” on page 131. You can specify up to six periods and offsets, as shown in Figure 100, if these run cycles have:

- The same in-effect dates as the job description
- The same input arrival times and deadline times as the job description (as specified in the RUN TIME FROM – TO field)
- No more than one offset specified
- Free-day rule E (exclude free days)

The use of run cycle groups is not supported in job descriptions.

If you want to create more than six run cycles, rule-based run cycles, or run cycles without these restrictions, enter the RUN command. The RUN CYCLES panel (Figure 62 on page 133) is displayed, where you can specify run cycles in the standard way.

If you specify run cycles with the RUN command, a plus sign (+) is displayed when you return to the CREATING A JOB panel, as shown in Figure 100.

Specifying additional operation details for job descriptions

If you enter the DETAILS command in the JOB DESCRIPTION panel, the OPERATION DETAILS panel is displayed. From this menu, you can specify the operation details as you would for a standard application. The difference is that you can specify operation details only for the processor operation. See “Specifying operation details” on page 152 for more information.

```
EQQAMSDP ---------------------- OPERATION DETAILS ------------------------
Option ===>

Select one of the following:

1  PREDECESSORS        - List of predecessors
2  WS RES AND SERVERS  - Work station resources and servers
3  SPECIAL RESOURCES   - List of special resources
4  AUTOMATIC OPTIONS   - Job, WTO, and print options
5  FEEDBACK            - Feedback options
6  TIME                - Time specifications
7  OP INSTRUCTIONS     - Operator instructions
8  JCL BROWSE          - JCL browse
9  CLEANUP OPTIONS     - Cleanup Options
10 EXTENDED INFO       - Operation extended info
11 AUTOMATION INFO     - System Automation operation info
12 USER FIELDS         - User Fields operation info
13 REMOTE JOB INFO     - Remote job information

Application            : PAYM2            MONTHLY PAYROLL TRANSFER
Operation              : CPU1 040
Jobname                :                  Number of int preds    : 0
Duration               : 00.01.00         Number of ext preds    : 0
                                          Number of conditions   : 2
```

Figure 101. EQQAMSDP - Operation details

How job descriptions affect the current and long-term plans

Each job description produces several operation occurrences in the LTP and current plan. If you have several job descriptions, especially if they are linked using external dependencies, your LTP and current plan can become too big and can take a lot of computer time to produce. If this occurs, consider combining related job descriptions into one standard application using internal dependencies. This can also simplify your schedules.

Deploying applications to another environment

About this task

Applications can be exported and imported so that they can be shared with other IBM Workload Scheduler for z/OS environments. In the new environment, the application can be subsequently updated, replaced, or deleted.

To deploy an application from one environment to another, you can use either the ISPF panels or the Dynamic Workload Console V9.4, Fix Pack 1. For details about how to export the job stream definition in the Workload Designer, see the Dynamic Workload Console User's Guide V9.4.

To export and import an application:

1. From the main menu, enter fast path 1.4 to display the MAINTAINING APPLICATION DESCRIPTIONS panel, as shown in Figure 60 on page 128. Select option 6 (EXPORT - IMPORT) to display the EXPORTING AND IMPORTING panel (EQQDEVOD).

   Note: You can display the EXPORTING AND IMPORTING panel also from the LIST OF APPLICATIONS panel (EQQALSTL) by issuing the X row command.

```
----------------- EXPORTING AND IMPORTING APPLICATIONS --------------------
Command ===>

Select one of the following:

1 EXPORT              - Export Application Definitions
2 IMPORT              - Import Application Definitions
```

Figure 102. EQQDEVOD - Exporting and Importing Applications

2. Select option 1 (Export application definitions) to display the EXPORT APPLICATION DEFINITIONS panel (EQQDEVOP), where you specify the name of the application you want to export, and optionally:

   Type The type of application, either **A** for Application, or **G** for Group definition.

   Subsystem
   The name of the controller subsystem where the application resides.

   A JCL is automatically generated for you to submit EQQYXJPX procedure that exports the application definition into a data set. This data set contains all the Workload Automation Programming Language statements that describe the application and its related objects (such as calendars, workstations, special resources), as shown in Figure 103.

```
***************************  Top of Data ********************************
ADSTART ADID(MYAPPLTVT5012) STATUS(A) TYPE(A) ADVALFROM(170511)
 OWNER(DEVOPS)PRIORITY(5)
 CALENDAR(CAL1)GROUPDEF()DSMOOTHING()DLIMFDBK()
ADOP WSID(CPU1)OPNO(001)JOBN(JOBB) DESCR() DURATION(1)
 LIMFDBK() HIGHRC() STARTDAY(0) STARTTIME() DLDAY(0)
 DLTIME()  R1NUM(0) R2NUM(0) PSNUM(1) JOBCLASS() PRTCLASS() FORM() AJSUB(Y)
 AJR(Y) CLATE(N) TIME(N) AEC(Y) WTO(N) RESTARTABLE() REROUTABLE()
 CLEANUP(N) CRITICAL(N) POLICY() USRSYS(N) EXPJCL(N)
 MONITOR(N) CSCRIPT(N) USEXTNAME(N) USEXTSE(N) USESAI(N)
 WLMCLASS() CONDRJOB(N) NOP(N) MH(N)
WSSTART WSNAME(CPUA) TYPE(C) REPATTR(A) JOBSETUP(N) TRANSPORT(0)
 DURATION(0) PRINTOUT(SYSPRINT) DESCR() USAGE(B)
 SPLITABLE(N) R1NAME(R1) R1PLAN(Y) R1CONT(N) R2NAME(R2) R2PLAN(Y)
 R2CONT(N) DEST(TCR1) STC(N) WTO(N) AUTO(N) FTWS(N) WAIT(N)
 VIRTUAL(N) ZCENTRIC(N)REMTYPE()
WSWD DAY(STANDARD) DESCR()
WSIVL START(0000) END(2400) PS(99) R1(99) R2(99) ALTWS()
```

Figure 103. Example of a data set containing the Workload Automation Programming Language statements

3. In the environment where you want to deploy the application, from the EXPORTING AND IMPORTING panel (EQQDEVOD) select option 2 (Import application definitions) to display the IMPORT APPLICATION DEFINITIONS panel (EQQDEVIP).

   Note: In alternative to the import process, you can automate the deployment of the application by using the Workload Automation plug-in of the IBM UrbanCode Deploy tool. For details about this plug-in, see the IBM UrbanCode Deploy documentation.

```
-------------------- IMPORTING APPLICATION DEFINITIONS --------------------
Command ===>

Enter data below:

TRANSLATE DATASET ===> TWSR.TRANS.TERI.(MEM1)_____________________________
```

Figure 104. EQQDEVIP - Importing Application Definitions

Optionally, you can specify the name of a partitioned data set where to define the translation rules to follow. A sample data set is created for you to edit, as shown in the following example:

```
*************************** Top of Data ********************************
TRANSLATE WS OLD(CPU1) NEW(CPUA)
TRANSLATE AD OLD(MYAPPLTVT5012) NEW(MYAPPLTVT1722)
TRANSLATE SR OLD(RESNO) NEW(RESNO22)
TRANSLATE CL OLD(CAL1) NEW(CAL22)
TRANSLATE OW OLD(DEVOPS) NEW(DEVOPSA)
TRANSLATE JS OLD(JOBB) NEW(JOBA)
TRANSLATE PR OLD(PERIOD1) NEW(PERIODA)
```

Figure 105. Example of a translation data set

A JCL is automatically generated for you to submit the Workload Automation Programming Language command that deploys the application. The imported application will be finally listed in the LIST OF APPLICATIONS panel, according to the settings specified in the translation data set.

Listing applications

This section describes how to create a list of all the applications in the Application Description database both by using the basic panels (default) and by using the advanced panels (see Panels Style).

Creating a list of applications

About this task

If you are using either the basic panels (default) or the advanced panels, to create a list of applications, enter fast path 1.4 from the main menu. The MAINTAINING APPLICATION DESCRIPTIONS panel opens, as shown in Figure 60 on page 128. Select option 3 (LIST) to display the SPECIFYING APPLICATION LIST CRITERIA panel. Leave all the criteria fields blank to see the entire list of applications in the database, or enter criteria to create a more specific list.

The criteria are listed in the panel as shown:

```
----------------- SPECIFYING APPLICATION LIST CRITERIA --------------------
Command ===>                                                Scroll ===> PAGE

Specify selection criteria below and press ENTER to create an application list.

APPLICATION ID     ===> _____________________
TYPE               ===> _              A = Application, G = Group AD  (blank=both)
JOBNAME            ===> _________
OWNER ID           ===> _____________________
STATUS             ===> _              A = active, P = pending  (blank=both)
LOW PRIORITY       ===> _              Low priority limit (1-9)
AUTHORITY GROUP ID ===> _________
Valid any time in period below:
 FROM DATE         ===> _________      Date in the format YY/MM/DD
                                       (blank = no starting limit or period)
 TO DATE           ===> _________      Date in the format YY/MM/DD
                                       (blank = no ending limit or period)
CALENDAR ID        ===> _____________________
RG/PERIOD          ===> _________
WORK STATION       ===> _____
AUTOMATION         ===> _              Y = Yes, N= No  (blank=all)
GROUP DEFINITION   ===> _____________________
OP. EXTENDED NAME  ===> ____________________________________________________________
OP. SE NAME        ===>_____________________
```

Figure 106. Specifying Application List Criteria panel

After you press ENTER, the LIST OF APPLICATIONS panel opens, as shown in Figure 107.

```
EQQALSTL ----------------- LIST OF APPLICATIONS ------------- ROW 1 to 10 of 2
Command ===>                                                Scroll ===> PAGE

Enter the CREATE command above to create a new application, or,
enter the GRAPH command above to view the list graphically, or,
enter any of the row commands below:
B - Browse, M - Modify, C - Copy, D - Delete,
P - Print, A - Calculate and print run days,
L - Modify LTP (external dependencies are not resolved)
X - devOps (Export and Import application)

Row  Application                              Valid       T S
cmd  ID                   text               From Date
.    PAYDAILY                                11/06/25    A A
.    PAYRUN                                  11/06/28    A A
.    PAYSUMMARY                              11/06/30    A A
.    PAYQUARTER                              11/06/30    A A
.    PAYYEAR                                 11/12/31    A A


 *************************** BOTTOM OF DATA ************************
```

Figure 107. EQQALSTL - List of Applications (default panel style)

The advanced LIST OF APPLICATIONS panel (EQQNALSL) provides more extensive information than the basic panel style. To distinguish between applications and groups of applications, you can set a different color for the letter in the column T (type). You can customize the type color in the ISPF options (see "Setting options" on page 32). In the first panel, you see the basic information (see Figure 108 on page 194). By scrolling to the right, using F11, you can see additional data such as priority, run cycle, and number of operations, as shown in Figure 109 on page 194, Figure 110 on page 194, and Figure 111 on page 194. Use F10 to scroll back to the left.

```
  Action  View  Help

EQQNALSL                    LIST OF APPLICATIONS
Command  ===> _____________________________________________Scroll ===> PAGE

    View: Compact (EQQNALST)    Row 1 of 55                            >>
Row    Application            Text           Valid       Valid     T  S
cmd    ID                                    From Date   To Date
_____  PAYDAILY      Daily run of pay calcs   15/07/11    14/07/12  A  A
__/__  PAYSUMMARY    Summay pay calculations  15/07/11    14/07/12  A  A
_____  PAYFORECAST   Forecast pay calcs       15/07/11    14/07/12  A  A
_____  PYWEEKLY      Weekly run of pay calcs  15/07/11    14/07/12  A  A
```

Figure 108. EQQNALSL - List of Applications panel (part 1)

```
  Action  View  Help

EQQNALSL                    LIST OF APPLICATIONS
Command  ===> _____________________________________________Scroll ===> PAGE

    View: Compact (EQQNALST)    Row 1 of 55                        >>
Row    Application    Owner                    Prio   Run    Opers
cmd    ID             ID                              Cycle
_____  PAYDAILY       PGMR                       5      1      3
__/__  PAYDAILY       PGMR                       4      1      3
_____  PAYDAILY       T8RR                       5      1      1
_____  PYWEEKLY       TMGR                       2      1      2
```

Figure 109. EQQNALSL - List of Applications panel (part 2)

```
  Action  View  Help

EQQNALSL                    LIST OF APPLICATIONS
Command  ===> _____________________________________________Scroll ===> PAGE

<<    View: Compact (EQQNALST)    Row 1 of 55                      >>
Row    Application   Last Update                    AuthGid  Calendar
cmd    ID            Date      Time  User                     ID
_____  PAYDAILY      11/10/11  09.49 PAYMGR          GRPA     CAL22
__/__  PAYDAILY      11/10/19  13.40 PAYMGR          GRPA     CAL03
_____  PAYDAILY      11/09/07  15.55 TWSADM                   CAL32
_____  PYWEEKLY      11/09/01  15.00 PAYADM          GRPB     CAL12
```

Figure 110. EQQNALSL - List of Applications (part 3)

```
  Action  View  Help

EQQNALSL                    LIST OF APPLICATIONS
Command  ===> _____________________________________________Scroll ===> PAGE

<<    View: Compact (EQQNALST)    Row 1 of 55                    >>
Row    Application   GroupDef       Deadline          Deadline
cmd    ID                       smoothing factor    feedback limit
_____  PAYDAILY      Group123          100                200
__/__  PAYDAILY      GroupABC          200                260
_____  PAYDAILY      GroupXYZ          210                270
_____  PYWEEKLY      GroupPay          280                320
```

Figure 111. EQQNALSL - List of Applications (part 4)

Performing tasks from the List of Applications panel

When using the advanced panels, the LIST OF APPLICATIONS panel has a menu bar that allows you to perform tasks without browsing away from the panel. The menu bar has the following three menus:

Action

You can perform the following actions by either entering the number next to the action or by entering, in the primary command line, the abbreviated name shown in parentheses:

Create (CREATE)
Displays the CREATING AN APPLICATION panel for creating a new application (see "Creating an application and its operations" on page 127).

Print Applications (PRINTA)
Displays the PRINTING APPLICATIONS panel.

Mass Update (MASSUP)
Displays the MASS UPDATING OF APPLICATION DESCRIPTIONS panel.

View You can choose between the Full or Graph views of the application data. The name of the template the panel is using is displayed next to the name of the view. There is a different template for each type of view of each type of advanced panel. See "Specifying panel views" on page 40 for more information.

Help You can learn more about the LIST OF APPLICATIONS panel, including:

- General help topics
- Primary commands
- Row commands

Enter forward slash (/) in the Row cmd column next to an application (see Figure 110 on page 194) to open the TABLE ROW COMMANDS panel. The Table row commands panel lists all the available commands for the selected application, as shown in Figure 112.

```
EQQSRCLP                   Table row commands

Choose one of the following commands by entering the number.


--- 1. Browse (B/S)
    2. Modify (M)
    3. Copy (C)
    4. Delete (D)
c    5. Print (P)
    6. Run Days (A)
    7. Modify LTP (L)

******************************** end of data ****************************
```

Figure 112. Table row commands

Enter the number of a table row command to open the corresponding panel. For example, enter 4 to open the CONFIRMING DELETION OF AN APPLICATION panel to delete the selected application.

Alternatively, without browsing away from the LIST OF APPLICATIONS panel, you can enter any of the command letters listed in parentheses (see Figure 112). For example, instead of entering forward slash (/) in the Row cmd column, as shown in Figure 113 on page 196, enter C to go directly to the COPYING AN APPLICATION panel.

```
  Action  View  Help

EQQNALSL                    LIST OF APPLICATIONS
Command  ===> _____________________________________________Scroll ===> PAGE

    View: Compact (EQQNALST)        Row 1 of 55
Row    Application  AuthGid  Calendar  GroupDef    Deadline        Deadline
cmd    ID                     ID              Smoothing Factor  Feedback Limit
_____  PAYDAILY     PYMGR    PayCal1   GrpABC       200               100
__C__  PAYDAILY                       GroupABC     200               260
_____  PAYDAILY                       GroupXYZ     210               270
_____  PYWEEKLY                       GroupPay     280               320
```

Figure 113. EQQNALSL - Enter command letters in Row cmd column

Browsing an application

From the LIST OF APPLICATIONS panel (EQQNALSL), enter B or S in the Row command column next to an application to browse its description and corresponding data. Alternatively, you can enter forward slash (/) in the Row command column of the application, and then enter 1 to select Browse in the TABLE ROW COMMANDS panel. The APPLICATION IN THE DATABASE panel (EQQNABGP) opens. This panel is scrollable down and to the right, with each part of the panel providing various types of information (see Figure 114).

The first part of the panel shows the basic information such as the application status, valid dates, type, owner, and so on.

```
  Action  Link  View  Help

EQQNABGP                  APPLICATION IN THE DATABASE
Command  ===> ___________________________________Scroll ===> PAGE

View: Full (EQQNABGT)             Line 1 of 34                            >>

Application  . . . . . .: PAYRUN7
Status  . . . . . . . . : Active
Valid From - To . . . . : 11/07/15 - 14/12/31
 ------------------------------------------------------------------------
Type  . . . . . . . . . : Application
Owner . . . . . . . . . : PayMgr
Priority  . . . . . . . : 4
Authority group ID  . . . :
Calendar ID  . . . . . .:
Group definition  . . . . :
Deadline smoothing factor :
Deadline feedback limit . :
Total number of:
  Run cycles  . . . . . . : 3
  Operations  . . . . . . : 3
  External predecessors . : 3
```

Figure 114. EQQNABGP - Browsing the application description in the database (part 1)

By scrolling down, you can see information about the latest updates to the data and the run cycles data.

```
  Action  Link  View  Help

EQQNABGP                    APPLICATION IN THE DATABASE
Command  ===>  _____________________________________Scroll ===> PAGE

View: Full (EQQNABGT)           Line 13 of 34                          >>

Application  . . . . . .: PAYRUN7
Status  . . . . . . . . : Active
Valid From - To . . . . . : 11/07/15 - 14/12/31
 ------------------------------------------------------------------------
  Conditions  . . . . . . : 3

Last updated by . . . . . : PayMgr     on 11/08/20 at 13.53

1-------------------------- Run Cycles ----------------------------------

     Name of
Row  period/rule  Input  Deadline        F Day  In        Out of
Cmd  Text         Time   Day Time  Type  Rule   Effect    Effect   Variable table
___  Rule_Pay1    00.00  01 23.59   R     4     10/10/13  15/12/31
___  Rule_Pay2    00.00  02 23.59   R     4     10/10/15  15/12/31
___  Rule_Pay3    00.00  03 23.59   R     4     10/10/13  15/12/31
```

Figure 115. EQQNABGP - Browsing the application description in the database (part 2)

By scrolling down even further, you see the list of operations in the application. The Run Cycles section, and all of the sections that follow, are prefixed by a number so you can easily jump to the required section using the **find** command, without having to scroll through each section. For example, to quickly display the Operations section, type `find 2-` at the command prompt.

```
  Action  Link  View  Help

EQQNABGP                    APPLICATION IN THE DATABASE
Command  ===>  _____________________________________Scroll ===> PAGE

View: Full (EQQNABGT)           Line 25 of 34                          >>

Application  . . . . . .: PAYRUN7
Status  . . . . . . . . : Active
Valid From - to . . . . . : 11/07/15 - 14/12/31
 ------------------------------------------------------------------------
2---------------------------Operations-----------------------------------

Row  Oper   no.   Duration   Job name   Internal predecessors   Morepreds No. of
cmd  ws                                                        -IntExt-  Conds
___  WS01   1     10.10.01   PayJob1    001                      0  0       0
___  WS012  3     10.11.01   PayJob12   001                      1  0       0
___  WS091  1     10.12.01   PayJob14   001                      0  1       1
 ------------------------------------------------------------------------
```

Figure 116. EQQNABGP - Application description in the database (part 3)

The APPLICATION IN THE DATABASE panel (EQQNABGP) has a menu bar that allows you to perform tasks without browsing away from the panel. The menu bar has the following three menus:

Action

You can perform the following actions by either entering the number next to the action or by entering, in the primary command line, the abbreviated name shown in parentheses:

Print Application (P)

Displays the GENERATING JCL FOR A BATCH JOB panel, where the data is ready to be generated for printing an application.

Print Run Cycles (A)
Displays the GENERATING JCL FOR A BATCH JOB panel, where the data is ready to be generated for calculating and printing run days.

Modify LTP (L)
Displays the GENERATING JCL FOR A BATCH JOB panel, where the data is ready to be generated for modifying the LTP of an application.

Link The Link menu options enable you to quickly open the Period, Calendar, Workstation, and Special Resources databases.

Link Period (LINKPER)
Displays the Maintaining the IWSz Periods panel, where you can manage periods.

Link Calendar (LINKCAL)
Displays the Maintaining the IWSz Calendars panel, where you can manage calendars.

Link Workstation (LINKWS)
Displays the Maintaining Work Stations Descriptions panel, where you can manage workstations.

Link Special Resources (LINKSR)
Displays the Maintaining Special Resources panel, where you can manage the special resources.

View You can choose between the Full or Graph views of the application data. The name of the template the panel is using is displayed next to the name of the view. There is a different template for each type of view of each type of advanced panel. See "Specifying panel views" on page 40 for more information.

Help You can learn more about sections of the APPLICATION IN THE DATABASE panel, including:

- General help topics
- Primary commands
- Run cycle
- Operations

For example, selecting Run cycle shows information specific to the section of the panel that contains the run cycle data. Selecting Operations shows specific information about the section of the panel that contains operation data, such as workstation number, duration, number or dependencies, and so on.

Browsing run cycle information

The APPLICATION IN THE DATABASE panel has a section for run cycles (see Figure 115 on page 197). Enter forward slash (/) in the Row cmd column next to a run cycle to open the TABLE ROW COMMANDS panel. The commands available for that run cycle are listed, as shown in the example in Figure 117 on page 199.

```
EQQSRCLP                  Table row commands

Choose the numeric option for the following commands.

                      Line 1 of 5
--- 1. Show Run Cycle details (B/S)
    2. Display the dates generated by this rule (GEN)
    3. Display the Every Options for this rule (E)
    4. Show Period (BPE)
    5. Modify Period (MPE)

******************************** end of data ********************************
```

Figure 117. Table row commands for a run cycle

1. Show Run Cycle details (B/S)
Displays the BROWSING A RULE basic panel.

2. Display the dates generated by this rule (GEN)
Displays the LIST OF GENERATED DATES basic panel.

3. Display the Every Options for this rule (E)
Displays the EVERY OPTIONS basic panel.

4. Show Period (BPE)
Displays the BROWSE PERIOD panel for the period of the selected row.

5. Modify Period (MPE)
Displays the MODIFY PERIOD panel for the period of the selected row.

You can enter the abbreviations shown in parentheses in the primary command-line in the APPLICATION IN THE DATABASE panel, without having to list the TABLE ROW COMMANDS.

Browsing application operations

The APPLICATION IN THE DATABASE panel has a section for the list of operations in that application (see Figure 116 on page 197). Enter forward slash (/) in the Row cmd column next to an operation to open the TABLE ROW COMMANDS panel. The commands available for the selected operation are listed, as shown in the example in Figure 118.

```
EQQSRCLP                  TABLE ROW COMMANDS

Choose the numeric option for the following commands.

                      Line 1 of 5
_1_ 1. Show details (B/S)
    2. Browse JCL (BJ)
    3. Browse operation instructions (O)
    4. Browse workstation (BWS)
    5. Modify workstation (MWS)

******************************** end of data ********************************
```

Figure 118. Table row commands for an operation

1. Show details (B/S)
Displays the OPERATION IN THE DATABASE advanced panel (EQQNABSP).

2. Browse JCL (BJ)
Displays the EDITING/BROWSING JCL FOR A COMPUTER OPERATION basic panel.

3. Browse operation instructions (O)
Displays the BROWSING AN OPERATION INSTRUCTOR panel, if operator instructions exist. If there are no operation instructions, option 3 takes you back to APPLICATION IN THE DATABASE panel (EQQNABGP).

4. Browse workstation (BWS)
Displays the BROWSING A WORK STATION DESCRIPTION panel for the workstation of the selected row.

5. Modify workstation (MWS)
Displays the MODIFYING GENERAL INFORMATION ABOUT A WORK STATION panel for the workstation of the selected row.

You can enter the abbreviations shown in parentheses in the primary command line in the APPLICATION IN THE DATABASE panel, without having to list the TABLE ROW COMMANDS.

The APPLICATION IN THE DATABASE advanced panel allows you to see, in a single panel, the comprehensive information for the selected operation in an application. You can scroll both right and down to view more information. While the operation details section of the panel remains static, you can scroll down to see the following sections:

- Automatic options
- Time options
- Predecessors
- Conditions
- Resources and servers
- Special resources
- User fields
- Feedback options
- Clean up options
- Extended info
- Automation info
- Remote job info

The sections are prefixed by a code so that you can easily jump to the required section using the **find** command, without having to scroll through each section. For example, to quickly display the Predecessors section, type `find PRED-` at the command prompt. Figure 119 on page 201 shows an example of the first part of an OPERATION IN THE DATABASE advanced panel.

```
 Action  Link  View  Help

EQQNABSP                  OPERATION IN THE DATABASE
Command  ===> _____________________________________________Scroll ===> PAGE

View: Full (EQQNABST)            Line 1 of 92                          >>

DET---------------------- Operation Details ---------------------
Application  . . . . . . : PAYRUN7
Operation  . . . . . . . : WS01 003
Jobname  . . . . . . . . : IEFBR15
 ---------------------------------------------------------------
Duration   . . . . . . . : 00.00.01
Number of int preds. . . : 3
Number of ext preds. . . : 1
Number of conditions . . : 1
Centralized script   . . : N
COND Recovery Job    . . : N
OPT---------------------- Automatic Options ---------------------
Tracking/monitoring options:
 Job class . . . . . . . :             Error tracking  . . . : Y
 Highest return code . . . : 0         External monitor. . . : N
Critical Path options. . . :

 ------------------------------------------------------------------------------
```

Figure 119. EQQNABSP - Showing operation details and some automatic options

Figure 120 shows an example of the predecessors and conditions information for the selected operation in the database.

```
 Action  Link  View  Help

EQQNABSP                  OPERATION IN THE DATABASE
Command  ===> _____________________________________________Scroll ===> PAGE

View: Full (EQQNABST)          Line 23 of 92                           >>

DET---------------------- Operation Details ---------------------
Application  . . . . . . : PAYRUN7
Operation  . . . . . . . : WS01 003
Jobname  . . . . . . . . : IEFBR15
TIM---------------------- Time Options --------------------------
Application time specifications
 Input arrival time . . . :     13.00    Time dependent . . . :
 Deadline day/time  . . . :  12 13.30    Suppress if late . . :
Operation input arrival . :              Deadline WTO . . . . :
 Day  . . . . . . . . . . :
 Time . . . . . . . . . . :
Operation deadline  . . . :
 Day  . . . . . . . . . . :
 Time . . . . . . . . . . :
PRED--------------------- Predecessors --------------------------
Row    Type    Oper      Transport   Application ID       Jobname   Cond
cmd            ws   no.  time        (for ext pred only)           no.
_____  P       WS01 002              APP_PAYDAY1          SLDJOB    000
_____  P       LW01 003              PAYWEEKLY3           JOBLW01   000
```

Figure 120. EQQNABSP - Showing time options and predecessors

Figure 121 on page 202 shows an example of the resources and servers, special resources, and user field information for the selected operation in the database.

```
  Action  Link  View  Help

EQQNABSP                    OPERATION IN THE DATABASE
Command  ===> _____________________________________________Scroll ===> PAGE

View: Full (EQQNABST)            Line 33 of 92                          >>

DET------------------------ Operation Details ---------------------
Application  . . . . . . . : PAYRUN7
Operation  . . . . . . . . : WS01 003
Jobname  . . . . . . . . . : IEFBR15
WSRES---------------------- Resources and servers -----------------
Work station resource:
  Resource 1  . . .  :  0
  Resource 2  . . .  :  0
Servers   . . . . .  :  1
SR------------------------- Special resources ---------------------

No Special Resources defined

UF------------------------- User Fields --------------------------
```

Figure 121. EQQNABSP - Showing resources and user field information

Chapter 9. Defining applications in batch

This chapter describes the following topics:
- How to choose between the mass update and batch-loader utilities
- How to run the mass update utility
- What the batch loader is
- How to code batch-loader control statements
- How to run the batch-loader program
- Batch-loader sample

For the syntax, explanation, and examples of the batch-loader control statements, see "Batch-loader control statements" on page 219.

Mass update or batch loader?

There are two utilities that process applications in batch; the batch loader and the mass update utility. Use Table 19 to decide which is best for your purpose.

Table 19. Comparison of batch loader (BL) and mass update (MU)

If you want to ...	BL	MU
Maintain a sequential data set with your application descriptions, group definitions, and operator instructions.	✓	
Change application descriptions in batch.	✓	✓
Change group definitions or operator instructions in batch.	✓	
Make changes to application descriptions conditional on the original values of options and attributes.		✓
Produce a report showing all applications that have specified values in certain fields.		✓
Note: If you want to create only operator instructions in batch, you can use the batch program EQQOIBLK. See "Layout of the operator instruction data set" on page 781 for details.		

Maintaining a sequential data set

You might want to maintain a sequential data set for loading your AD and OI databases, because:

1. It is a backup that you can use if you lose the databases.
2. You can use it when you use IBM Workload Scheduler for z/OS for the first time, if you already have application descriptions in some format that you can convert.
3. You might find it convenient to use the ISPF editor to change the control statements.
4. You can easily delete and re-create your AD and OI databases, for example, if you are new user of IBM Workload Scheduler for z/OS and are developing naming standards.

Changing application descriptions in batch

You can use either the batch loader or mass update to do this. The batch loader:

- Replaces the application description without paying attention to the original values.

- Can perform syntax and validity checking on your new application description.

The mass update function:

- Changes individual fields in your application description, and you can specify what the old value must be for the change to occur.
- Can do the update in trial mode, so that you see what applications will be changed.

Attention: Run cycle group names are not supported in the `RUN - PERIOD NAME` field of mass update.

Changing group definitions and operator instructions

You must use the batch loader to change group definitions in batch, a sample program is provided in the EQQYCBAG member of the SEQQSAMP library. To change operator instructions in batch, use the batch loader or the program EQQOIBLK. See "Layout of the operator instruction data set" on page 781 for details of EQQOIBLK.

Making changes conditional on the original values

You might want to change all priority 5 applications to priority 4, for example.

Searching applications for values in specified fields

You might want to list all time-dependent operations on workstation CPU1, for example. Use the mass update function as though you are changing the time-dependency from Y to N, but in trial mode. You get a list of all the hits, which is the report that you need. Use the mass update function to do this.

How to run the mass update utility

About this task

If you need to make many updates to application or job descriptions, consider using the mass update function to perform the updates to the database in batch. Perform mass updates in trial mode first. Trial mode produces a report from which you can verify the proposed changes before submitting the request in update mode, which implements the changes in the application description database.

This example shows how you might use the panel to change the priority of all Paymore applications (which have an OWNER ID of SAMPLE) from priority 5 to priority 4, or simply make a list of applications that have priority 5:

1. Select option 5 from the MAINTAINING APPLICATION DESCRIPTIONS or MAINTAINING JOB DESCRIPTIONS menu to display the panel in Figure 122 on page 205.

```
EQQAUPDL --------- MASS UPDATING OF APPLICATION DESCRIPTION  ROW 1 TO 10 OF 54
 Command ===>                                                 Scroll ===> CSR

 Enter the row command S to create pending updates for a data item.
 Enter the CLEAR command above to delete all pending updates.

 Number of pending updates in this session: 0

 TYPE OF BATCH JOB  ===> _           T - Trial run, U - Updating run

 Row
 cmd Data item
 '   GEN - APPLICATION TEXT
 '   GEN - OWNER ID
 '   GEN - OWNER TEXT
 s   GEN - PRIORITY
 '   GEN - AUTHORITY GROUP ID
 '   GEN - CALENDAR ID
 '   GEN - APPLICATION GROUP ID
 '   RUN - TEXT
 '   RUN - PERIOD NAME
 '   RUN - RULE NAME
```

Figure 122. EQQAUPDL - Mass updating of application description

2. Enter the CLEAR command on the command line to delete pending updates that you no longer need.
3. Scroll down through the list of items that can be modified using the mass update function. You can update these data items:
   GEN General information
   RUN Run cycle definitions
   OPR Operation data
   INT Internal predecessors
   EXT External predecessors
4. Type s beside GEN – PRIORITY and press Enter. The UPDATING DATA ITEM panel, shown in Figure 123, is displayed:

```
EQQAUUGL -------------------- UPDATING DATA ITEM ------------  ROW 1 TO 1 OF 1
Command ===>                                                 Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete
S - Specify filter criteria

Updating data item     : GEN - PRIORITY
Maximal data length    : 1
Valid data             : A digit 1 to 9

Row  Target
cmd  criteria
s''          Old data: ____________________________________________________
             New data: ____________________________________________________

****************************** BOTTOM OF DATA ************************
```

Figure 123. EQQAUUGL - Updating data item

5. Enter the S row command to select a subset of applications. The SPECIFYING FILTER CRITERIA panel, shown in Figure 124 on page 206, is displayed:

```
EQQAUFIP ---------------- SPECIFYING FILTER CRITERIA --------------------
Command ===>

Specify filter criteria below:

OWNER ID           ===> sample_________
                                       Restrict the updating of applications to
                                       applications with a certain owner.
Enter data in one
of these fields only:
 PERIOD/RULE NAME  ===> ________       Restrict the updating of runcycles to
                                       runcycles with a certain period name.

 JOB NAME          ===> ________       Restrict the updating of operations to
                                       operations with a certain job name.

 WORK STATION NAME ===> ____           Restrict the updating of operations to
                                       operations with a certain work station
                                       name.
```

Figure 124. EQQAUFIP - Specifying filter criteria

6. Type `sample` in the OWNER ID field. You can also use global search characters to limit the scope of a change, typing `sam*`, for example, for all IDs beginning with SAM. Press PF3 (End) to return to the UPDATING DATA ITEM panel. You now see the word `Filter` in the Target criteria column.
7. Enter `5` in the Old data field and `4` in the New data field:

   ```
   Row  Target
   cmd  criteria
    '' Filter   Old data: 5
                New data: 4
   ```

   If you specify no old data value, all applications matching the filtering criteria that have the field defined are changed to the new data value. For example, if you specify a new value of `NEW.RESOURCE` for a resource name, and leave the old value blank, any operation with a resource defined will be updated with the new resource name: operations that did not originally have a resource defined remain unchanged.

   Note: If the old data string is found anywhere in the target field data, it is replaced by the new data string. If the new data string is longer than the old data string, the target field can be truncated, as shown in this example:

   Before the mass update:
8. The target field is 8 bytes long.
9. Three instances of the target field contain PAYUPD, PAYUPDAT, and UPDATE.
10. Old data is UPD.
11. New data is BKUP.

    After the mass update:
12. The updated fields contain PAYBKUP, PAYBKUPA, and BKUPATE respectively.
13. Press PF3 (End). You return to the MASS UPDATING OF APPLICATION DESCRIPTION panel.
14. When you request a trial run, a batch job is submitted that produces a report of all specified pending updates without updating the database. An update run generates a batch job that updates the database and produces a report of all changed fields. Type `t` in the TYPE OF BATCH JOB field to specify a trial run, and press PF3 (End). The GENERATING JCL FOR A BATCH JOB panel,

shown in Figure 125, is displayed:

```
EQQXSUBP -------------- GENERATING JCL FOR A BATCH JOB ------------------
Command ===>

Enter/change data below and press ENTER to submit/edit the JCL.

JCL to be generated for: MASS UPDATE OF APPLICATIONS

SYSOUT CLASS       ===> _           (Used only if output to system printer)
LOCAL PRINTER NAME ===> ________    (Used only if output on local printer)
                                    (Used only if CLASS is blank)
DATASET NAME       ===> XRAYNER.EIDA.ADMUP.LIST_____________________
                                    (Used only if CLASS and LOCAL PRINTER
                                    are both blank). If blank default name
                                    used is XRAYNER.EIDA.ADMUP.LIST

SUBMIT/EDIT JOB    ===> S           S to submit JOB, E to edit

Job statement    :
 ===> //XRAYNERE JOB  (890122,NOBO),'SIMON RAYNER',_____________________
 ===> //       MSGCLASS=H,NOTIFY=XRAYNER,CLASS=A_____________________
 ===> //OUTPUT1  OUTPUT DEST=LAB21,DEFAULT=YES_____________________
 ===> //*_____________________________________________________________
```

Figure 125. EQQXSUBP - Generating JCL for a batch job

15. Check the report to see the applications that have been found with priority 5.
16. To update the AD database, rerun the job, this time with u in the TYPE OF BATCH JOB field.

Note: If you want to use mass update to change operation input arrival day or time, only those operations are changed where all operations in the application already have a value in both fields. You cannot leave these fields blank and then change them with mass update. Also, note that with mass update, no check is made to ensure that the deadline day and time is later than the operation input arrival day and time.

What is the batch loader?

Use the batch-loader program in IBM Workload Scheduler for z/OS to create and update application descriptions, group definitions, and operator instructions, in the AD, OI, and RG databases. With the batch loader, you can perform in the batch environment some of the functions you would otherwise perform online with the IBM Workload Scheduler for z/OS panels.

This chapter does not describe fully all the application options. Read “Things you should consider before creating applications” on page 123 and “Standard applications and group definitions” on page 127 before using the batch loader.

Input

Input to the batch loader is a set of control statements in an input data set. These control statements, which you provide, describe your applications or operator instructions, or both.

Output

Output from the batch loader can be for an AD, OI, or RG database, or all of them. The output can be directed to:

- Databases allocated to an active IBM Workload Scheduler for z/OS subsystem

- A database that you set up yourself, that is, a VSAM key-sequenced data set (KSDS)

Important: Unlike AD and OI which are also physical data sets, the RG is a logical database whose records are located physically in the WS database.

If the batch-loader output is directed to an active IBM Workload Scheduler for z/OS subsystem, you specify which IBM Workload Scheduler for z/OS subsystem the information should be directed to. You can also specify if your AD, OI, or RG information is new and should be added to the database, or if it should replace existing information.

If the batch-loader output is directed to a VSAM data set, the batch-loader program is run independently of any IBM Workload Scheduler for z/OS subsystem; it is not necessary to start the IBM Workload Scheduler for z/OS subsystem. This independently created database can then be allocated to an active IBM Workload Scheduler for z/OS subsystem at a later time.

Validity checking

The batch loader checks the validity of the information you provide in the input data set. However, validity checking is optional if the output is directed to a VSAM data set. You can also instruct the batch loader to perform only validity checking, without producing output. In this case, only basic syntax checking of the control statements is performed.

Description of the databases

A brief description of the information in, and structure of, the AD, OI, and RG databases follows. This background information should help you understand and code the batch-loader control statements.

AD database

The basic unit of information in the AD database is an *application description* (AD), containing all the information about one application. An AD can contain:

General information
This section contains information, such as the application name, status, and owner, which uniquely identifies the application and must appear only once in each AD. You build this section with an ADSTART control statement.

Run cycle definitions
These definitions describe when the application should run, such as daily or weekly. The IBM Workload Scheduler for z/OS planning functions convert this information into calendar run dates. There can be more than one run cycle in each AD; for example, if a particular application must be run daily with an additional run at the end of each week. You specify a run cycle with an ADRUN control statement.

Operations
An application usually consists of a series of related operations, such as:
- JCL setup
- Execution of a job or started task
- Printing and dispatch of reports

Each operation is described by its own section, which contains a unique operation number and the name of the workstation. There are normally multiple operation sections in each AD. You build an operation section with an ADOP control statement.

An operation section can have one or more of these subsections:

Dependencies
Each operation in an application can have one or more dependencies, or predecessor operations, which must be completed before it can start. A predecessor operation can be part of the same occurrence of the application (internal dependency), part of another application (external dependency), or part of another occurrence of the same application (external dependency). Within each operation section in the AD, there can be one or more dependency subsections, one for each dependency. You create a dependency subsection with an ADDEP control statement. You can also add application or operation dependencies with the ADAPD control statement.

Special resources
Each operation can use one or more special resources. A special resource subsection contains details of how the operation uses the resource. There can be one or more resource subsections within each operation section. You create a resource subsection with an ADSR control statement. See Chapter 5, "Creating special resources," on page 75 for information about special resources.

Operation Extended Info
Within an application every operation can have its own extended information area, so that there can be one operation extended name subsection per operation. You create or delete an operation extended information subsection with an ADOPEXTN control statement. The extended information area contains two types of information:

- Extended job name
- Scheduling Environment name

System Automation Info
Within an application every operation can have its own System Automation information area, so that there can be one operation system automation subsection per operation. The subsection is present only for operations running on automation workstations. The System Automation information area contains the following data:

- Command text
- Automated function
- Security element
- Completion information

User Fields
Each operation can use one or more user fields. A user field subsection contains details about user field name and value. There can be one or more user fields subsections within each operation section. You create a user field subsection with an ADUSF control statement.

Remote Job Info
Within an application, every operation can have their own Remote Job information area. The subsection is present only for operations running on remote workstations. The Remote Job information area contains the following data:

- ADID or job stream name
- Operation number (IBM Workload Scheduler for z/OS only)
- Job stream workstation (IBM Workload Scheduler only)
- Job name (IBM Workload Scheduler only)
- Complete on failed bind (Y | N)

OI Database

The basic unit of information in the OI database is the *operator instruction* (OI), which contains instruction text for a particular operation in an application. Each OI contains these sections:

Identification
The information in this section identifies the application operation that the operator instruction belongs to. The application is identified by its name. The operation can be identified by the operation number, the job name, or the name of the workstation where the operation takes place. This section can appear only once in each OI. You build the identification section with an OISTART control statement.

Text Each OI can contain one or more text sections. Each text section contains one line of text and is built with an OIT control statement.

RG Database

The RG database is a logical entity whose records are physically located in the WS dataset.

The basic unit of information in the RG database is the *run cycle group* (RG), which contains all the information about a run cycle group and about the single run cycles that make it up. Each RG contains these sections:

Run cycle group information
This section contains information such as the run cycle group name, description and owner, the names of the default JCL variable table and calendar, and the default input arrival time. The default JCL variable table, calendar, and input arrival time are valid for all the run cycles in the group unless the definitions of the single run cycles specify other ones. You build this section with an "RGSTART" on page 273 control statement.

Run cycle definitions
Each run cycle group contains several run cycle definitions. Each run cycle definition specifies the name, description, type, free-day rule, validity dates, deadlines, subset, and optionally, the input arrival time and the JCL variable table and calendar names if different from the ones specified for the group. You specify each run cycle with the RGRUN control statement.

Rule definitions
Every run cycle definition must be followed by the ADRULE statement that defines the rule followed by the run cycle. The rule specifies the days of the week, month, or year an application will run, and their recursiveness, and generates a set of dates based on the calendar chosen. A run cycle definition is made up by an RGRUN/ADRULE couple.

The run cycles defined in the run cycle groups (RG) are compatible with the run cycles defined in the application descriptions (AD). Applications can therefore use any mix of the two.

How to code batch-loader control statements

The batch-loader control statements closely reflect the structure of the AD, OI, and RG databases. Each AD, OI, or RG consists of one or more sections. One batch-loader control statement is required for each section that describes your environment.

Structure of AD control statements

The ADSTART control statement tells the batch loader that you want to start building a new AD and builds the general information section. Also, when an ADSTART is found in the input data set, it signals the batch loader to complete the previous AD, OI, or RG being built and write it to the database.

Put statements representing the remaining sections of the AD record after ADSTART. The sequence of control statements describing one AD is not important, except:

- ADDEP, ADOPEXTEN, ADSR, ADOPSAI, ADUSF, and ADRE must follow the ADOP to which they belong, because they build subsections of an operation section.
- An ADRULE statement must immediately follow its associated ADRUN statement.

The "Example of control statement sequence" illustrates this. Place control statements in a logical sequence to avoid mistakes and to make the input easier to read.

Structure of OI control statements

The OI control statements are used to build an operator instruction in the OI database. You start with an OISTART control statement, followed by up to 443 OIT control statements that provide the text for the operator instruction (or the text can be in a separate file).

Structure of RG control statements

The RGSTART control statement tells the batch loader that you want to start building a new RG and builds the general information section. Also, when an RGSTART is found in the input data set, it signals the batch loader to complete the previous AD, OI, or RG being built and write it to the database.

Put statements representing the remaining sections of the RG record after RGSTART. Every run cycle defined in a run cycle group must be represented by a sequence of RGRUN and ADRULE statements.

The "Example of control statement sequence" illustrates this. Place control statements in a logical sequence to avoid mistakes and to make the input easier to read.

Example of control statement sequence

This example shows the structure and sequence of batch-loader control statements. Do not worry if you do not understand all of it, because only the basic structure is important. The parameters are described in detail later.

```
OPTIONS  SUBSYS(EIDA) CHECK(Y)
ADSTART  ACTION(SETDEFAULT) ADTYPE(A) DESC('PAYROLL SAMPLE')
         ODESCR('SAMPLE APPLICATION') PRIORITY(5)
         OWNER(SAMPLE)
```

```
ADRULE   ACTION(SETDEFAULT) TYPE(R)
ADSTART  ADID(PAYDAILY) DESCR('DAILY PAYROLL JOBS')
ADAPD APDADID(PAYDAILYPRED)
DESC('WAIT FOR PAYDAILYPRED') APDCSEL(R)
APDWSID(CPU1) APDOPNO(020) APDIVTYPE(R)
APDIVFWHE(B) APDIVFHHH(012) APDIVFMM(30)
ADPIVTWHE(A) APDIVTHHH(000) APDIVTMM(15)
ADRUN    NAME(DAILY) RULE(1) DESCR('RUN EVERY WORK DAY')
         IATIME(1200) DLTIME(1600)
ADRULE   EVERY DAY(WORKDAY) YEAR
ADOP     WSID(SETP) OPNO(10) JOBN(PAYDAILY)
         DESC('SETUP FOR PAYDAILY') DURATION(5)
ADOP     WSID(CPU1) OPNO(20) JOBN(PAYDAILY)
         DESC('PAYDAILY JOB') DURATION(5) PREOP(10)
ADSR     RES(PAYROLL.DATABASE) USAGE(X)
ADOPEXTN EXTNAME('  ')
ADSTART  ADID(GPAYW) DESCR('WEEKLY PAYROLL GROUP') ADTYPE(G)
ADRUN    NAME(THURS) RULE(1) DESCR('RUN ON THURSDAY')
         IATIME(1200) DLTIME(1600)
ADRULE   EVERY DAY(THURSDAY) YEAR
ADSTART  ADID(PAYW) DESCR('WEEKLY PAYROLL JOBS') ADGROUP(GPAYW)
ADOP     WSID(SETP) OPNO(10) JOBN(PAYWEEK)
         DESC('SETUP FOR PAYWEEK') DURATION(5)
ADOP     WSID(CPU1) OPNO(20) JOBN(PAYWEEK)
         DESC('PAYWEEK JOB') DURATION(5) PREOP(10)
ADDEP    PREWSID(CPU1) PREOP(020) PREADID(PAYDAILY)
         DESC('WAIT FOR PAYDAILY') PRECSEL(R)
ADXIV    ADXIVADID(PAYDAILY) ADXIVWSID(CPU1) ADXIVOPNO(020)
         ADXIVTYPE(R) ADXIVFWHE(B) ADXIVFHHH(012) ADXIVFMM(30)
         ADXIVTWHE(B)ADXIVTHHH(000) ADXIVTMM(15)
ADOPEXTN EXTNAME('CALCULATE SIMPLE PAYWEEK JOB')
OISTART  ADID(PAYW) OPNO(020)
OIT      'Please note...'
OIT      'If this job (PAYWEEK) fails, automatic recovery'
OIT      'will be attempted for some situations.'
RGSTART  RGNAME(BLRG0001) RGIATIME(1812)
         RGCALEND(CALSUN) RGOWNER(FRZAP12)
RGRUN    NAME(RUNR2) TYPE(A) RULE(1) VALFROM(121020) VALTO(121031)
         IATIME(1430) SUBSETID(A3) CALENDAR(CALSAT) JVTAB(TABLE1)
ADRULE   EVERY DAY(WORKDAY) YEAR
RGRUN    NAME(RUNR3) TYPE(R) RULE(4) VALFROM(121017)
ADRULE   EVERY DAY(DAY) YEAR
RGRUN    NAME(RUNR4) TYPE(R) RULE(4) VALFROM(121017)
ADRULE   EVERY DAY(DAY) YEAR
RGSTART  RGNAME(BLRG0002) RGJVTAB(TABLE1)
RGRUN    NAME(RUNR1) TYPE(A) RULE(1)
ADRULE   EVERY DAY(DAY) YEAR
```

You can find simple examples at the end of each control statement section and in "Batch-loader sample" on page 216.

Table 20 illustrates the differences between updating the active subsystem or using a VSAM data set.

Table 20. Deciding whether to update the active subsystem

If you update the active subsystem:	If you use independent VSAM data sets:
The IBM Workload Scheduler for z/OS subsystem must be active.	The IBM Workload Scheduler for z/OS subsystem need not be active.
Code the SUBSYS keyword on the OPTIONS statement.	Provide the EQQADDS, EQQAD2DS, EQQOIDS, EQQWSDS ddnames in the batch-loader JCL, and the associated data sets. See "How to run the batch-loader program" on page 213.

Table 20. Deciding whether to update the active subsystem (continued)

If you update the active subsystem:	If you use independent VSAM data sets:
You can use the added application descriptions and operator instructions as soon as the job ends.	You must shut down the IBM Workload Scheduler for z/OS subsystem, allocate the new data sets, and restart the subsystem, before the new application descriptions and operator instructions can be used.
You might have problems if the batch loader goes wrong, and leaves incomplete application descriptions and operator instructions in the active database.	You can delete and redefine the VSAM data sets and rerun the batch loader if things go wrong.
There can be performance problems if your IBM Workload Scheduler for z/OS subsystem is busy writing to the active database. You might have to turn off AUDIT for the AD, OI, and RG databases to stop the auditing file filling up.	There is little impact on the active IBM Workload Scheduler for z/OS subsystem.

Batch-loader security considerations

If you are updating the databases of an IBM Workload Scheduler for z/OS subsystem, you need the same authority that would be required if you were to make the updates using the IBM Workload Scheduler for z/OS panels. You will need access to these resource codes:

AD For the application descriptions
OI For the operator instructions
RG For the run cycle group definitions

How to run the batch-loader program

This section describes the requirements for executing the batch loader. It also describes the batch-loader report and provides sample JCL.

Coding the JCL

The IBM Workload Scheduler for z/OS sample library (SEQQSAMP) contains samples to execute the batch loader. For the data set name of the library, see your system programmer.

These samples are provided:

- EQQBSCAN uses the scan action to syntax check an AD.
- EQQBSUBS creates three new application descriptions and operator instructions through the controller.
- EQQBVSAM updates VSAM data sets directly with new application descriptions and operator instructions.

If you use the batch loader a lot, you might find it easier to allocate a PDS and create a member for each batch-loader request type. This ensures that syntax errors are not repeated, and could save you time. You can use the samples provided in SEQQSAMP as the basis for your batch-loader PDS.

Following is a sample JCL for executing the batch loader:

```
//XRAYNERE JOB (890122,NOBO),'SIMON RAYNER',
//     MSGCLASS=H,NOTIFY=XRAYNER,CLASS=A
//STEP1    EXEC PGM=EQQYLTOP
```

```
//STEPLIB  DD DSN=OPCESA.VvRrMm.LOAD,DISP=SHR
//EQQMLIB  DD DSN=OPCESA.VvRrMm.MSGLIB,DISP=SHR
//EQQMLOG  DD SYSOUT=*
//EQQDUMP  DD SYSOUT=*
//EQQUDUMP DD SYSOUT=*
//* -- Required if your operator instructions are in
//* -- separate members
//* //EQQOIPDS DD DSN=XRAYNER.OPCESA.MESSAGES,DISP=SHR
//SYSIN    DD DSN=XRAYNER.OPCESA.BATCH(PAYROLL),DISP=SHR
//* -- Required if you are writing to VSAM data sets
//* //EQQWSDS  DD DISP=SHR,DSN=OPCESA.WORK.STATIONS
//* //EQQADDS  DD DISP=OLD,DSN=OPCESA.NEW.AD
//* //EQQOIDS  DD DISP=OLD,DSN=OPCESA.NEW.OI
```

The program name EQQYLTOP is required on the EXEC statement in your JCL. EQQYLTOP should reside in the IBM Workload Scheduler for z/OS load module library, or at least in an APF-authorized library. If this library is not defined in the active z/OS LNKLST*xx* member of SYS1.PARMLIB, you must provide a STEPLIB DD statement in your JCL so that EQQYLTOP can be found.

The data set requirements depend on whether you are directing the batch-loader output to an IBM Workload Scheduler for z/OS subsystem or to VSAM data sets. If the output is directed to VSAM data sets, you must allocate them with the correct VSAM data set characteristics for an AD or OI database. The *Planning and Installation Guide* and the sample library have JCL and IDCAMS control statements for creating an AD or OI database.

The ddnames for the required data sets are listed here with a description of their function:

SYSIN
The batch-loader input data set that contains your control statements. You can use a disk or tape data set, with fixed blocked 80-byte records, or use SYSIN DD * and place the control statements in your JCL.

SYSIN data cannot exceed 72 characters. For details, see "Syntax and construction" on page 220.

EQQMLIB
The IBM Workload Scheduler for z/OS message library.

EQQMLOG
Message log. This can be allocated to a data set or to SYSOUT.

EQQDUMP
Diagnostics data set. If batch-loader output is directed to a VSAM data set, diagnostic information is written to this data set during validity checking of the records in the input data set. If output is directed to an IBM Workload Scheduler for z/OS subsystem, diagnostic information is written to the diagnostics data set of that subsystem.

SYSUDUMP
For z/OS dumps.

EQQOIPDS
Required if the MEMBER keyword is specified on an OISTART control statement. EQQOIPDS specifies a partitioned data set, fixed blocked with a record length of 80 bytes, which contains operator instruction text.

EQQADDS

Required if output is being directed to a VSAM data set. Specifies the VSAM data set that is to receive the AD information. This DD statement is also used to check:

- That applications and operations identified on ADDEP and ADAPD control statements exist.
- That applications and operations identified on OISTART control statements exist.
- That JCL variable tables identified on ADRUN control statements exist.

EQQAD2DS

This optional DD statement is used only if batch loader output is directed to a VSAM data set. If present, it is used with EQQADDS to check that applications and operations on ADDEP, ADAPD, and OISTART statements exist. You might need to specify this ddname if you are merging two sets of application descriptions (the batch-loader statements and an old database, represented by this ddname) into a new database, represented by the EQQADDS ddname.

If no match is found on the EQQADDS data set, IBM Workload Scheduler for z/OS searches:

- EQQAD2DS for an application description that can be the predecessor.
- The operator instruction database for a matching application description.

No information is ever written to EQQAD2DS.

EQQOIDS

Required only if output is directed to a VSAM data set. EQQOIDS specifies the VSAM data set that is to receive OI information.

EQQWSDS

Required only if output is directed to a VSAM data set. EQQWSDS specifies the data set name of your existing workstation description database. This is required so that the batch loader can check that the specified workstations, calendars, periods, and run cycle groups exist.

Batch-loader reports

The only report produced by the batch loader is a list of messages, written to the data set specified by the EQQMLOG DD statement. Refer to this report to find syntax or validation errors in your control statements. The batch-loader message log must not be the same message log that your IBM Workload Scheduler for z/OS subsystem uses, but if you have directed the batch-loader output to an IBM Workload Scheduler for z/OS subsystem, some messages might be written to the EQQMLOG data set that is allocated to that subsystem. Errors related to the request itself, such as a syntax error in a parameter argument, result in a message being written only to the EQQMLOG that is allocated in the batch-loader JCL.

If the batch loader terminates with message EQQX268W, the database is being used by another function. When the batch loader has a completed database record to store, it enqueues on the database. If the database is busy, the batch loader waits for a maximum of 90 seconds for the database to become available. Normally, only the planning programs or mass update hold the database for more than 90 seconds.

To avoid failures like this, allocate a data set such as the dump data set with disposition OLD or MOD in all IBM Workload Scheduler for z/OS batch programs.

This ensures that if there is a severe error, multiple dumps are not overwritten, and a beneficial side effect is serialization of batch programs requiring access to the databases.

To verify that the AD, OI, or RG information that has been created accurately reflects your environment, use the IBM Workload Scheduler for z/OS ISPF panel to print application descriptions or operator instructions. Several reports are available.

Batch-loader sample

These batch-loader sample statements create applications for the Paymore example.

```
OPTIONS ACTION(SCAN)         /* SYNTAX CHECK ONLY                    */
    SUBSYS(EIDA)             /* SUBSYSTEM IS EIDA                    */
ADSTART                      /* SET DEFAULTS FOR SUBSEQUENT          */
    ACTION(SETDEFAULT)       /* ADSTART STATEMENTS.                  */
    ADTYPE(A)                /* APPLICATION TYPE                     */
    DESC('PAYROLL SAMPLE')   /* DESCRIPTION TEXT                     */
    ODESC('SAMPLE APPLICATION') /* OWNER DESCRIPTION                 */
    PRIORITY(5)              /* PRIORITY                             */
    OWNER(SAMPLE)            /* OWNER ID                             */
ADRUN                        /* SET DEFAULTS FOR SUBSEQUENT          */
    ACTION(SETDEFAULT)       /* ADRUN   STATEMENTS.                  */
    TYPE(R)                  /* USE RULE-BASED RUN CYCLES            */
ADSTART ADID(PAYDAILY)       /* DEFINE PAYDAILY                      */
    DESC('DAILY PAYROLL JOBS')  /*                                   */
ADDEP
    PREADID(PAYDAILY)        /*                                      */
    DESC('WAIT FOR PAYDAILY PRED')                                    */
ADRUN   NAME(DAILY)          /* SPECIFY RULE-BASED RUN CYCLE         */
    DESCR('RUN EVERY WORK DAY') /*                                   */
    IATIME(1200)             /* INPUT ARRIVAL TIME                   */
    DLTIME(1600)             /* DEADLINE TIME                        */
ADRULE EVERY DAY(WORKDAY)    /* SPECIFY EVERY WORK DAY IN THE YEAR   */
    YEAR                     /* SELECT ALL DAYS IN THE WEEK          */
ADOP    WSID(WTO1)           /* SEND A WTO TO CLOSE THE PAYROLL      */
    OPNO(05)                 /* DATASET.                             */
    JOBN(PAYDAILY)           /* THE DESC KEYWORD SPECIFIES THE       */
    DESC('PAYX CLOSE DATASET')   /* OPERATION TEXT, WHICH CAN        */
    DURATION(1)              /* BE USED BY THE RECEIVER OF THE WTO   */
    TIME(Y)                  /* START THIS JOB AT IATIME             */
ADOP    WSID(SETP)           /* DEFINE THE SETUP OPERATION (010)     */
    OPNO(10)                 /* FOR THE PAYDAILY JOB                 */
    JOBN(PAYDAILY)           /*                                      */
    DESC('SETUP FOR PAYDAILY')   /*                                  */
    DURATION(5)              /*                                      */
    PREOP(05)                /* WTO IS PREDECESSOR                   */
ADOP    WSID(CPU1)           /* DEFINE THE PAYDAILY JOB (020)        */
    OPNO(20)                 /*                                      */
    JOBN(PAYDAILY)           /*                                      */
    DESC('PAYDAILY JOB')     /*                                      */
    DURATION(5)              /* ESTIMATED JOB DURATION               */
    PREOP(10)                /* JCL SETUP IS PREDECESSOR             */
ADSR    RES(PAYROLL.DATABASE)    /* ASK FOR EXCLUSIVE USE OF THE     */
    USAGE(X)                 /* RESOURCE PAYROLL.DATABASE SO THAT    */
                             /* PAYDAILY DOES NOT RUN ALONGSIDE OTHER*/
                             /* PAYROLL JOBS                         */
ADOPEXTN EXTNAME('CALCULATE SIMPLE PAYWEEK JOB') /*                  */
ADSTART ADID(GPAYW)          /* DEFINE THE WEEKLY PAYROLL GROUP      */
    DESCR('WEEKLY PAYROLL GROUP')  /*                               */
    ADTYPE(G)                /* APPLICATION TYPE IS G (GROUP)        */
ADRUN   NAME(THURS)          /* SPECIFY THE RUN CYCLE FOR THE        */
    RULE(1)                  /* WEEKLY PAYROLL GROUP DEFINITION      */
    DESCR('RUN ON THURSDAY') /* RUN ON THURSDAY OR ON THE PREVIOUS   */
    IATIME(1200)             /* DAY (FREE-DAY RULE 1) IF THURSDAY IS */
    DLTIME(1600)             /* A FREE DAY.                          */
```

```
ADRULE EVERY DAY(THURSDAY)   /*                                      */
 YEAR                        /* THIS COULD ALSO BE WEEK OR MONTH     */
ADSTART ADID(PAYW)           /* THIS WEEKLY JOB IS PART OF GPAYW, SO */
    DESCR('WEEKLY PAYROLL JOBS') /* IT DOES NOT HAVE ITS OWN ADRUN.  */
    ADGROUP(GPAYW)           /*                                      */
ADOP    WSID(CPU1)           /*                                      */
    OPNO(20)                 /*                                      */
    JOBN(PAYWEEK)            /*                                      */
    DESC('PAYWEEK JOB')      /*                                      */
    DURATION(5)              /*                                      */
ADDEP   PREWSID(CPU1)        /*                                      */
    PREOP(020)               /*                                      */
    PREADID(PAYDAILY)        /*                                      */
    DESC('WAIT FOR PAYDAILY')    /*                                  */
ADSR    RES(PAYROLL.DATABASE)    /*                                  */
    USAGE(X)                 /*                                      */
ADOP    WSID(CPU1)           /* THE PAYSLIPS JOB.                    */
    OPNO(30)                 /*                                      */
    JOBN(PAYWSLIP)           /*                                      */
    DESC('PAYWSLIP JOB')     /*                                      */
    DURATION(5)              /*                                      */
    PREOP(20)                /*                                      */
ADOP    WSID(PRT1)           /* TRACK   THE PRINTING OF THE JES      */
    OPNO(90)                 /* OUTPUT GROUP.                        */
    JOBN(PAYWSLIP)           /* SAME NAME AS THE PREDECESSOR JOB.    */
    DESC('PAYWSLIP PRINT')   /*                                      */
    DURATION(20)             /*                                      */
    PREOP(30)                /*                                      */
    PRTCLASS(D) FORM(SLIPS)  /* TRACKS THIS SYSOUT CLASS AND FORM NO */
ADOP    WSID(PAY1)           /* TRACK THE COLLATION OF PAY SLIPS   */
    OPNO(95)                 /* AND PREPARATION OF PAY PACKETS       */
    JOBN(PAYWSLIP)           /* IN THE PAY OFFICE.                   */
    DESC('PAY PACKETS')      /*                                      */
    DURATION(60)             /*                                      */
    PREOP(90)                /*                                      */
ADOPEXTN EXTNAME('  ')       /* DELETE THE EXTENDED NAME INFO        */
ADSTART ADID(GPAYM)          /* DEFINE THE MONTHLY PAYROLL GROUP     */
    DESCR('MONTHLY PAYROLL GROUP')  /*                               */
    ADTYPE(G)                /* APPLICATION TYPE IS G (GROUP)        */
ADRUN     NAME(FIRSTTHU)     /* SPECIFY THE RUN CYCLE FOR THE        */
    RULE(1)                  /* MONTHLY PAYROLL GROUP DEFINITION     */
    DESCR('RUN ON THURSDAY') /* RUN ON THE THIRD THURSDAY IN MONTH   */
    IATIME(1200)             /* OR DAY BEFORE(RULE 1) IF THURSDAY IS */
    DLTIME(1600)             /* A FREE DAY.                          */
ADRULE ONLY(3)               /*                                      */
 DAY(THURSDAY) MONTH         /*                                      */

ADSTART ADID(PAYM1)          /* THIS MONTHLY JOB IS PART OF GPAYM, SO*/
    DESCR('MONTHLY PAYROLL JOBS') /* IT DOES NOT HAVE ITS OWN ADRUN. */
    ADGROUP(GPAYM)           /*                                      */
ADOP    WSID(CPU1)           /*                                      */
    OPNO(40)                 /*                                      */
    JOBN(PAYMONTH)           /*                                      */
    DESC('PAYMONTH JOB')     /*                                      */
    DURATION(5)              /*                                      */
ADDEP   PREWSID(CPU1)        /*                                      */
    PREOP(020)               /*                                      */
    PREADID(PAYDAILY)        /*                                      */
    DESC('WAIT FOR PAYDAILY')    /*                                  */
ADSR    RES(PAYROLL.DATABASE)    /*                                  */
    USAGE(X)                 /*                                      */
ADOP    WSID(CPU1)           /* THE PAYSLIPS JOB.                    */
    OPNO(50)                 /*                                      */
    JOBN(PAYMSLIP)           /*                                      */
    DESC('PAYMSLIP JOB')     /*                                      */
    DURATION(5)              /*                                      */
    PREOP(40)                /*                                      */
```

```
ADOP    WSID(PRT1)           /* TRACK   THE PRINTING OF THE JES      */
    OPNO(99)                 /* OUTPUT GROUP.                        */
    JOBN(PAYMSLIP)           /* SAME NAME AS THE PREDECESSOR JOB.    */
    DESC('PAYMSLIP PRINT')   /*                                      */
    DURATION(20)             /*                                      */
    PREOP(50)                /*                                      */
    PRTCLASS(D) FORM(SLIPS)  /* TRACKS THIS SYSOUT CLASS AND FORM NO */
ADSTART ADID(PAYM2)          /* THIS MONTHLY JOB IS PART OF GPAYM, SO*/
    DESCR('MONTHLY GIRO')    /*      IT DOES NOT HAVE ITS OWN ADRUN. */
    ADGROUP(GPAYM)           /*                                      */
ADOP    WSID(CPU1)           /* PAYTRANS IS THE JOB THAT SENDS       */
    OPNO(40)                 /* INFORMATION ABOUT MONTHLY PAYMENTS   */
    JOBN(PAYTRANS)           /* TO THE BANKS.                        */
    DESC('GIRO TRANSFER')    /*                                      */
    DURATION(5)              /*                                      */
ADDEP   PREWSID(CPU1)        /*                                      */
    PREOP(040)               /*                                      */
    PREADID(PAYMONTH)        /*                                      */
    DESC('WAIT FOR PAYMONTH')    /*                                  */
ADDEP   PREWSID(CPU1)        /*                                      */
    PREOP(020)               /*                                      */
    PREADID(PAYWEEK)         /*                                      */
    DESC('WAIT FOR PAYWEEK') /*                                      */
ADSR    RES(PAYROLL.DATABASE)    /*                                  */
    USAGE(X)                 /*                                      */
ADSR    RES(TAPES)           /*                                      */
    USAGE(X) QUANTITY(1)     /* EXCLUSIVE USE OF ONE TAPE DRIVE      */
ADSTART ADID(PAYTAXYR)       /* DEFINE THE YEARLY TAX RUN            */
    DESC('YEARLY TAX RUN')   /*                                      */
ADRUN     NAME(FSTTHU7)      /* SPECIFY RUN CYCLES                   */
    DESCR('RUN 3RD THU IN JULY') /*                                  */
    RULE(1)                  /* RUN DAY BEFORE IF A FREE DAY         */
    IATIME(1200)             /* INPUT ARRIVAL TIME                   */
    DLTIME(2000)             /* DEADLINE TIME (SAME DAY ASSUMED)     */
ADRULE ONLY(3)               /* GENERATE THE THIRD THURSDAY IN JULY  */
  DAY(THURSDAY) MONTH(JULY)  /*                                      */
ADOP    WSID(CPU1)           /* DEFINE THE PAYTAXYR JOB              */
    OPNO(15)                 /*                                      */
    JOBN(PAYTAXYR)           /* MUST BE THE SAME NAME AS JCL MEMBER  */
    DESC('PAYTAXYR JOB')     /*                                      */
    DURATION(5)              /* ESTIMATED JOB DURATION               */
ADDEP   PREWSID(CPU1)        /*                                      */
    PREOP(040)               /*                                      */
    PREADID(PAYM2)           /* DEPEND ON THE MONTHLY GIRO JOB       */
    DESC('WAIT FOR PAYTRANS') /*                                     */
ADSR    RES(PAYROLL.DATABASE)    /* ASK FOR EXCLUSIVE USE OF THE     */
    USAGE(X)                 /* RESOURCE PAYROLL.DATABASE            */
ADSTART ADID(PAYRECOV)       /* RECOVERY JOB.                        */
    DESCR('RECOVER PAYROLL') /* RUN AS REQUIRED, SO NO ADRUN.        */
ADOP    WSID(CPU1)           /*                                      */
    OPNO(20)                 /*                                      */
    JOBN(PAYRECOV)           /*                                      */
    DESC('PAYRECOV JOB')     /*                                      */
    DURATION(5)              /*                                      */
ADSR    RES(PAYROLL.DATABASE)    /*                                  */
    USAGE(X)                 /*                                      */
ADSR    RES(TAPES)           /*                                      */
    USAGE(X) QUANTITY(1)     /* EXCLUSIVE USE OF ONE TAPE DRIVE      */
ADSTART ADID(PAYQUERY)       /* QUERY JOB.                           */
    DESCR('AD-HOC QUERY')    /* RUN AS REQUIRED, SO NO ADRUN.        */
ADOP    WSID(CPU1)           /*                                      */
    OPNO(50)                 /*                                      */
    JOBN(PAYQUERY)           /*                                      */
    DESC('PAYQUERY JOB')     /*                                      */
    DURATION(5)              /*                                      */
ADSR    RES(PAYROLL.DATABASE)    /*                                  */
    USAGE(X)                 /*                                      */
```

```
ADSTART ADID(PAYBACKP)       /* BACKUP JOB.                          */
    DESCR('BACKUP PAYROLL')  /* RUN AFTER ALL OTHER PAYROLL JOBS.    */
ADRUN   NAME(DAILY)          /* SPECIFY RULE-BASED RUN CYCLE         */
    DESCR('RUN EVERY WORK DAY') /*                                   */
    IATIME(1200)             /* INPUT ARRIVAL TIME                   */
    DLTIME(1600)             /* DEADLINE TIME                        */
ADRULE EVERY DAY(WORKDAY)    /* SPECIFY EVERY WORK DAY IN THE YEAR   */
    YEAR                     /* SELECT ALL DAYS IN THE WEEK          */
ADOP    WSID(CPU1)           /*                                      */
    OPNO(15)                 /*                                      */
    JOBN(PAYBACKP)           /*                                      */
    DESC('PAYBACKP JOB')     /*                                      */
    DURATION(5)              /*                                      */
ADSR    RES(PAYROLL.DATABASE)    /*                                  */
    USAGE(S)                 /*                                      */
ADSR    RES(TAPES)           /*                                      */
    USAGE(X) QUANTITY(1)     /* EXCLUSIVE USE OF ONE TAPE DRIVE      */
ADDEP   PREWSID(CPU1)        /*        ALL THESE                     */
    PREAD(PAYDAILY)          /*        DEPENDENCIES                  */
    PREOP(020)               /*        ARE EFFECTIVE                 */
    DESC('WAIT FOR PAYDAILY')    /*    ONLY                          */
ADDEP   PREWSID(CPU1)        /*        IF THE                        */
    PREAD(PAYWSLIP)          /*        SPECIFIED                     */
    PREOP(030)               /*        OPERATION                     */
    DESC('WAIT FOR PAYWSLIP')    /*    IS SCHEDULED                  */
ADDEP   PREWSID(CPU1)        /*        FOR THE SAME DAY              */
    PREAD(PAYMSLIP)          /*        AS PAYBACKP.                  */
    PREOP(050)               /*        SO, IF IT IS A NORMAL         */
    DESC('WAIT FOR PAYMSLIP')    /*    MONDAY, FOR EXAMPLE,          */
ADDEP   PREWSID(CPU1)        /*        PAYBACKP IS DEPENDENT         */
    PREAD(PAYTRANS)          /*        ONLY ON PAYDAILY.             */
    PREOP(040)               /*                                      */
    DESC('WAIT FOR PAYTRANS')    /*                                  */
ADDEP   PREWSID(CPU1)        /*                                      */
    PREAD(PAYTAXYR)          /*                                      */
    PREOP(015)               /*                                      */
    DESC('WAIT FOR PAYTAXYR')    /*                                  */
ADOP    WSID(WTO1)           /* SEND A WTO WHICH TRIGGERS A CICS     */
    OPNO(30)                 /* TRANSACTION TO REOPEN THE DATASET    */
    JOBN(PAYBACKP)           /*                                      */
    DESC('PAYX OPEN DATASET') /* THIS TEXT CAN BE USED AS THE COMMAND*/
    DURATION(1)              /*                                      */
    PREOP(15)                /* INTERNAL DEPENDENCY ON BACKUP JOB    */
/*
```

Batch-loader control statements

The batch-loader control statements are:

ADAPD
Specifies an application or an operation as the predecessor to the application being built.

ADCIV
Specifies the interval associated to an external conditional predecessor (absolute or relative).

ADCNC
Specifies a condition for the operation being built.

ADCNS
Specifies a condition dependency for the operation being built.

ADDEP
Specifies an application or an operation as the predecessor to the operation being built.

ADOP
Defines an operation in the application.

ADOPEXTN
Specifies extended information for the operation (extended name, Scheduling Environment name, or both).

ADOPSAI
Defines the system automation information for the operation.

ADRE Defines the remote job information for the operation.

ADRULE
Provides additional information to the ADRUN statement for rule-based run cycles and to the RGRUN statement of run cycles in run cycle groups.

ADRUN
Describes when the application is to run.

ADSR Specifies special resources required by the operation.

ADSTART
Starts the creation of an application description.

ADUSF
Creates a user field for the operation.

ADVDD
Adds a variable duration and deadline section to the operation of an application description.

ADXIV
Specifies the interval associated to an external predecessor (absolute or relative).

OISTART
Starts the creation of an operator instruction.

OIT Specifies a line of text in the operator instruction that is under construction.

OPTIONS
Defines execution options for the batch loader.

RGRUN
Defines a run cycle of a run cycle group.

RGSTART
Starts the creation of a run cycle group definition.

Syntax and construction

Batch loader control statements follow the same syntax rules as TSO commands.

Begin each statement on a new line. A control statement is the statement name followed by keyword parameters with the value of the parameter in parentheses, like this:

controlstatementname keyword(value) keyword(value) ...

Some keywords can have more than one value, for example `IADAYS(1,2,3,4)`. Blanks separate the control statement name and the keywords. For example:

```
ADSTART ADID(APPLNAME) DESCR('Application Description')
```

Control statements must not exceed column 72 and can continue over two or more lines. Continuation characters are not required. Any information in columns 73 through 80 is ignored. Any parameter that begins before column 72, and ends after this column, is ignored with no error message or non-zero return code being issued.

You can abbreviate keywords down to their shortest unambiguous form in the current statement. Control statement names cannot be abbreviated.

The statements can include comments in the form

```
/* comment */
```

Keyword values containing delimiters, like blanks, should be written with single quotation marks. See *TSO Extensions Command Language Reference* for details of the syntax rules.

Defaults

When coding batch-loader control statements, you do not need to provide every keyword and a corresponding value. Keywords that are required are clearly noted in the text. For other keywords, a default value is used for that keyword if you do not supply it.

IBM Workload Scheduler for z/OS selects default values in this sequence:

1. Some control statements have the ACTION keyword. By specifying ACTION(SETDEFAULT), you can provide your own default values for that control statement. These default values will remain in effect for all later occurrences of the control statement in the input data set, or until you specify another ACTION(SETDEFAULT). For example:

   ```
   ADOP ACTION(SETDEFAULT) OPNO(10) DURATION(5)
   ```

   In this example, the default values set for the keywords OPNO and DURATION are used for all following ADOPs in the input data set. When you specify a default value for the OPNO keyword (operation number), it is used as an *increment* rather than an absolute value. This is because each operation within an application must have a unique operation number. A statement with ACTION(SETDEFAULT) as the only keyword removes all defaults that have been previously set in this way and returns the defaults to their normal values. A control statement with ACTION(SETDEFAULT) specified does not cause any creation of AD or OI information.

   Keywords that cannot be set by the SETDEFAULT command are listed in the text.
2. A keyword parameter can have a specific default as shown in the description of that control statement.
3. If no default value is obtained from the preceding two steps, the following rules apply when you omit the keyword:
   a. A character value defaults to blank.
   b. An integer value defaults to 0.

The following sections describe purpose and format of the supported statements.

ADAPD

Purpose

Use the ADAPD control statement to specify an application or an operation as the predecessor for the application that is being built by the ADSTART statement.

You should remember that there can be up to four versions of an AD with different validity dates. If there is more than one version, the batch loader searches the ADs defined by your APDADID keyword to find an AD with a current validity date. ADs with *active* status are searched first, followed by those with *pending* status.

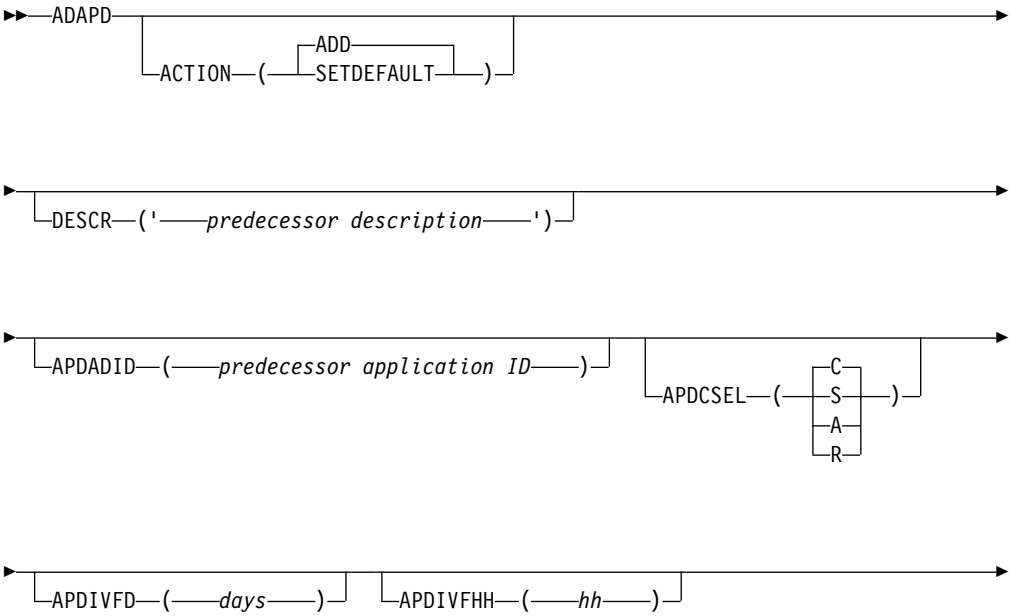
You identify a predecessor operation by one or more of the following values:
- Operation number (APDOPNO)
- Workstation name (APDWSID)

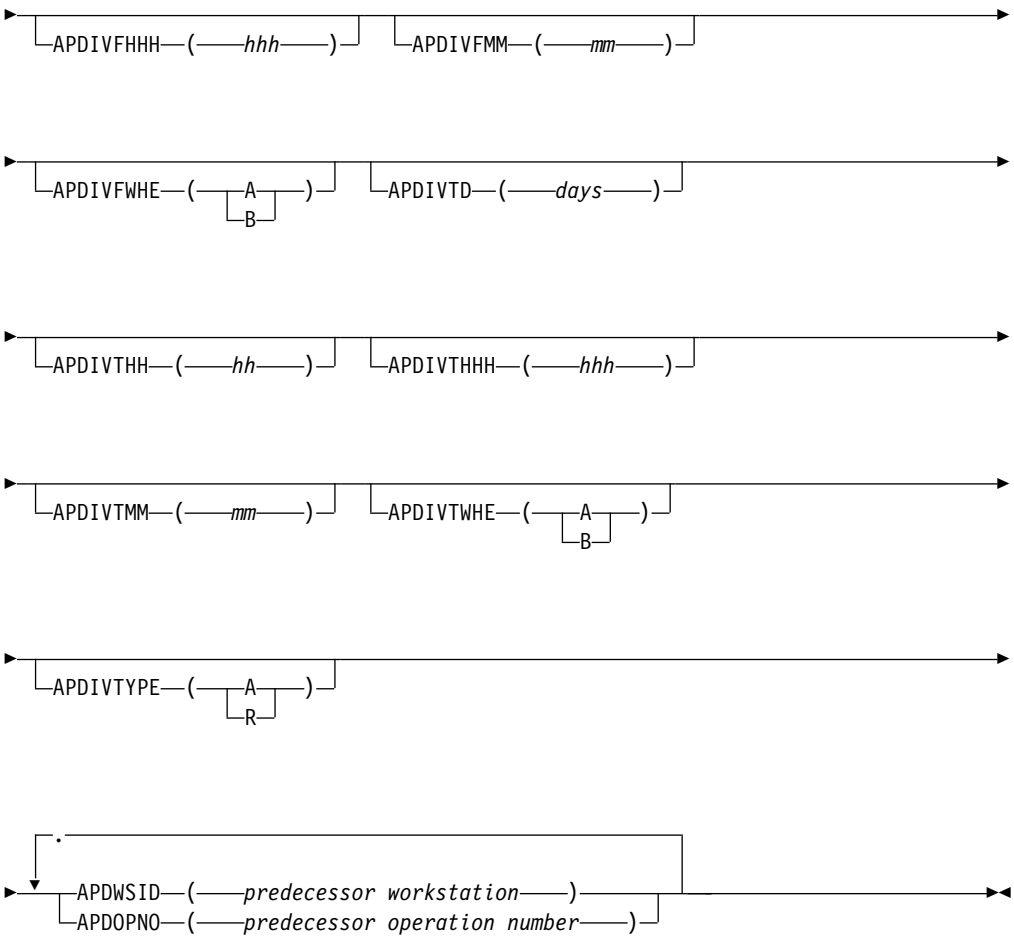
You must specify enough of these keywords to uniquely identify a predecessor operation. If no operation is specified it is assumed that the predecessor is an application, therefore an application dependency is created.

If the output is directed to a VSAM data set, a predecessor operation can be defined by an ADOP statement occurring later in the input data set. This is because most validity checking occurs after all statements in the input data set are read.

If the output is directed to an active IBM Workload Scheduler for z/OS subsystem and the predecessor operation does not already exist in the AD database, specify both the operation number and the workstation name in the ADAPD statement.

Format





Restrictions

You cannot use ACTION(SETDEFAULT) to set default values for the following keywords:

APDADID
APDWSID

Parameters

ACTION (SETDEFAULT | ADD)

If you specify SETDEFAULT, the remaining keyword values that you specify on the ADAPD statement become default values for all ADAPD statements that follow. No application description is updated. Keywords that you do not specify are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

DESCR (*'predecessor description'***)**

A free-format description of the dependency. It can be up to 50 characters and must be contained within single quotation marks. Do not include delimiters, such as parentheses and single quotation marks, in the description.

IBM Workload Scheduler for z/OS holds descriptions only for external dependencies. This field cannot be used to hold a description for an internal dependency.

APDADID (*predecessor application ID***)**
Specifies the application ID. If you use DBCS characters, you must enter them as a quoted string started by a shift-out and ended by a shift-in.

APDCSEL (C | S | A | R)
Specifies on which basis a matching predecessor is selected. Can be one of the following values:

C Closest preceding. The matching predecessor is the one with the nearest preceding input arrival time. This is the default.

S Same scheduled date. The matching predecessor is the one with the nearest input arrival time within the same day of the operation (occurrence) under consideration. A matching predecessor is first searched before the IA time of the operation. Then, if not found, it is searched after the IA time of the operation.

A Within an absolute interval. The matching predecessor is the one with the closest input arrival time in the specified interval. The interval boundaries are specified by a time and a number of days before or after the IA time of the operation (occurrence). The interval can be timed entirely before, entirely after, or across the IA time of the operation (occurrence).

R Within a relative interval. The matching predecessor is the one with the closest input arrival time in the specified interval. The interval boundaries are calculated using an offset expressed in hours and minutes before or after the IA time of the operation (occurrence). The interval can be timed entirely before, entirely after, or across the IA time of the operation (occurrence).

APDIVFD (*days***)**
The start of the absolute interval, in days. The allowed range is 0-7.

APDIVFHH (*hh***)**
The start of the absolute interval, in the HH format. The allowed range is 00-24. Goes together with APDIVFMM. For example, if the absolute interval starts at 10:30 of the day before the input arrival time of the successor, it is defined by:

```
APDIVFHH(10) APDIVFMM(30) APDIVFD(1) APDIVFWHE(B)
```

APDIVFHHH (*hhh***)**
The start of the relative interval, in hours. The format is HHH and the allowed range is 0-167. Goes together with APDIVFMM.

APDIVFMM (*mm***)**
The *minutes* fraction of the start of the relative or absolute interval.

APDIVFWHE (A | B)
Specifies if the start of the relative or absolute interval is before (B) or after (A) the input arrival time of the successor.

For relative intervals only, you can choose to make the interval start at an indefinite time in the plan (in this case the mechanism used is similar to that of the closest preceding predecessor). To do this, do not specify this parameter, nor any of the APDIVF... ones.

APDIVTD (*days***)**
The end of the absolute interval, in days. The allowed range is 0-7.

APDIVTHH (*hh***)**
The end of the absolute interval, in the HH format. The allowed range is

00-24. Goes together with APDIVFMM. For example, if the absolute interval ends at 12:30 two days after the input arrival time of the successor, it is defined by:

```
APDIVTHH(12) APDIVTMM(30) APDIVTD(2) APDIVTWHE(A)
```

APDIVTHHH (*hhh*)
The end of the relative interval, in hours. The format is HHH and the allowed range is 0-167. Goes together with APDIVTMM.

APDIVTMM (*mm*)
The *minutes* fraction of the end of the relative or absolute interval.

APDIVTWHE (A | B)
Specifies if the end of the relative or absolute interval is before (B) or after (A) the input arrival time of the successor.

For relative intervals only, you can choose to make the interval start at an indefinite time in the plan (in this case the mechanism used is similar to that of the closest preceding predecessor). To do this, do not specify this parameter, nor any of the APDIVF* ones.

APDIVTYPE (A | R)
The interval type. Can be one of the following:

A Absolute interval. Must be defined by the following parameters: APDIVFWHE, APDIVFHH, APDIVFMM, APDIVFD, APDIVTWHE, ADPDIVTHH, ADPDIVTMM, ADPDIVTD.

R Relative interval. Must be defined by the following parameters: APDIVFWHE, APDIVFHHH, APDIVFMM, APDIVTWHE, APDIVTHHH, APDIVTMM.

APDWSID (*predecessor workstation*)
The four-character workstation name of a predecessor operation to this operation.

APDOPNO (*predecessor operation number*)
The operation number of a predecessor operation to this operation.

Examples

In this example, an application predecessor named PAYDAILYPRED is defined for the application PAYDAILY:

```
ADSTART ADID(PAYDAILY)...
ADAPD APDADID(PAYDAILYPRED) APDCSEL(R)
APDIVTYPE(R) APDIVFHHH(012) APDIVFMM(30) APDIVFWHE(B)
APDIVTHHH(018) APDIVTMM(15) APDIVTWHE(A)
```

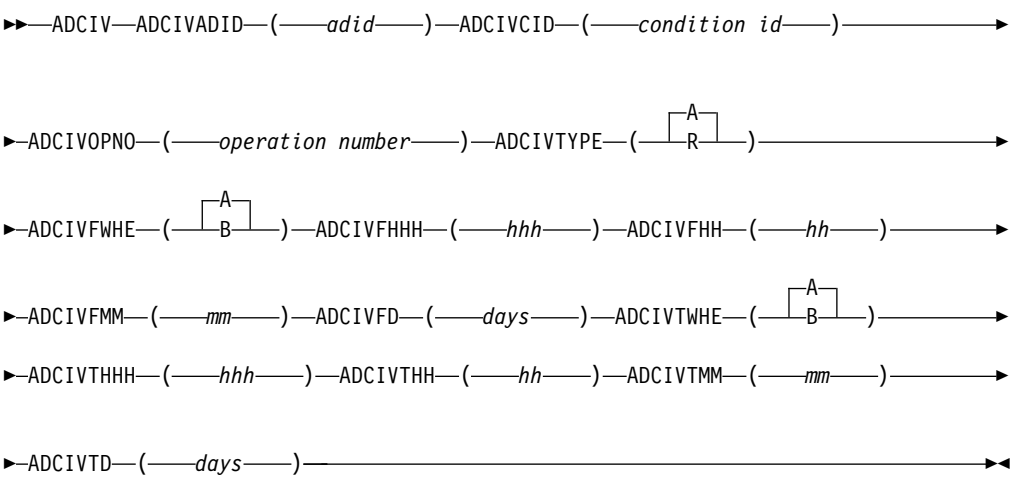
The application dependency is to be resolved by finding the matching predecessor within a relative interval, as defined by the value of APDCSEL. The details of the interval are defined by the APDIV* statements.

ADCIV

Purpose

Use the ADCIV statement to define the absolute or relative interval specified with the A or R value in the ADCNS CONDDEPCSEL parameter. Only one ADCIV per ADCNS can be used, but the same ADCIV can be used by more ADCNS statements if they refer to the same external predecessor application and operation. The statement must be nested within the ADCNS to which it refers.

Format



Parameters

ADCIVADID(*adid* **)**
The application name of the conditional external predecessor to which the interval applies.

ADCIVCID(*condition ID***)**
The condition ID of the conditional external predecessor to which the interval applies.

ADCIVFD(*days***)**
The start of the absolute interval in days. The allowed range is 0-7.

ADCIVFHH(*hh***)**
The start of the absolute interval in the HH format. The allowed range is 00-24. Goes together with ADCIVFMM. For example, if the absolute interval starts at 10:30 of the day before the input arrival time of the successor, it is defined by:

```
ADCIVFHH(10) ADCIVFMM(30) ADCIVFD(1) ADCIVFWHE(B)
```

ADCIVFHHH(*hhh***)**
The start of the relative interval in hours. The format is HHH and the allowed range is 0-167. Goes together with ADCIVFMM.

ADCIVFMM(*mm***)**
The *minutes* fraction of the start of the relative or absolute interval.

ADCIVFWHE(A | B)
Specifies if the start of the relative or absolute interval is before (B) or after (A) the input arrival time of the successor.

For relative intervals only, you can choose to make the interval start at an indefinite time in the plan (in this case the mechanism used is similar to that of the *closest preceding* predecessor). To do this, do not specify this parameter, nor any of the ADCIVF... ones.

ADCIVOPNO(*operation number***)**
The operation number of the conditional external predecessor to which the interval applies.

ADCIVTD(*days*)
The end of the absolute interval in days. The allowed range is 0-7.

ADCIVTHH(*hh*)
The end of the absolute interval in the HH format. The allowed range is 00-24. Goes together with ADCIVTMM. For example, if the absolute interval ends at 12:30 two days after the input arrival time of the successor, it is defined by:

```
ADCIVTHH(12) ADCIVTMM(30) ADCIVTD(2) ADCIVTWHE(A)
```

ADCIVTHHH(*hhh*)
The end of the relative interval in hours. The format is HHH and the allowed range is 0-167. Goes together with ADCIVTMM.

ADCIVTMM(*mm*)
The *minutes* fraction of the end of the relative or absolute interval.

ADCIVTWHE(A | B)
Specifies if the end of the relative or absolute interval is before (B) or after (A) the input arrival time of the successor.

ADCIVTYPE(A | R)
The interval type. Can be one of the following values:

A Absolute interval. Must be defined by the following parameters: ADCIVFWHE, ADCIVFHH, ADCIVFMM, ADCIVFD, ADCIVTWHE, ADCIVTHH, ADCIVTMM, ADCIVTD.

R Relative interval. Must be defined by the following parameters: ADCIVFWHE, ADCIVFHHH, ADCIVFMM, ADCIVTWHE, ADCIVTHHH, ADCIVTMM.

Examples

This example specifies the absolute interval where an occurrence of application PAYREV, containing the operation 001, is to be searched as a matching conditional predecessor for the successor (the PAYTRANS operation defined in a preceding ADOP statement). The interval starts at 7:30 on the same day before the input arrival time of PAYTRANS (10:00) and ends at 9:55 of the same day.

```
ADCIV   ADCIVADID(payrev) ADCIVCID(005) ADCIVOPNO(001) ADCIVTYPE(A)  ADCIVFWHE(B)
        ADCIVFHH(07) ADCIVFMM(30) ADCIVFD(0) ADCIVTWHE(B) ADCIVTHH(09) ADCIVTMM(55)
        ADCIVTFD(0)
```

This example specifies a relative interval to search the matching conditional predecessor that resolves the same dependency of the previous example. The interval starts at 7:30 one day before the input arrival time of PAYTRANS (10:00) and ends at 18:00 of one day after that input arrival time.

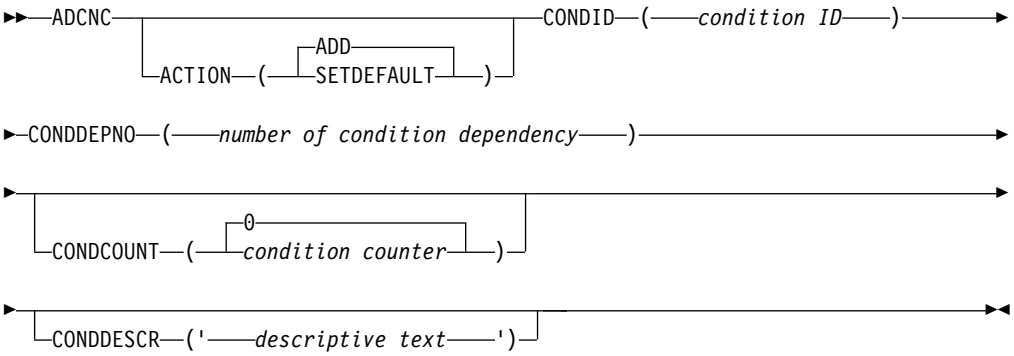
```
ADCIV   ADCIVADID(payrev) ADCIVCID(005) ADCIVOPNO(001) ADCIVTYPE(R)  ADCIVFWHE(B)
        ADCIVFHHH(026) ADCIVFMM(30) ADCIVTWHE(A) ADCIVTHHH(032) ADCIVTMM(00)
```

ADCNC

Purpose

Use the ADCNC statement when defining conditional dependencies for an operation, to specify a condition.

Format



Restrictions

You cannot use ACTION(SETDEFAULT) to set default values for these keywords:
CONDID
CONDDEPNO

Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, all the other values that you set in the ADCNC statement become the default values for all the ADCNC statements that follow. The application description database is not updated. The parameters that you do not set, are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

CONDID(*condition ID***)**
Condition identifier. Valid values are from 1 to 999.

CONDDEPNO(*number of condition dependencies***)**
Number of condition dependencies to be included in this condition, each one corresponding to an ADCNS statement.

CONDCOUNT(*condition counter* **| 0)**
Condition counter. Use it to define the rule type:

0 All the condition dependencies in this condition must be true.

n At least *n* out of the condition dependencies in this condition must be true.

CONDDESCR(*'descriptive text'***)**
A free-format description of the condition. It can be up to 16 characters and must be contained within single quotation marks. Do not include delimiters, such as parentheses and single quotation marks, in the description.

Examples

This example defines a condition including two condition dependencies:

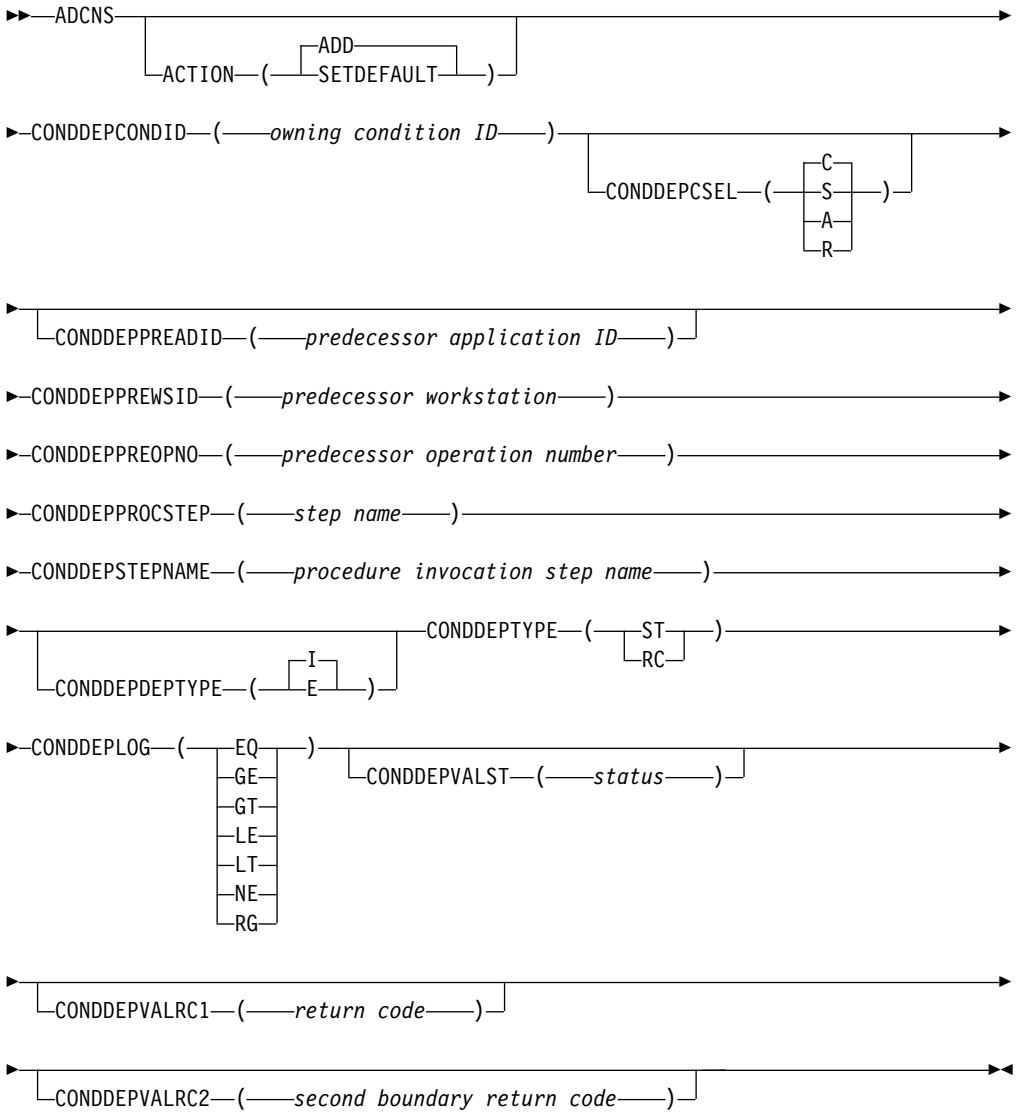
```
ADCNC   CONDID(  3) CONDDEPNO(2) CONDCOUNT(1)
        CONDDESCR('WITH 2 COND.DEPS')
ADCNS ...
ADCNS ...
```

ADCNS

Purpose

Use the ADCNS statement when defining conditional dependencies for an operation.

Format



Restrictions

You cannot use ACTION(SETDEFAULT) to set default values for these keywords:

CONDDEPCONDID
CONDDEPPREADID
CONDDEPPREWSID
CONDDEPPREOPNO
CONDDEPDEPTYPE
CONDDEPTYPE
CONDDEPLOG

Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, all the other values that you set in the ADCNS statement become the default values for all the ADCNS statements that follow. The application description database is not updated. The parameters that you do not set, are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

CONDDEPCONDID(*owning condition ID***)**
Owning condition identifier. Valid values are from 1 to 999.

CONDDEPCSEL(C | S | A | R)
Specifies on which basis a matching predecessor is selected. Can be one of the following values:

C Closest preceding. The matching predecessor is the one with the nearest preceding input arrival time. This is the default.

S Same scheduled date. The matching predecessor is the one with the nearest input arrival time within the same day of the operation (occurrence) under consideration. A matching predecessor is first searched before the IA time of the operation. Then, if not found, it is searched after the IA time of the operation.

A Within an absolute interval. The matching predecessor is the one with the closest input arrival time in the specified interval. The interval boundaries are specified by a time and a number of days before or after the IA time of the operation (occurrence). The interval can be timed entirely before, entirely after, or across the IA time of the operation (occurrence).

If you select this option, the ADCIV statement must follow ADCNS with the specification of the interval boundaries.

R Within a relative interval. The matching predecessor is the one with the closest input arrival time in the specified interval. The interval boundaries are calculated using an offset expressed in hours and minutes before or after the IA time of the operation (occurrence). The interval can be timed entirely before, entirely after, or across the IA time of the operation (occurrence).

If you select this option, the ADCIV statement must follow ADCNS with the specification of the interval boundaries.

CONDDEPPREADID(*predecessor application ID***)**
If the predecessor operation is in a different application from the one being built, or is in a different occurrence of the same application, you must identify the application ID with this keyword. If you use DBCS characters, you must enter them as a quoted string started by a shift-out and ended by a shift-in.

CONDDEPPREWSID(*predecessor workstation***)**
The four-character workstation name of a predecessor operation to this operation.

CONDDEPPREOPNO(*predecessor operation number***)**
The operation number of a predecessor operation to this operation.

CONDDEPPROCSTEP(*step name***)**
Use it to define a step level dependency. If the step is not in a procedure,

this parameter identifies the job step name, otherwise it identifies the step name in the JCL procedure. It must correspond to the name of an `EXEC PGM=` statement.

CONDDEPSTEPNAME(*procedure invocation step name***)**
Use it in conjunction with CONDDEPPROCSTEP when defining a step level dependency, only if the step is in a procedure, to identify the name of a step that invokes an in-stream or cataloged procedure. It must correspond to the name of an `EXEC PROC=` statement.

CONDDEPDEPTYPE(E | I)
Depending on the dependency type (internal or external), specify one of the following values:

E External predecessor.

I Internal predecessor.

CONDDEPTYPE(RC | ST)
Depending on the type of check that you require on the predecessor, specify one of the following values:

ST To check the predecessor status. It does not apply to step dependencies.

RC To check the predecessor return code.

CONDDEPLOG(GE | GT | LE | LT | NE | RG | EQ)
Depending on the type of check that you require on the predecessor, specify one of the following logical operators:

EQ Equal to.

GE Greater than or equal to. Valid only for RC as CONDDEPTYPE value.

GT Greater than. Valid only for RC as CONDDEPTYPE value.

LE Less than or equal to. Valid only for RC as CONDDEPTYPE value.

LT Less than. Valid only for RC as CONDDEPTYPE value.

NE Not equal to. Use it to specify conditions on final statuses only.

RG Range.

CONDDEPVALST(*status***)**
Status. Valid only for ST as CONDDEPTYPE value.

CONDDEPVALRC1(*return code***)**
Return code value. Valid only for RC as CONDDEPTYPE value.

CONDDEPVALRC2(*second boundary return code***)**
Return code value, as second boundary in a range expressed by the RG logical operator.

Examples

This example defines a condition including two condition dependencies:

```
ADCNC CONDID(  3) CONDDEPNO(2) CONDCOUNT(1)
      CONDDESCR('WITH 2 COND.DEPS')
ADCNS   CONDDEPCONDID( 3)
        CONDDEPPREADID(APPL1)
        CONDDEPPREWSID(CPU1)
        CONDDEPPREOPNO(2)
        CONDDEPDEPTYPE(E)
```

```
        CONDDEPTYPE(ST)
        CONDDEPLOG(EQ)
        CONDDEPVALST(X)
        CONDDEPCSEL(A)
ADCIV   ADCIVADID(APPL1)
        ADCIVCID(3)
        ADCIVOPNO(2)
        ADCIVTYPE(R)
        ADCIVFWHE(B)
        ADCIVFHHH(026)
        ADCIVFMM(30)
        ADCIVTWHE(A)
        ADCIVTHHH(032)
        ADCIVTMM(00)ADCNS   CONDDEPCONDID( 3)
        CONDDEPPREADID(APPL1)
        CONDDEPPREWSID(CPU1)
        CONDDEPPREOPNO(2)
        CONDDEPPROCSTEP(STEP100)
        CONDDEPDEPTYPE(E)
        CONDDEPTYPE(RC)
        CONDDEPLOG(RG)
        CONDDEPVALRC1(4)
        CONDDEPVALRC2(8)
```

The first dependency is to be resolved by finding the matching predecessor within an absolute interval, as defined by the value of CONDDEPCSEL. The details of the interval are defined by the ADCIV statement.

This example shows the complete definition of application APPLBLADDEP1 inclusive of its conditional dependencies.

```
OPTIONS SUBSYS(TWSR) ACTION(REPLACE) DURUNIT(SECONDS)
ADSTART ADID(APPLBLADDEP1) OWNER(RITABL) DESCR('BL ADDDEP')
ADOP WSID(CPU1) OPNO(001) JOBN(JOBB)
ADCNC CONDID(10) CONDDEPNO(4) CONDCOUNT(1)
ADCNS CONDDEPCONDID(10) CONDDEPCSEL(A)
CONDDEPPREADID(APPLBLADCNSPRE) CONDDEPPREWSID(CPU1)
CONDDEPPREOPNO(006) CONDDEPDEPTYPE(E)
CONDDEPTYPE(ST) CONDDEPLOG(EQ) CONDDEPVALST(C)
ADCIV ADCIVADID(APPLBLADCNSPRE) ADCIVOPNO(6) ADCIVCID(10)
ADCIVTYPE(A)
ADCIVFWHE(A) ADCIVFHH(00) ADCIVFMM(19) ADCIVFD(7)
ADCIVTWHE(A) ADCIVTHH(0) ADCIVTMM(20) ADCIVTD(7)
ADCNS CONDDEPCONDID(10) CONDDEPCSEL(A)
CONDDEPPREADID(APPLBLADCNSPRE) CONDDEPPREWSID(CPU1)
CONDDEPPREOPNO(005) CONDDEPDEPTYPE(E)
CONDDEPTYPE(ST) CONDDEPLOG(EQ) CONDDEPVALST(C)
ADCIV ADCIVADID(APPLBLADCNSPRE) ADCIVOPNO(5) ADCIVCID(10)
ADCIVTYPE(A)
ADCIVFWHE(B) ADCIVFHH(10) ADCIVFMM(20) ADCIVFD(3)
ADCIVTWHE(A) ADCIVTHH(23) ADCIVTMM(20) ADCIVTD(7)
ADCNS CONDDEPCONDID(10) CONDDEPCSEL(R)
CONDDEPPREADID(APPLBLADCNSPRE) CONDDEPPREWSID(CPU1)
CONDDEPPREOPNO(004) CONDDEPDEPTYPE(E)
CONDDEPTYPE(ST) CONDDEPLOG(EQ) CONDDEPVALST(C)
ADCIV ADCIVADID(APPLBLADCNSPRE) ADCIVOPNO(4) ADCIVCID(10)
ADCIVTYPE(R)
ADCIVFWHE(B) ADCIVFHHH(0) ADCIVFMM(0)
ADCIVTWHE(A) ADCIVTHHH(0) ADCIVTMM(0)
ADCNS CONDDEPCONDID(10) CONDDEPCSEL(S)
CONDDEPPREADID(APPLBLADCNSPRE) CONDDEPPREWSID(CPU1)
CONDDEPPREOPNO(003) CONDDEPDEPTYPE(E)
CONDDEPTYPE(ST) CONDDEPLOG(EQ) CONDDEPVALST(C)
ADCNC CONDID(20) CONDDEPNO(4) CONDCOUNT(1)
ADCNS CONDDEPCONDID(20) CONDDEPCSEL(A)
CONDDEPPREADID(APPLBLADCNSPRE) CONDDEPPREWSID(CPU1)
```

```
CONDDEPPREOPNO(006) CONDDEPDEPTYPE(E)
CONDDEPTYPE(ST) CONDDEPLOG(EQ) CONDDEPVALST(C)
ADCIV ADCIVADID(APPLBLADCNSPRE) ADCIVOPNO(6) ADCIVCID(20)
ADCIVTYPE(A)
ADCIVFWHE(A) ADCIVFHH(00) ADCIVFMM(19) ADCIVFD(7)
ADCIVTWHE(A) ADCIVTHH(0) ADCIVTMM(20) ADCIVTD(7)
ADCNS CONDDEPCONDID(20) CONDDEPCSEL(A)
CONDDEPPREADID(APPLBLADCNSPRE) CONDDEPPREWSID(CPU1)
CONDDEPPREOPNO(005) CONDDEPDEPTYPE(E)
CONDDEPTYPE(ST) CONDDEPLOG(EQ) CONDDEPVALST(C)
ADCIV ADCIVADID(APPLBLADCNSPRE) ADCIVOPNO(5) ADCIVCID(20)
ADCIVTYPE(A)
ADCIVFWHE(B) ADCIVFHH(10) ADCIVFMM(20) ADCIVFD(3)
ADCIVTWHE(A) ADCIVTHH(23) ADCIVTMM(20) ADCIVTD(7)
ADCNS CONDDEPCONDID(20) CONDDEPCSEL(R)
CONDDEPPREADID(APPLBLADCNSPRE) CONDDEPPREWSID(CPU1)
CONDDEPPREOPNO(004) CONDDEPDEPTYPE(E)
CONDDEPTYPE(ST) CONDDEPLOG(EQ) CONDDEPVALST(C)
ADCIV ADCIVADID(APPLBLADCNSPRE) ADCIVOPNO(4) ADCIVCID(20)
ADCIVTYPE(R)
ADCIVFWHE(B) ADCIVFHHH(0) ADCIVFMM(0)
ADCIVTWHE(A) ADCIVTHHH(0) ADCIVTMM(0)
ADCNS CONDDEPCONDID(20) CONDDEPCSEL(S)
CONDDEPPREADID(APPLBLADCNSPRE) CONDDEPPREWSID(CPU1)
CONDDEPPREOPNO(003) CONDDEPDEPTYPE(E)
CONDDEPTYPE(ST) CONDDEPLOG(EQ) CONDDEPVALST(C)
ADDEP PREADID(APPLBLADCNSPRE) PREOP(001) PREMAND(P)
ADRUN NAME(RULE1) RULE(4) TYPE(R) IATIME(0400) DLTIME(2300)
ADRULE EVERY DAY(DAY) YEAR
```

ADDEP

Purpose

Use the ADDEP control statement to specify an application or an operation as the predecessor of the operation that is being built by the previous ADOP statement. The ADOP statement lets you specify one internal predecessor to the operation being defined. So you need to use ADDEP control statements if the operation has more than one predecessor or if it has any external predecessors.

If the predecessor operation is in a different AD from the one being built, you must specify the PREADID keyword to identify the AD containing the predecessor. You should remember, though, that there can be up to four versions of an AD with different validity dates. If there is more than one version, the batch loader searches the ADs defined by your PREADID keyword to find an AD with a current validity date. ADs with *active* status are searched first, followed by those with *pending* status.

If you do not supply the PREADID keyword, IBM Workload Scheduler for z/OS assumes that the predecessor operation is in the AD that is currently being built (that is, the one defined by the last ADSTART statement).

You identify the predecessor operation by one or more of the following values:

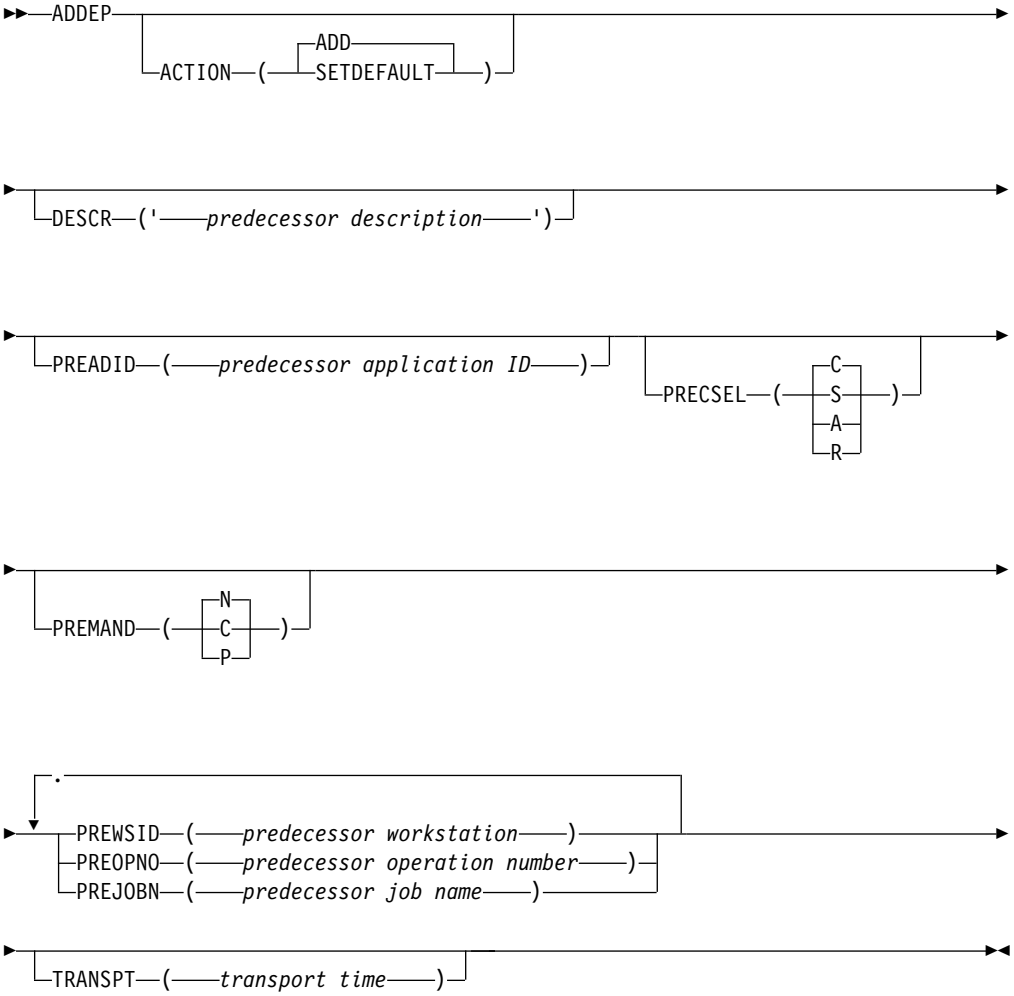
- Operation number (PREOPNO)
- Workstation name (PREWSID)
- Job name (PREJOBN)

You must specify enough of these keywords to uniquely identify the predecessor operation. If you do not specify any of these keywords, an application dependency is added.

If the output is directed to a VSAM data set, the predecessor operation can be defined by an ADOP statement occurring later in the input data set. This is because most validity checking occurs after all statements in the input data set are read.

If the output is directed to an active IBM Workload Scheduler for z/OS subsystem and the predecessor operation does not already exist in the AD database, specify both the operation number and the workstation name in the ADDEP statement.

Format



Restrictions

You cannot use ACTION(SETDEFAULT) to set default values for the following keywords:

PREWSID
PREOPNO
PREJOBN
PREADID

Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, the remaining keyword values that you specify on the ADDEP statement become default values for all ADDEP statements that follow. No application description is updated. Keywords that you do not specify are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

DESCR (*'predecessor description'***)**
A free-format description of the dependency. It can be up to 50 characters and must be contained within single quotation marks. Do not include delimiters, such as parentheses and single quotation marks, in the description.

IBM Workload Scheduler for z/OS holds descriptions only for external dependencies. This field cannot be used to hold a description for an internal dependency.

PREADID (*predecessor application ID***)**
If the predecessor operation is in a different application from the one being built, or is in a different occurrence of the same application, you must identify the application ID with the PREADID keyword. If you use DBCS characters, you must enter them as a quoted string started by a shift-out and ended by a shift-in.

PRECSEL (C | S | A | R)
Specifies on which basis a matching predecessor is selected. Can be one of the following values:

C Closest preceding. The matching predecessor is the one with the nearest preceding input arrival time. This is the default.

S Same scheduled date. The matching predecessor is the one with the nearest input arrival time within the same day of the operation (occurrence) under consideration. A matching predecessor is first searched before the IA time of the operation. Then, if not found, it is searched after the IA time of the operation.

A Within an absolute interval. The matching predecessor is the one with the closest input arrival time in the specified interval. The interval boundaries are specified by a time and a number of days before or after the IA time of the operation (occurrence). The interval can be timed entirely before, entirely after, or across the IA time of the operation (occurrence).

If you select this option, the ADXIV statement must follow ADDEP with the specification of the interval boundaries.

R Within a relative interval. The matching predecessor is the one with the closest input arrival time in the specified interval. The interval boundaries are calculated using an offset expressed in hours and minutes before or after the IA time of the operation (occurrence). The interval can be timed entirely before, entirely after, or across the IA time of the operation (occurrence).

If you select this option, the ADXIV statement must follow ADDEP with the specification of the interval boundaries.

PREMAND (N | C | P)
Specifies if it is mandatory that the dependency be resolved before the operation can start. Can be one of the following values:

N The dependency is not mandatory. This means that, if the predecessor is not found, the dependency is considered resolved unless failure is required (within the dynamic addition of a dependency in the Modify Current Plan panel). This is the default value.

C The dependency is mandatory at ad hoc add level. The predecessor is required, but may not be in the plan at the time the occurrence that includes the successor is added and may be made available later via ETT, PIF, or manual intervention. This means that if the predecessor is not found when an occurrence is added to the current plan, a pending mandatory predecessor entry is created and the occurrence is added in the waiting status. The pending mandatory predecessor entry is created also when LTP and DP batch start running and the predecessor is not found.

P The dependency is mandatory at plan level. The predecessor is expected to exist at the time the occurrence that includes the successor is dynamically added into the current plan (via the MCP panel). If it does not, the addition of the occurrence fails. Also LTP and DP batch will fail if the predecessor is not found when they run.

PREWSID (*predecessor workstation***)**
The four-character workstation name of a predecessor operation to this operation.

PREOPNO (*predecessor operation number***)**
The operation number of a predecessor operation to this operation.

PREJOBN (*predecessor job name***)**
The job name of a predecessor operation to this operation.

TRANSPT (*transport time***)**
When IBM Workload Scheduler for z/OS creates the plan, it allows this many minutes between the completion of the predecessor and the start of the successor operation that is being defined. You must specify an integer. The default is the time specified for the workstation.

Examples

In this example, the operation on workstation CPU1 with job name SMFCHK is made an internal predecessor to the operation being defined. An external predecessor is also defined: operation 020 in application PAYDAILY:

```
ADOP ...
ADDEP PREWSID(CPU1) PREJOBN(SMFCHK)
ADDEP PREADID(PAYDAILY) PREOP(020) DESC('WAIT FOR DAILY PAYROLL') PRECSEL(R)
ADXIV ADXIVADID(PAYDAILY) ADXIVWSID(CPU1) ADXIVOPNO(020) ADXIVTYPE(R) ADXIVFWHE(B)
       ADXIVFHHH(012) ADXIVFMM(30) ADXIVTWHE(B)ADXIVTHHH(000) ADXIVTMM(15)
```

The external dependency is to be resolved by finding the matching predecessor within a relative interval, as defined by the value of PRECSEL. The details of the interval are defined by the ADXIV statement.

ADOP

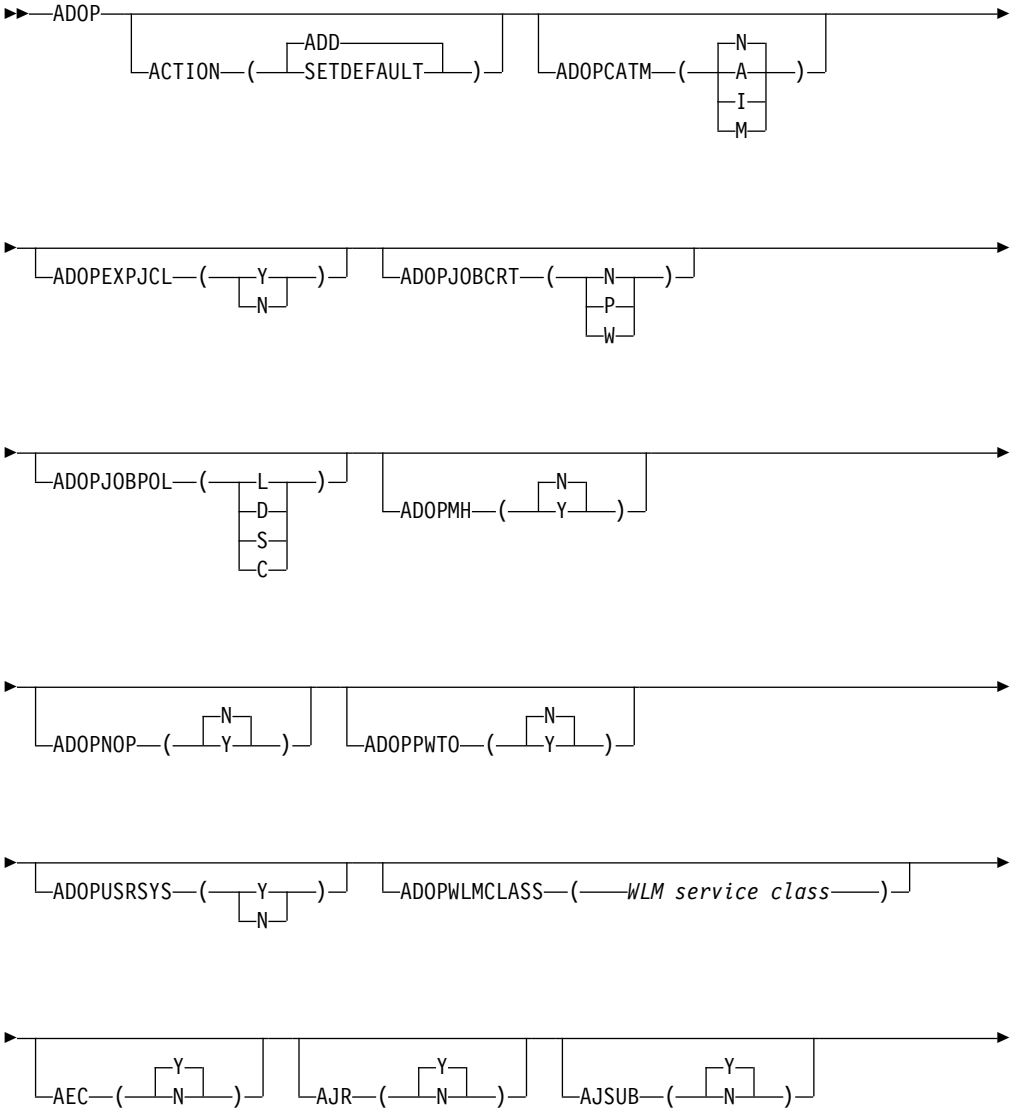
Purpose

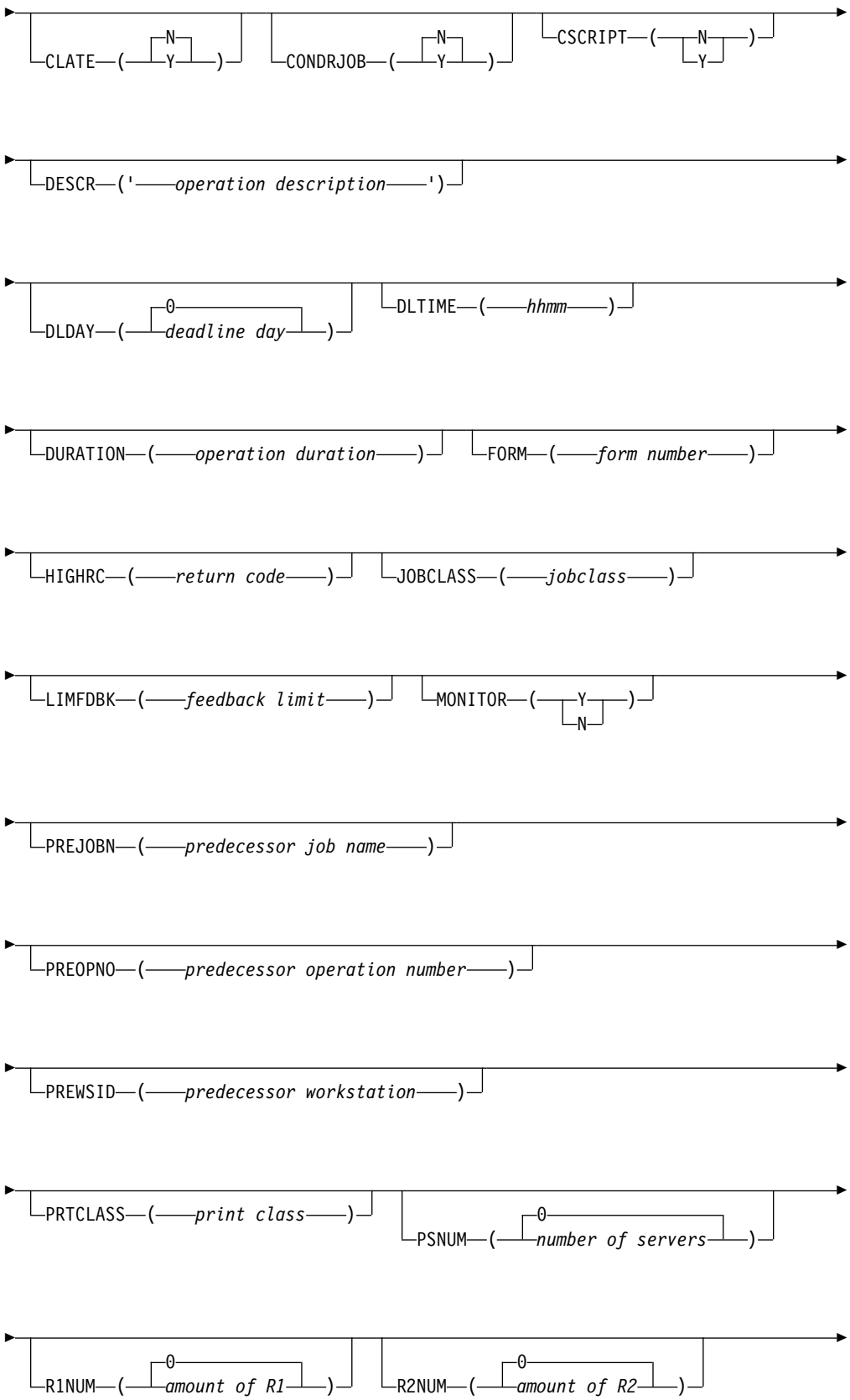
Use the ADOP control statement to add operations to an application description. Provide an ADOP statement for each operation that is to be defined in the current application.

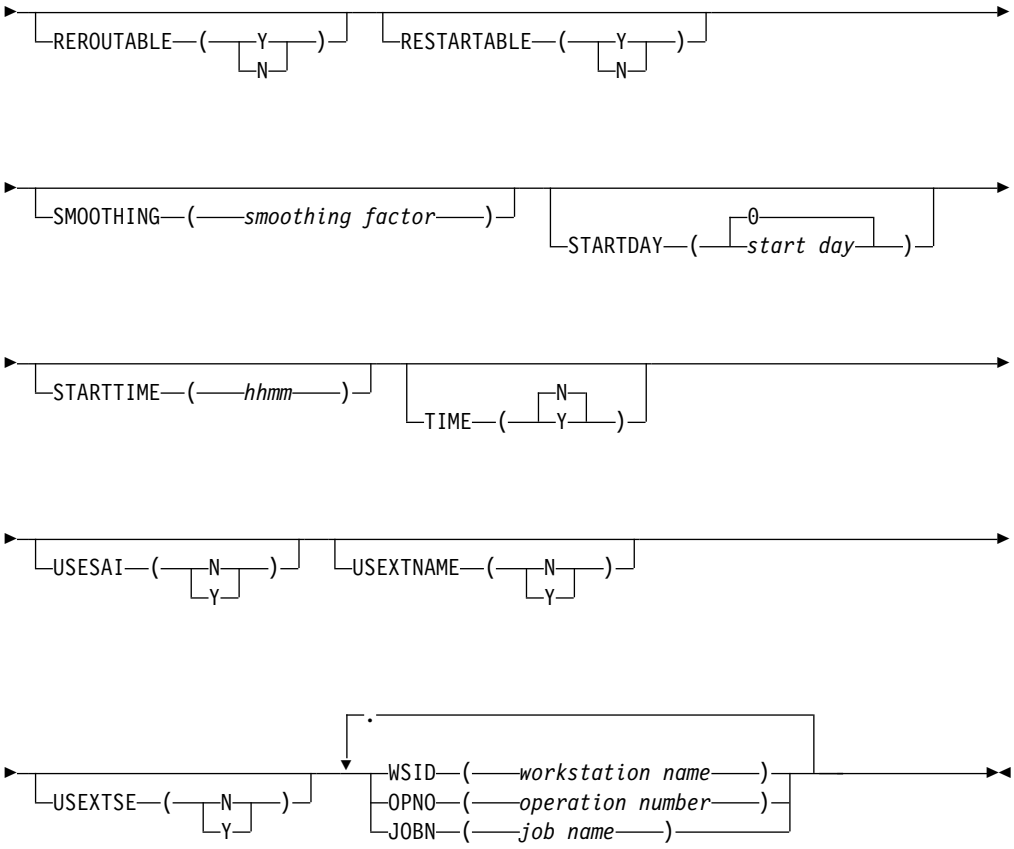
On this statement, you can specify one internal predecessor for the operation being defined. If you need to specify external predecessors, or more internal predecessors, use one or more ADDEP statements immediately after the ADOP statement.

Note: You cannot add operations to a group definition.

Format




CLATE
N
Y
CONDRJOB
N
Y
CSCRIPT
N
Y
DESCR
'operation description'
DLDAY
0
deadline day
DLTIME
hhmm
DURATION
operation duration
FORM
form number
HIGHRC
return code
JOBCLASS
jobclass
LIMFDBK
feedback limit
MONITOR
Y
N
PREJOBN
predecessor job name
PREOPNO
predecessor operation number
PREWSID
predecessor workstation
PRTCLASS
print class
PSNUM
0
number of servers
R1NUM
0
amount of R1
R2NUM
0
amount of R2



Restrictions

You cannot use ACTION(SETDEFAULT) to set default values for these keywords:

WSID
OPNO
JOBN
PREWSID
PREOPNO
PREJOBN

Parameters

ACTION (SETDEFAULT | ADD)

If you specify SETDEFAULT, the remaining keyword values that you specify on the ADOP statement become default values for all ADOP statements that follow. No application description is updated. Keywords that you do not specify are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

ADOPCATM (A | I | M | N)

The cleanup type for this operation:

A Automatic. When the operation is ready to be submitted and the controller selects it for submissions, the controller automatically finds the cleanup actions to be taken and also inserts them as the first step in the JCL of the restarted job. Whenever the operation is started from the panels, the cleanup actions are shown to the user

for confirmation, only if the CLEANUP CHECK option was set to YES through the DEFINING PARAMETERS AND OPTIONS panel.

I Immediate. data set cleanup is immediately performed if the operation ends in error. The operation is treated as if it had the automatic option when it is rerun.

M Manual. data set cleanup actions are deferred for the operation. They are performed when initiated manually from the panel.

N None. No data set cleanup actions are performed.

ADOPEXPJCL (Y | N)
Specifies if the scheduler uses the JCL extracted from the JES JCL sysout.

Y Uses the fully expanded JCL.

N Uses the JCL contained in the libraries of the scheduler.

ADOPJOBCRT (W | P |N)
Specifies if the operation is to be considered critical.

W The operation is considered eligible for Workload Manager (WLM) assistance, if late.

P The operation is considered the target job of a critical path and eligible, with all the operations belonging to that critical path, for WLM assistance.

N The operation is not to be considered critical. This is the default.

For W and P, the scheduler automatically sends a request to WLM to promote the job or started task to the specified WLM service class, whenever the conditions of the specified assistance policy are met.

ADOPJOBPOL (L | D | S | C)
Specifies which policy is to be applied for WLM assistance, if the job is defined as critical.

L Long duration. The job is assisted if it runs beyond its estimated duration time.

D Deadline. The job is assisted if it has not finished when its deadline time is reached.

S Latest start time. The job is assisted if it is submitted after the latest start time.

C Conditional. An algorithm calculates whether to apply the Deadline or the Latest start time policy.

' ' Default. WLM uses the policy specified in OPCOPTS.

If no WLM policy is specified and the operation belongs to a critical path, the policy of the critical path target job is applied.

ADOPMH (Y | N)
If you specify Y, the operation is added to the Application Description database with the Manually Hold option set to Y.

ADOPNOP (Y | N)
If you specify Y, the operation is added to the Application Description database with the NOP option set to Y.

ADOPPWTO (Y | N)
If you specify Y, a WTO message is issued if the operation passes its deadline and is in started status.

ADOPUSRSYS (Y | N)
Specifies if user sysout support is needed. If you specify Y, the data store logs user sysout.

ADOPWLMCLASS (*WLM service class***)**
The name of the WLM service class to which late critical jobs are promoted. It can be an existing service class or a new service class created for this purpose. If you do not set this keyword and the operation belongs to a critical path, the WLM service class of the critical path target job is used.

AEC (N | Y)
For operations on automatic reporting workstations, IBM Workload Scheduler for z/OS does some processing when a job completes to determine whether the operation should be given error status or completed status. If you specify AEC(N), IBM Workload Scheduler for z/OS will not check for errors and will give the operation completed status, regardless of any error reported by job tracking.

AJR (N | Y)
Jobs can be placed in HOLD status on the job queue by the event writer (an event writer option). Such jobs can either be released when all IBM Workload Scheduler for z/OS scheduling conditions are met, or be released immediately. AJR(Y) means that IBM Workload Scheduler for z/OS should control the scheduling. AJR(N) means that IBM Workload Scheduler for z/OS will release the job immediately.

The automatic job release option is applicable only when the HOLDJOB keyword of the EWTROPTS is set to USER or YES.

AJSUB (N | Y)
Automatic job submission.

CLATE (Y | N)
Specify Y to cancel this operation if it is time-dependent and late.

Note: IBM Workload Scheduler for z/OS never cancels a job that has already started running.

CONDRJOB (Y | N)
Specifies if the operation might recover a conditional predecessor.

CSCRIPT(Y| N)
Use this keyword to set the centralized script flag.

DESCR (*'operation description'***)**
A free-format description of the operation. It can be up to 24 characters and must be contained within single quotation marks.

DLDAY (*deadline day* **| 0)**
Specifies the number of days, relative to the start of the application, when this operation must be completed. This must be an integer. 0 means that the deadline is on the same day as the occurrence input arrival.

DLTIME (*hhmm***)**
Required if you have specified DLDAY. DLTIME specifies the time, on the day specified by the DLDAY keyword, by which this operation should be completed. This must be in the format *hhmm*.

DURATION (*operation duration***)**
The estimated duration of this operation in minutes or seconds according to the DURUNIT value in OPTIONS. It must be an integer greater than 0. The maximum value is 99 hours 59 minutes 00 seconds. If you specify 99 hours 59 minutes 01 seconds, you do not receive an alert message if the actual duration is greater than the planned duration.

FORM (*form number***)**
If this operation is a printing operation, the printer form number that will appear on the daily plan and on ready lists. For printer workstations with automatic reporting, the printer class and form number let IBM Workload Scheduler for z/OS identify the different print operations belonging to a specific job. This can be up to 8 characters.

HIGHRC (*return code***)**
If this operation is a z/OS job, the highest return code that should not be considered an error. If the job ends with this return code or less, the operation will be treated by IBM Workload Scheduler for z/OS as completed. This must be an integer less than 4096. If you leave out the parameter, IBM Workload Scheduler for z/OS takes the value you specified in the JTOPTS statement.

JOBCLASS (*jobclass***)**
A single character that appears on workstation ready lists for information only. This should be the z/OS job class from the JCL.

JOBN (*job name***)**
The job name for this operation, if applicable.

LIMFDBK (*feedback limit***)**
The default is the value you set in the job-tracking initialization statement JTOPTS. The feedback limit must be an integer in the range 100-999.

MONITOR (Y | N)
If you specify Y, the operation is monitored by an external monitor, for example by IBM Business Systems Manager.

OPNO (*operation number***)**
The operation number for this operation, in the range 1 to 255. Each operation within an application must have a unique number. If you do not specify an operation number, the default value will be the previous operation in this application, plus 1. If this is the first operation in an application, the default OPNO is 1. You can also specify your own default operation number increment with ACTION(SETDEFAULT).

If ACTION(SETDEFAULT) is specified, the value entered is an increment to be used when allocating a default operation number.

PREJOBN (*predecessor job name***)**
The job name of an internal predecessor operation to this operation.

PREOPNO (*predecessor operation number***)**
The operation number of an internal predecessor operation to this operation.

PREWSID (*predecessor workstation***)**
The workstation name of an internal predecessor operation to this operation.

PRTCLASS (*print class***)**
If this operation is a printing operation, the printer SYSOUT class that appears on the daily plan and on ready lists. For printer workstations with

automatic reporting, the printer class and form number let IBM Workload Scheduler for z/OS identify the different print operations belonging to a specific job. This is a single character, and must be specified for print operations.

PSNUM (*number of servers* **|** **0)**
The number of workstation parallel servers required by this operation. This must be an integer.

R1NUM (*amount of R1* **|** **0)**
The amount of workstation type 1 resources required by this operation. This must be an integer.

R2NUM (*amount of R2* **|** **0)**
The amount of workstation type 2 resources required by this operation. This must be an integer.

REROUTABLE (Y | N)
This keyword specifies the reroute option for the operation. The default is that the operation is reroutable if the WSFAILURE initialization statement RESTART keyword is set to REROUTE.
Y The operation is always reroutable.
N The operation is never reroutable.

RESTARTABLE (Y | N)
This keyword specifies the restart option for the operation. The default is that the operation is restartable if the WSFAILURE initialization statement RESTART keyword is set to RESTART.
Y The operation is always restartable.
N The operation is never restartable.

SMOOTHING (*smoothing factor***)**
The default is the value you set in the job-tracking initialization statement JTOPTS. The smoothing factor must be an integer in the range 0–999.

STARTDAY (*start day* **|** **0)**
Specifies the input arrival day of this operation, as a number of days offset from the occurrence input arrival day (0 means the same day). This must be an integer. Specifying a separate input arrival day and time for an operation can be useful if the operation is time-dependent and you want to ensure that it will not start before the specified time.

STARTTIME (*hhmm***)**
Required if you have specified STARTDAY. STARTTIME specifies the input arrival time of this operation, on the day specified with the STARTDAY keyword. This must be in the format *hhmm*. If you specify STARTTIME but not STARTDAY, STARTDAY defaults to 0 (zero), which is the occurrence input arrival day.

TIME (Y | N)
If you specify Y, the job is made time-dependent. See "Creating time-dependent operations" on page 184 for more details.

USESAI (N | Y)
Determines whether the system automation information for the operation is used in the current plan. This keyword must be set to Y (yes) if the workstation has the system AUTOMATION option set to Y (yes).

USEXTNAME (N | Y)
Determines whether or not the operation extended name is used in the current plan.

USEXTSE (N | Y)
Determines if the Scheduling Environment name of the operation is used in the current plan.

Y Scheduling Environment name specified and stored in CP by the DP or dynamic addition process.

N Scheduling Environment name not specified or specified in AD and not stored in CP by the DP or dynamic addition process.

WSID Specifies the name of the workstation where you are scheduling the operation.

Examples

In this example, a job SMFCHK is given an operation number of 060. It has an internal predecessor—operation 030:

```
ADOP WSID(CPU1) JOBN(SMFCHK) OPNO(060) PREOP(030)
```

The following example creates three operations:

```
ADOP WSID(SETP) JOBN(BACKUP) OPNO(010)
ADOP WSID(CPU1) JOBN(BACKUP) TIME(Y) STARTDAY(0) STARTTIME(2000)
  PREOPNO(010) OPNO(015) DLTIME(2100) ADOPPWTO(Y) ADOPCATM(Y)
ADOP WSID(PRT1) JOBN(BACKUP) PRTCLASS(H) PREOPNO(015)
```

The first, number 010, is on the job setup workstation SETP. The second, number 015, depends on the setup operation, and cannot start before 20.00 because it is time-dependent. If it is still running at 21.00, IBM Workload Scheduler for z/OS issues a DEADLINE WTO. IBM Workload Scheduler for z/OS performs immediate cleanup if the job fails.

The last operation has no number specified, but IBM Workload Scheduler for z/OS gives it operation number 016 (the default operation number increment is 1). It is a print operation, and depends on the predecessor job 015. IBM Workload Scheduler for z/OS will track the output with class H, and report the operation completed when this output has finished printing.

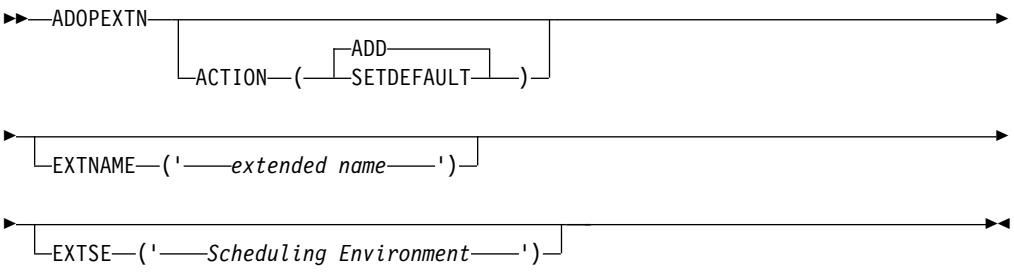
The setup and print operations have the same job name as the main operation; this is required.

ADOPEXTN

Purpose

Use the ADOPEXTN statement to give an operation a descriptive name.

Format



Restrictions

You cannot use ACTION(SETDEFAULT) to set default values for the keyword EXTNAME.

Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, the remaining keyword values that you specify on the ADOPEXTN statement become default values for all ADOPEXTN statements that follow. No application description is updated. Keywords that you do not specify are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

EXTNAME(*'extended name'***)**
A free-format name for the operation. It can include blanks and special characters for a maximum of 54 characters. It must be contained in single quotation marks. Do not include delimiters, such as parentheses and single quotation marks for the extended name.

EXTSE (*'Scheduling Environment name'***)**
The name of the scheduling environment for this operation. Special characters are allowed. To delete the name, enter EXTSE followed by blank.

Examples

This example sets the extended name `daily payroll job` for the operation:

```
ADOP ...
ADOPEXTN  ACTION(ADD) EXTNAME('DAILY PAYROLL JOB')
```

This example removes the extended name for the operation:

```
ADOP ...
ADOPEXTN  ACTION(ADD) EXTNAME(' ')
```

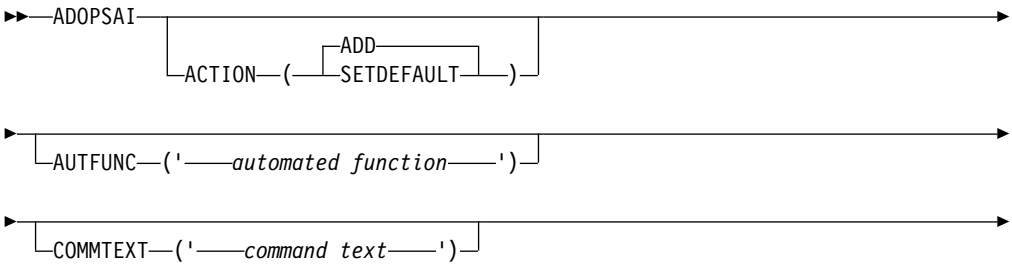
ADOPSAI

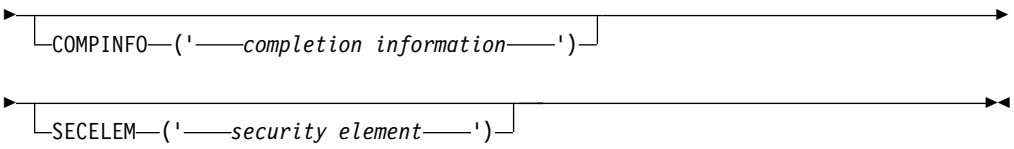
Purpose

Use the ADOPSAI statement to define the system automation information for an operation.

If you specify this statement, set to Y the USESAI parameter of the corresponding ADOP statement.

Format





Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, all the other values that you set in the ADOPSAI statement become the default values for all the ADOPSAI statements that follow. The application description database is not updated. The parameters that you do not set, are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

AUTFUNC(*'automated function'***)**
Alphanumeric name for the automated function field of the operation. It can be up to 8 characters. It must be specified between single quotation marks (see the following examples).

COMMTEXT (*'command text'***)**
Free-format name for the command text of the operation. It can include blanks and special characters for a maximum of 255 characters. It must be specified between single quotation marks. This parameter is required.

COMPINFO (*'completion information'***)**
The completion information for the operation. It can be up to 64 characters. This parameter is positional. You can specify the following information, in the following order, separated by commas:

- Maximum wait time, in the format hh:mm:ss.
- Maximum return code accepted as successful execution.
- Name of an optional user-supplied completion checking routine It must be contained in single quotation marks.

To delete this information, set COMPINFO to blank.

SECELEM (*'security element'***)**
Free-format name for the security element of the operation. It can be up to 8 characters and include blanks and special characters. It must be specified between single quotation marks.

Examples

This example sets the command text and security element for the operation:

```
ADOP ...
ADOPSAI  ACTION(ADD) COMMTEXT('DAILY PAYROLL JOB')
SECELEM('PPPP')
```

This example removes the completion information set for the operation:

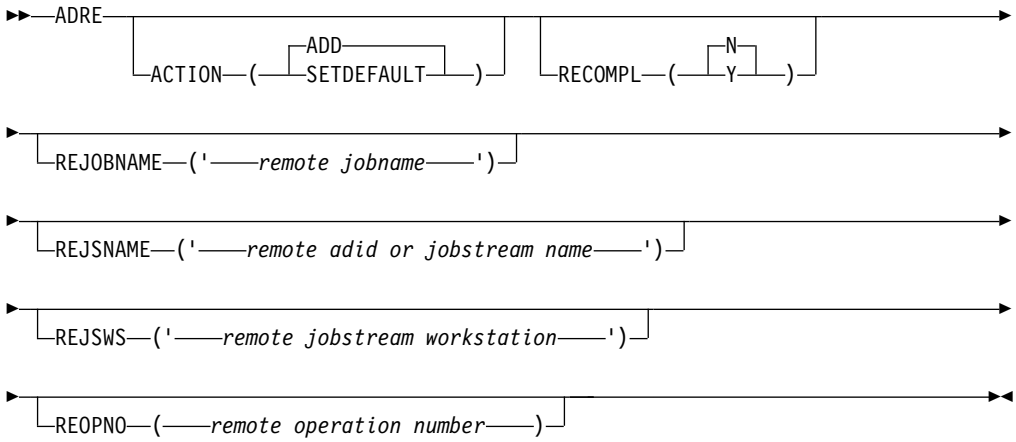
```
ADOP ...
ADOPSAI  ACTION(ADD)
COMMTEXT('DAILY PAYROLL JOB') SECELEM('PPPP') COMPINFO (' ')
```

ADRE

Purpose

Use the ADRE control statement to define the remote job information for an operation.

Format



Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, the remaining keyword values that you specify on the ADRE statement become default values for all ADRE statements that follow. No application description database is updated. Keywords that you do not specify are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

RECOMPL (Y | N)
Specifies if the shadow job status must be automatically set to complete, if the remote job does not exist:

Y Sets the operation status to complete.

N Sets the operation status to error.

REJOBNAME (*'remote jobname'*)
Specifies the remote job name. It can be up to 40 characters and must be specified between single quotation marks. This parameter is required if the remote job runs on an IBM Workload Scheduler remote engine.

REJSNAME (*'remote adid or jobstream name'*)
Specifies the name of the remote application (for IBM Workload Scheduler for z/OS) or of the remote job stream (for IBM Workload Scheduler). It can be up to 16 characters and must be specified between single quotation marks.

REJSWS (*'remote jobstream workstation'*)
Specifies the name of the remote job stream workstation. It can be up to 16 characters and must be specified between single quotation marks. This parameter is required if the remote job runs on an IBM Workload Scheduler remote engine.

REOPNO (*remote operation number***)**
Specifies the remote operation number. It must be a number in the range 1-255. This parameter is required if the remote job runs on an IBM Workload Scheduler for z/OS remote engine.

Examples

In the following example, you set the application name and operation number of a remote job that runs on IBM Workload Scheduler for z/OS:

```
ADOP ...
ADRE ACTION(ADD)
REJSNAME('APPLREMOTE   ')
REOPNO(  1)
RECOMPL(N)
```

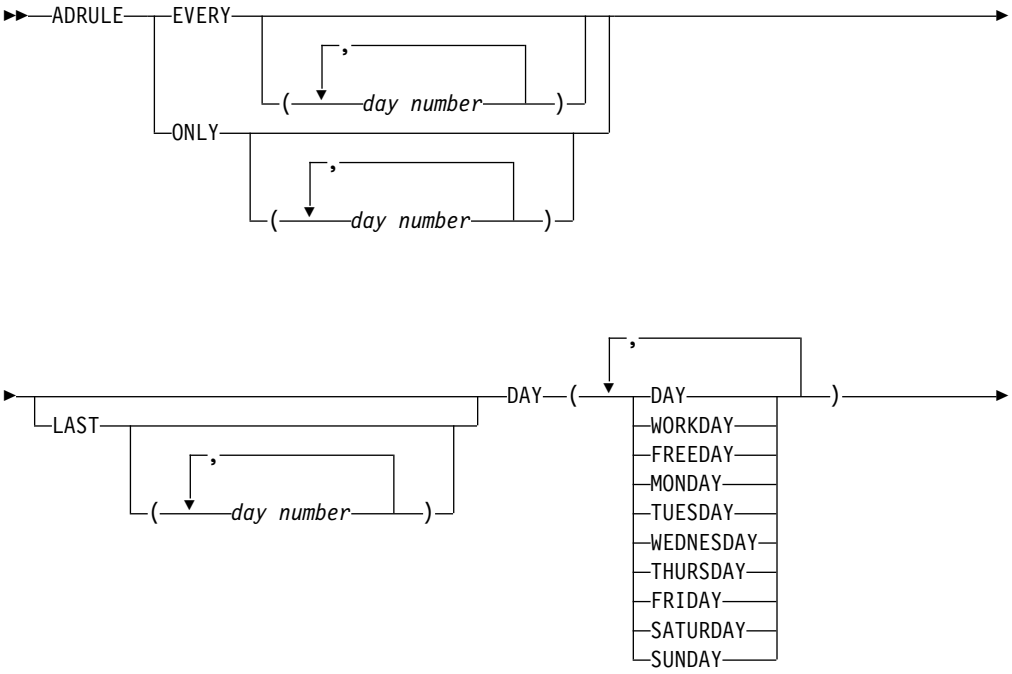
ADRULE

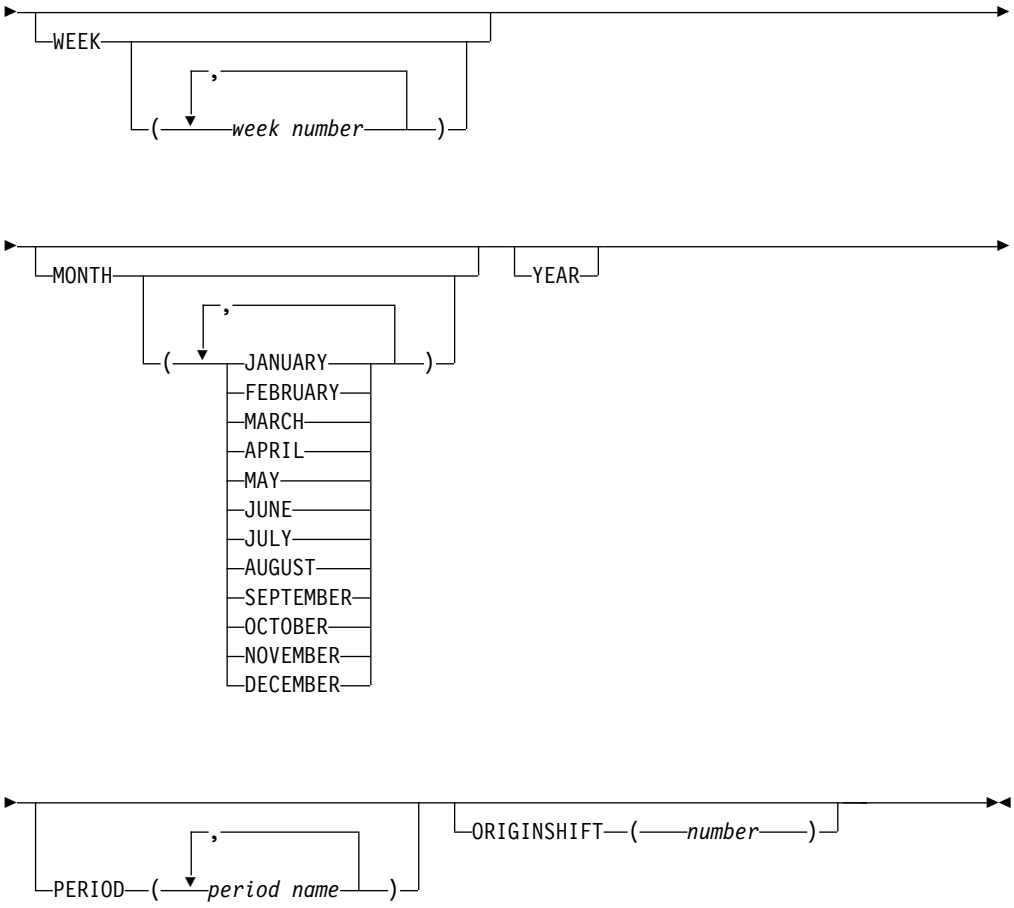
Purpose

Use the ADRULE control statement to specify a rule, which generates a set of dates. The ADRULE control statement must immediately follow an ADRUN or RGRUN statement. If you have many rules, use a pair of ADRUN/ADRULE statements for each one. In run cycle groups, you must use pairs of RGRUN/ADRULE statements.

Note: The only abbreviations allowed for the keywords on this statement are the first letter and OS for ORIGINSHIFT.

Format





Restrictions

You cannot use ACTION(SETDEFAULT) to set default values for this control statement.

Parameters

DAY (DAY | WORKDAY | FREEDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY | SUNDAY)
Specifies the day or days. You can abbreviate the names of the days to MON TUE WED THU FRI SAT SUN WORK and FREE.

EVERY | ONLY
Use EVERY to specify a series of days. For example, EVERY(2) DAY(DAY) FEBRUARY specifies days 1, 3, 5, 7 etc. in February. The origin of the series is 1 unless you also specify ORIGINSHIFT.

Use ONLY to specify the days precisely. For example, ONLY(2) DAY(DAY) FEBRUARY specifies only February 2.

(*day number***)**
Specifies the number (for ONLY) of the day or days to be selected. For EVERY, this specifies the interval of the series. The number is in the range 1 to 999.

LAST (*day number***)**
Specifies the number (for ONLY) of the day or days to be selected. For LAST(3), read "third last," so ONLY LAST(3) DAY(DAY) JANUARY specifies JANUARY 29.

For EVERY, this specifies the interval of the series, starting from the end, so EVERY LAST(3) DAY(DAY) JANUARY specifies January 31, 28, 25 etc. The origin of the series is the last day unless you also specify ORIGINSHIFT. The number is in the range 1 to 999.

MONTH (JANUARY | FEBRUARY | MARCH | APRIL | MAY | JUNE | JULY | AUGUST | SEPTEMBER | OCTOBER | NOVEMBER | DECEMBER)
Specifies the month or months. You can abbreviate the names of the months to the first three characters. If you omit the name of the month, the rule selects every month.

ORIGINSHIFT (*number***)**
Specifies the origin shift in days. The number is in the range 1 to 999. Use this only with the EVERY keyword, when the origin is not the first (or, with LAST, the last) day of the cycle or period. If you specify EVERY(4) DAY(DAY) MONTH ORIGINSHIFT(1), for example, the rule selects a series starting at the *second* day of each month, with an interval of 4 days: January 2, 6, 10 etc., then February 2, 6, 10 etc., for each month in the year.

PERIOD (*period name***)**
The name of a user-defined period, which must be in the period database. If you specify a period name such as JULY, which is the same name as a predefined cycle, IBM Workload Scheduler for z/OS looks for a user-defined period JULY, and gives an error if one does not exist.

WEEK (*week number***)**
Specifies the week number or numbers. The number might range from 1 to 53. Week 1 is defined as the first week with at least 4 days of the new year. If you omit the number, the rule selects every week.

YEAR
Used to specify that the cycle is a year, as in EVERY(2) DAY(DAY) YEAR, which gives January 1, January 3, January 5 etc. for each year. ONLY LAST DAY(FRIDAY) YEAR gives the last Friday in each year.

Examples

In the following example, EX1A (type R) selects the fourth Thursday in each month, or the closest work day before, if the Thursday is a free day (free-day rule 1). EX1B (type E) excludes the last Thursday of the year. Note that the exclusion rule has exactly the same input-arrival time and free-day rule as EX1A:

```
ADRUN NAME(EX1A) TYPE(R) RULE(1) IATIME(1800) DLTIME(2300)
ADRULE ONLY(4) DAY(THU) MONTH
ADRUN NAME(EX1B) TYPE(E) RULE(1) IATIME(1800) DLTIME(2300)
ADRULE ONLY LAST DAY(THU) YEAR
```

In the next example, EX2A (type R) selects February 3 and February 5, whether or not these are free days (rule 3). EX2B (type R) selects March 8, whether or not this is a free day (rule 3). The total effect of the two rules is to select these three days each year:

```
ADRUN NAME(EX2A) TYPE(R) RULE(3) IATIME(1800) DLTIME(2300)
ADRULE ONLY(3,5) DAY(DAY) MONTH(FEB)
ADRUN NAME(EX2B) TYPE(R) RULE(3) IATIME(1800) DLTIME(2300)
ADRULE ONLY(8) DAY(DAY) MONTH(MARCH)
```

EX3A (type R) is a complex rule which is a result of two series. EVERY(2) DAY(DAY) YEAR specifies January 1, 3, 5, 7, 9 etc., and EVERY(3) DAY(DAY) YEAR specifies January 1, 4, 7, 10, 13 etc. IBM Workload Scheduler for z/OS adds these two series and removes the duplicates, creating this series: January 1, 3, 4, 5, 7, 9, 10, 13 etc. It then ignores any days that are free days (free-day rule 4):

```
ADRUN NAME(EX3A) TYPE(R) RULE(4) IATIME(1800) DLTIME(2300)
ADRULE EVERY(2,3) DAY(DAY) YEAR
```

EX4A (type R) specifies every Monday, even if Monday is a free day. Be careful with the work day end time defined in the calendar, because the input arrival time is early (01.00). If the work day end time is 01.00 or later, this rule will cause the application to be scheduled early on *Tuesday* morning, because times up to the work day end time are considered part of the previous day:

```
ADRUN NAME(EX4A) TYPE(R) RULE(3) IATIME(0100) DLTIME(2300)
ADRULE EVERY DAY(MONDAY) YEAR
```

EX5A (type R) specifies every week day (Monday to Friday), even if a free day. EX5B (type E) excludes all work days. The result is to select all week days that are free days:

```
ADRUN NAME(EX5A) TYPE(R) RULE(3) IATIME(0800) DLTIME(2300)
ADRULE EVERY DAY(MON,TUE,WED,THU,FRI)
  YEAR
ADRUN NAME(EX5B) TYPE(E) RULE(3) IATIME(0800) DLTIME(2300)
ADRULE EVERY DAY(WORK) YEAR
```

In the following example, EX6A (type R) specifies the first free day in each week and the first free day in each year, because ONLY without a number is equivalent to ONLY(1). This is really a combination of two simple rules: ONLY(1) DAY(FREEDAY) WEEK and ONLY(1) DAY(FREEDAY) YEAR. The days generated are also affected by the free day rule, so you normally use rule 3 (select the free day) with FREEDAY. If EX6A had specified free-day rule 1 (closest work day before), for example, IBM Workload Scheduler for z/OS would have generated the closest work day before the first free day in each week and the first free day in the year.

```
ADRUN NAME(EX6A) TYPE(R) RULE(3) IATIME(0800) DLTIME(2300)
ADRULE ONLY DAY(FREE) WEEK YEAR
```

Note: You are not recommended to build complex rules that are hard to understand. It is better to create two simple rules:

```
ADRUN NAME(EX6A)TYPE(R)RULE(3)IATIME(0800)DLTIME(2300)
ADRULE ONLY(1)DAY(FREE)WEEK
ADRUN NAME(EX6B)TYPE(R)RULE(3)IATIME(0800)DLTIME(2300)
ADRULE ONLY(1)DAY(FREE)YEAR
```

EX7A (type R) selects February 29. In years that are not leap years, no day is selected:

```
RGRUN NAME(EX7A)TYPE(R)RULE(3)IATIME(0800)DLTIME(2300)
ADRULE ONLY(29)DAY(DAY)MONTH(FEB)
```

EX8A (type R) selects the first day in the year and the first day in week 4. This is another combination rule, like example 6. The free-day rule is 1, so IBM Workload Scheduler for z/OS generates the closest work day before if either January 1 or Monday in week 4 is a free day, generating a day in December or in week 3.

```
RGRUN NAME(EX8A) TYPE(R) RULE(1) IATIME(0800) DLTIME(2300)
ADRULE O D(DAY) W(4) Y    /* USING KEYWORD ABBREVIATIONS  */
```

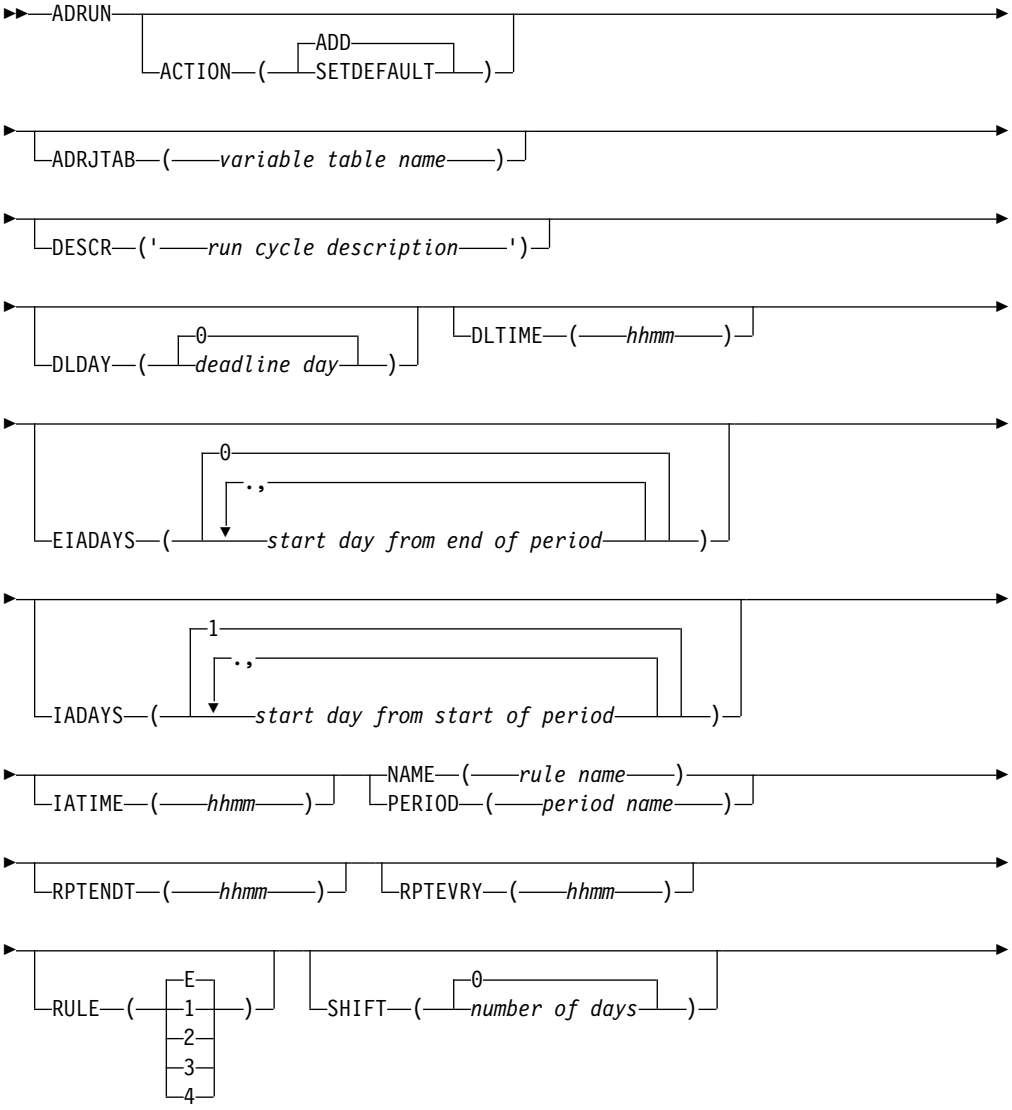
ADRUN

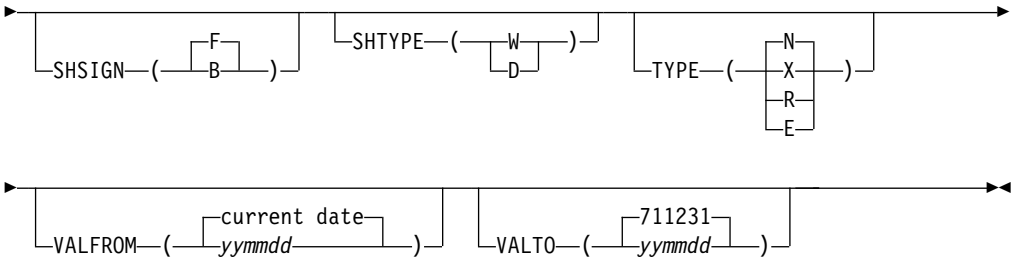
Purpose

Use the ADRUN control statement to add a run cycle specification to an application description. To specify a rule-based run cycle, follow the ADRUN statement with an ADRULE statement. See “Creating run cycles” on page 132 for a description of run cycles. If you are specifying an offset-based run cycle, you supply all the information on the ADRUN statement.

Note: The ADRUN statement cannot be used to add run cycles to an application that is a member of a group; specify ADRUN when you create the group.

Format





Restrictions

You cannot use ACTION(SETDEFAULT) to set default values for the NAME and PERIOD keywords.

Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, the remaining keyword values that you specify on the ADRUN statement become default values for all ADRUN statements that follow. No application description is updated. Keywords that you do not specify are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

ADRJTAB (*variable table name*)
A 16-character field that identifies the JCL variable table to be used for the occurrences generated. For offset-based run cycles, this JCL variable table overrides the one specified for the period. For rule-based run cycles, specify the JCL variable table here, because IBM Workload Scheduler for z/OS ignores any JCL variable table associated with the period. The first character must be alphabetic.

DESCR (*'run cycle description'*)
A free-format description of the run cycle, up to 50 characters and contained in single quotation marks.

DLDAY (*deadline day* | 0)
The number of days from the input arrival day that the application should be completed in: 0 means that the deadline is on the same day as the input arrival day. This must be an integer.

DLTIME (*hhmm*)
The time on the deadline day that the application should be completed by, in the format *hhmm*.

EIADAYS (*start day from end of period* | 0)
Depending on the TYPE keyword, this keyword defines one or more days relative to the start of the period when the application should be scheduled (TYPE N) or when it should not be scheduled (TYPE X). The numbers count from the *end* of the period; 1 is the *last* day.

IADAYS (*start day from start of period* | 1)
Depending on the TYPE keyword, this keyword defines one or more days relative to the start of the period when the application should be scheduled (TYPE N) or when it should not be scheduled (TYPE X). The numbers count from the start of the period; 1 is the first day.

IATIME (*hhmm*)
The time, in the format *hhmm*, that the application is to arrive at the first workstation.

NAME (*rule name*)
For rule-based run cycles, this is the name of the rule—up to 8 characters and unique for this application. Specify NAME, and type R or E, if you are creating a rule-based run cycle.

PERIOD (*period name*)
For offset-based run cycles, this is the name of a cyclic or noncyclic period defined in the calendar database. Specify PERIOD, and type N or X, if you are creating an offset-based run cycle.

RPTENDT (*hhmm*)
The repeat end time for the EVERY options, in the format *hhmm*. It must be a time between the IA time of the run cycle and the calendar work day end time of the application.

RPTEVRY (*hhmm*)
The repeating frequency for the EVERY options, in the format *hhmm*. It specifies that the application has an occurrence in the long-term plan every *hhmm*, starting from the IA time to the repeat end time (RPTENDT keyword). If this keyword is not set, only the occurrence related to the IA time is added to the long-term plan.

RULE (*1* | *2* | *3* | *4* | E)
Defines which free-day rule is in effect. See "Selecting a free-day rule" on page 139.

SHIFT (*number of days* | 0)
The number of days to shift the rule dates. This field is optional. It provides the means to define a run cycle relative to another, where the run cycle without the *shifting* offset is used to schedule an application in relation to which - using the same rule with a negative or positive shift of days - another application is scheduled.

SHSIGN (B | F)
Determines the negative or positive sense of the number defined in SHIFT. B (back) specifies that the shift is of a *number of days* before the dates generated by the rule. F (forth) specifies that the shift is of a *number of days* after the dates generated by the rule.

SHTYPE (W | D)
Defines the type of days that are to be counted for the shift. W implies work days, while D implies any day in the calendar. This keyword is mandatory if you used SHIFT.

TYPE (X | E | R | N)
Specify R or E *without* IADAYS or EIADAYS when you create a rule-based run cycle. You must specify the NAME keyword, and an ADRULE statement must follow this ADRUN statement. R (regular) means that the ADRULE statement specifies days when the application should be scheduled. E (exclusion) means that the ADRULE statement specifies days when the application should not be scheduled.

Specify N or X together with IADAYS or EIADAYS when you create an offset-based run cycle. You must specify the PERIOD keyword. N (normal) means that the IADAYS and EIADAYS parameters define days when the

application should be scheduled. X (negative) means that the IADAYS and EIADAYS parameters define days when the application should not be scheduled.

VALFROM (*yymmdd* **| current date)**
The start date of validity of this run cycle, in the format *yymmdd*. See the note under VALTO.

VALTO (*yymmdd* **| 711231)**
The end date of validity of this run cycle, in the format *yymmdd*.

Note: IBM Workload Scheduler for z/OS interprets the *yy* part in the VALTO and VALFROM keywords as follows:

YY	Year
72 - 99	1972 - 1999
00 - 71	2000 - 2071

Examples

In the following sample, the first ADRUN statement is type R, which is a regular rule-based run cycle. The ADRULE statement immediately following this statement specifies the last work day of each month. The deadline for the application is 21.00 on the same day. The input arrival time is 9.00, but this is not necessarily the time that the application will start.

The second ADRUN statement is type N, which is a normal offset-based run cycle, so you must have defined a period called WEEK. The AD that is being built will be scheduled for the first day in each week. If the first day is a free day, the application is not scheduled for that week.

```
ADRUN NAME(LASTWD) IATIME(0900) DLTIME(2100) TYPE(R) RULE(1)
ADRULE ONLY LAST(1) DAY(WORKDAY) MONTH
⋮
ADRUN PERIOD(WEEK) IATIME(0900) DLTIME(2100) IADAYS(1) RULE(4)
```

In the following example, the statement is used to specify a shift of 2 work days before the last work day of the year.

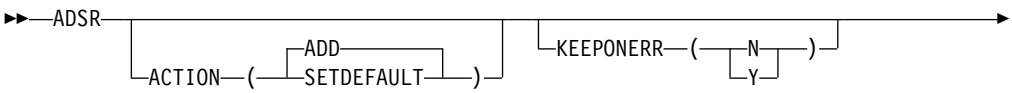
```
ADRUN NAME(LSTWDYE) IATIME(0900) TYPE(R) RULE(1) SHIFT(2) SHSIGN(B) SHTYPE(W)
ADRULE ONLY LAST(1) DAY(WORKDAY) YEAR
```

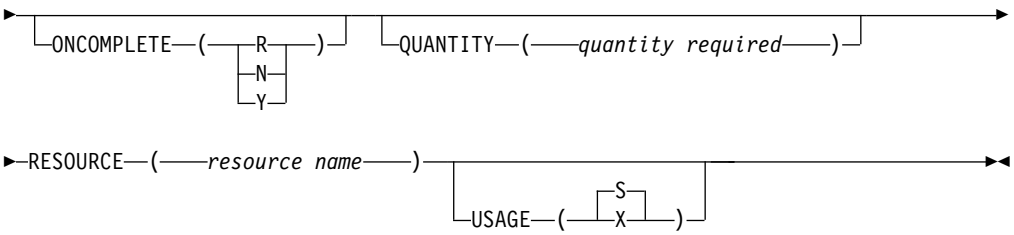
ADSR

Purpose

Use the ADSR control statement to specify the use of special resources by an operation.

Format





Restrictions

You cannot use ACTION(SETDEFAULT) to set default values for this keyword: RESOURCE.

Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, the remaining keyword values that you specify on the statement become default values for all ADSR statements that follow. No application description is updated. Keywords that you do not specify are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

KEEPONERR (N | Y)
Defines whether the resource should be kept if the operation ends in error. If you do not specify this keyword, the default action is taken from the resource definition or RESOPTS statement.

ONCOMPLETE (N| Y | R)
Defines the value to which the global availability of the resource is reset at operation completion. If you do not specify this keyword, the default action is taken from the resource definition or RESOPTS statement.

QUANTITY (*quantity required***)**
The number of this resource that the operation needs, in the range 1 to 999999. If you do not specify this keyword, the operation takes all the resource exclusively, if USAGE is X, or prevents the exclusive use of any of this resource by any other operation, if USAGE is S.

RESOURCE (*resource name***)**
The name of the resource required by this operation. You can specify up to 44 characters. If the name contains special characters, enclose the string in quotation marks.

USAGE (X | S)
Defines whether the resource should be allocated as shared (S) or exclusive (X).

Examples

In this example, the operation needs two of the resource 'LINE.LONDON' exclusively. The KEEPONERR action is taken from the definition in the special resource database:

```
ADOP ...
ADSR RESOURCE(LINE.LONDON) USAGE(X) Q(2)
```

In this example, the operation requires shared access to the whole quantity of the special resource PAYROLL.DATABASE, and keeps its allocation if the operation fails:

```
ADOP ...
ADSR RESOURCE(PAYROLL.DATABASE) KEEP(Y)
```

ADSTART

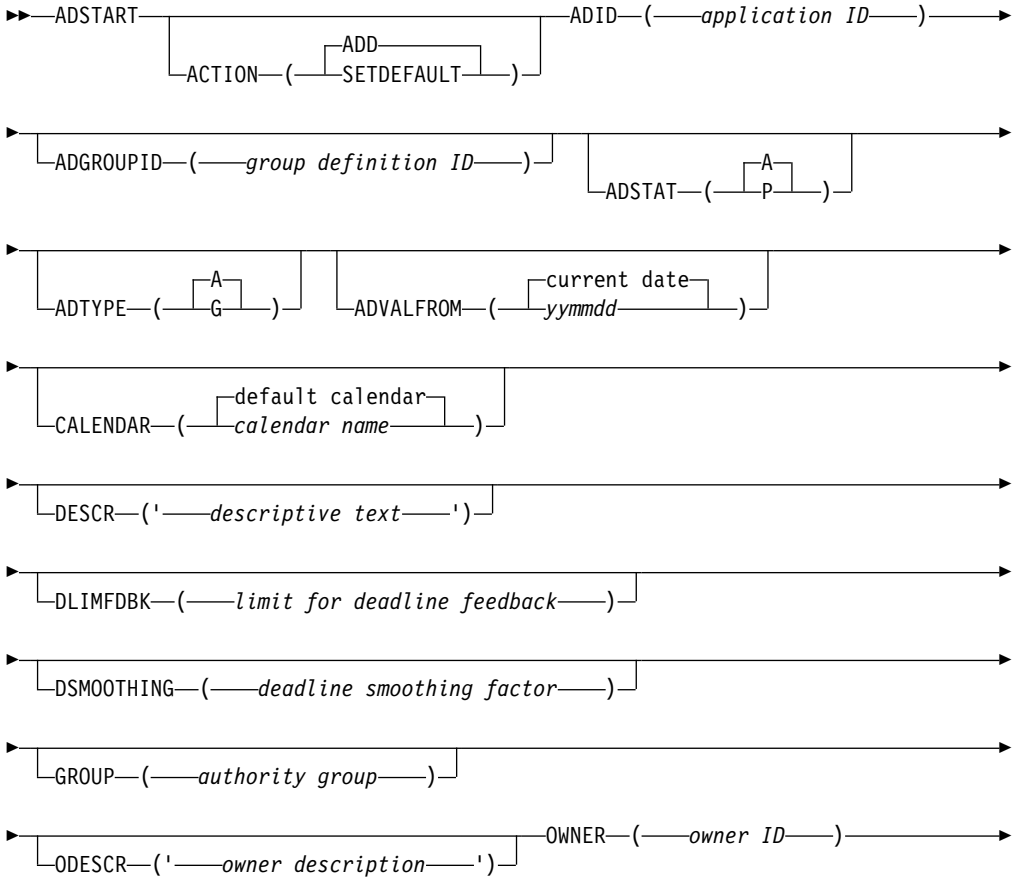
Purpose

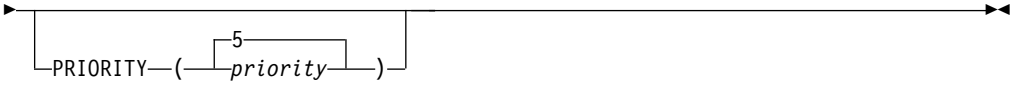
Use the ADSTART control statement to signal the start of an application description. When this statement is found in the input data set, it signals the batch loader to complete the preceding AD or OI being built and write it to the database.

If you have specified OPTIONS ACTION(ADD) and an application description with the same ADID, STATUS, and ADVALFROM already exists, these actions are taken:

- The processing of the ADSTART is terminated.
- An error message is issued.
- The statements that follow are ignored until the next ADSTART or OISTART statement is found in the input data set.

Format





Restrictions

You cannot use ACTION(SETDEFAULT) to set default values for this keyword: ADID.

Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, the remaining keyword values that you specify on the ADSTART statement become default values for all ADSTART statements that follow. No application description is updated. Keywords that you do not specify are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

ADID (*application ID*)
The job name or identifier of the new application, in either EBCDIC or DBCS format, as specified on the OPTIONS statement. If you use DBCS characters, you must enter them as a quoted string started by shift-out (X'0E') and ended by shift-in (X'0F').

An ADID must be specified.

ADGROUPID (*group definition ID*)
The name of the group definition used by this application to generate run cycle information. The name can be in either EBCDIC or DBCS format, as specified on the OPTIONS statement. If you use DBCS characters, you must enter them as a quoted string started by shift-out (X'0E') and ended by shift-in (X'0F').

This keyword is valid only for an ADTYPE of A and should not be specified with CALENDAR.

ADSTAT (A | P)
Application status indicator. A is for active, P is for pending application description.

ADTYPE (A | G)
Application type indicator. A is for applications, G is for group definitions.

ADVALFROM (*yymmdd* | current date)
Defines the start date of the validity period of the AD. Only the start date can be specified. The end of the validity period is set so that the time up to 31 December 2071 is covered, taking existing application descriptions into account. IBM Workload Scheduler for z/OS interprets the *yy* part as follows:

YY	Year
72 - 99	1972 - 1999
00 - 71	2000 - 2071

CALENDAR (*calendar* | *default calendar*)
The name of the calendar to be used when run days are calculated for this application or group definition. Do not specify this keyword for applications that are members of a group.

DESCR (*'descriptive text'***)**
A free-format description of the application up to 24 characters and contained in single quotation marks.

DLIMFDBK (*limit for deadline feedback***)**
The deadline limit for feedback. This keyword determines if the estimated deadline in the application description run cycle or operation is updated when an occurrence of the application reaches the complete status. The DLIMFDBK keyword value you set in this keyword is used only if no value is set in the application description.

Feedback values are in the range 100 through 999. The value 0, meaning that the deadline must always be updated, regardless of the estimated and actual values, cannot be specified at application level in batch loader, PIF, and ISPF panels. It can be specified only in the DLIMFDBK keyword of the JTOPTS statement.

The feedback limits for *ADL* are calculated as follows:
- Lower limit = *ODL* * 100/*DLF*
- Upper limit = *ODL* * *DLF*/100

Where:

ADL The actual deadline, considered as the elapsed minutes between the IA and the completion time of the occurrence or operation.

ODL The old deadline estimated for the run cycle or operation (considered as offset in minutes from the IA) currently stored in the application description database.

DLF The deadline limit for feedback.

When the deadline feedback limit is set to 100, no new estimated deadline is stored in the application description database. If the actual deadline lies within the feedback limits, a smoothing factor is applied before the application description is updated.

If the completion time occurs before the IA time, the deadline is not updated and a missed feedback record is generated.

When the occurrence is generated, an identifier of the run cycle that generates the occurrence is stored in the occurrence record. This identifier is used to determine which run cycle must be updated. If the application description or the occurrence input arrival was modified, the run cycle might no longer be matchable. In this case, the deadline is not updated and a missed feedback record is generated.

DSMOOTHING (*deadline smoothing factor***)**
The smoothing factor. It determines how much the actual deadline influences the new deadline estimated for a run cycle or operation in the application description database. The smoothing factor is applied only if the actual deadline lies within the deadline feedback limits. The DSMOOTHING keyword value is used only if you did not set a smoothing factor in the application description.

The smoothing factor is in the range 0 through 999. A value of 0 means that the deadline is not updated, a value of 100 means that the actual deadline replaces the existing estimated deadline.

The new deadline is calculated as follows:

```
NDL = ODL + ((ADL - ODL) * DSF/100)
```

Where:

NDL The new deadline estimated for the run cycle or operation (considered as offset in minutes from the IA) to be stored in the application description database.

ODL The old deadline estimated for the run cycle or operation (considered as offset in minutes from the IA) currently stored in the application description database.

ADL The actual deadline, considered as the elapsed minutes between the IA and the completion time of the occurrence or operation.

DSF The smoothing factor.

GROUP (*authority group***)**
The name of the application authority group to be used for additional authority checking. You can specify up to 8 characters.

ODESCR (*'owner description'***)**
A free-format description of the application owner up to 24 characters and contained in single quotation marks.

OWNER (*owner ID***)**
The name of the application owner. You can specify up to 16 characters for EBCDIC, or 7 characters for DBCS. The lowercase alphabetic characters, a–z, are translated to uppercase A–Z. If you use DBCS characters, you must enter the name as a quoted string started by a shift-out and ended by a shift-in. This keyword is required.

PRIORITY (*priority* | **5)**
The scheduling priority of the application. Must be a single digit in the range 1–9. This keyword is valid only for an ADTYPE of A.

Examples

This example sets defaults for all following ADSTART statements:

```
ADSTART  ACTION(SETDEFAULT) OWNER(PAYGRP) PRIORITY(6)
     ODESCR('PAYROLL GROUP')
```

In this example, the batch loader will create application REORG7, which is an urgent application. It will be valid for inclusion in IBM Workload Scheduler for z/OS plans on the first day of 1999:

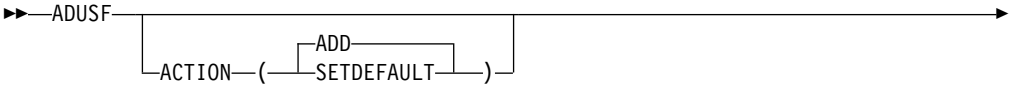
```
ADSTART  ADID(REORG7) PRIORITY(9) DESCR('Reorganize IMS databases')
         ADVALFROM(990101) OWNER(XDARVOD)
```

ADUSF

Purpose

Use the ADUSF statement to define user fields for the operation. For detailed information about user fields, refer to "Creating user fields to specify additional information" on page 174.

Format



Restrictions

You cannot use ACTION(SETDEFAULT) to set a default value for the UFNAME keyword.

Parameters

ACTION (SETDEFAULT | ADD)
ACTION(SETDEFAULT) is applicable only to the UFVALUE keyword. If you specify SETDEFAULT, the value that you set for UFVALUE becomes the default for all the UFVALUE keywords that you set in the ADUSF statement. The application description database is not updated.

If you specify ADD or use it by default, the statement can result in an update of the database.

UFNAME(*'user field name'***)**
The name for the user field, up to a maximum of 16 characters and enclosed in single quotation marks.

UFVALUE(*'user field value'***)**
The value for the user field, up to a maximum of 54 characters and enclosed in single quotation marks. You can set the user field value to blank.

Examples

This example defines the user field `Path`, which is set to `/TWS/local/zcentric`, and the user field `Workstation name`, which is set to `Lab1328`:

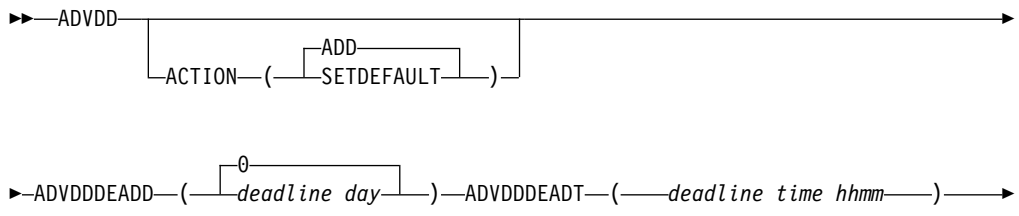
```
ADOP...
ADUSF
  UFNAME ('Path')
  UFVALUE ('/TWS/local/zcentric')
ADUSF
  UFNAME ('Workstation name')
  UFVALUE ('Lab1328')
```

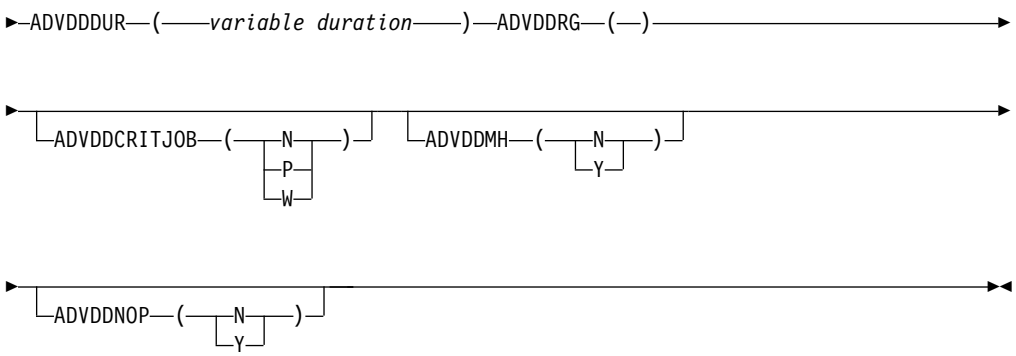
ADVDD

Purpose

Use the ADVDD statement to add a variable duration and deadline section to the operation of an application description. For more detailed information about variable durations and deadlines, see "Specifying input arrival times, deadlines, and durations for operations" on page 168.

Format





Restrictions

You cannot use ACTION(SETDEFAULT) to set a default value for the ADVDDRG keyword.

Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, the remaining keyword values that you specify on the ADVDD statement become the default values for all ADVDD statements that follow. The application description database is not updated. Keywords that you do not specify are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

ADVDDCRITJOB(N | P | W)
Optional. Specifies a variable Job Critical indicator to be associated with a variable run cycle. Valid values are:

N Not eligible for WLM assistance.

P Critical Path target.

W Eligible for WLM assistance.

ADVDDDEADD(*deadline day* **| 0)**
The number of days from the input arrival day in which the application is to be completed: 0 means that the deadline is on the same day as the input arrival day. This value must be an integer.

If specified, this value replaces the operation deadline day for the occurrence generated by the ADVDDRG keyword specified in the same ADVDD statement.

ADVDDDEADT(*deadline time***)**
Required if you have specified the ADVDDDEADD keyword. ADVDDDEADT specifies the time, related to the day set by ADVDDDEADD, by which this operation is to be completed. This value must be in the format *hhmm*.

If specified, this value replaces the operation deadline time for the occurrences generated by the ADVDDRG keyword specified in the same ADVDD statement.

ADVDDDUR(*variable duration***)**
The duration of the current operation, specified in seconds. It must be an integer greater than 0. The maximum value is 99 hours 59 minutes 00 seconds.

If specified, this value replaces the operation duration for the occurrences generated by the ADVDDRG keyword specified in the same ADVDD statement.

ADVDDRG(*run cycle group or application rule***)**
Required. The name of the run cycle group or the name of the rule that is defined in the application. This value defines the occurrence dates when the variable duration and deadline is applied for the current operation.

ADVDDMH (N | Y)
Optional. Specifies a variable Manually Hold option to be associated with a variable run cycle. If you set it to Y, the Manually Hold option is set to Y in the Application Description database that is associated with the related ADVDD run cycle.

ADVDDNOP (N | Y)
Optional. Specifies a variable NOP option to be associated with a variable run cycle. If you set it to Y, the NOP option is set to Y in the Application Description database that is associated with the related ADVDD run cycle.

Example

This example defines the variable durations and deadlines, associated respectively to the application rules RULE1 and RULE2, and to the run cycle group RUNG10, which are set for the operation 001.

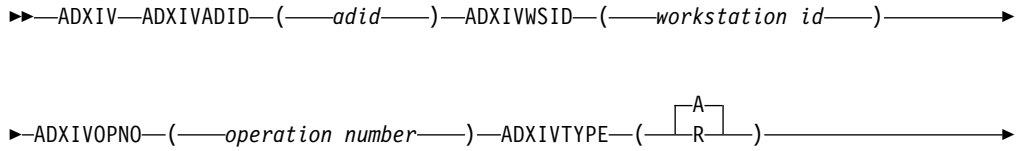
```
ADOP WSID(CPU1) OPNO(001) JOBN(JOBB)
  ADVDD
    ADVDDDUR(003600)
    ADVDDRG(RULE1 )
  ADVDD
    ADVDDDUR(007200)
    ADVDDDEADD( 2) ADVDDDEADT(2300)
    ADVDDRG(RULE2 )
  ADVDD
    ADVDDDEADD( 1) ADVDDDEADT(1830)
    ADVDDRG(RUNG10 )
```

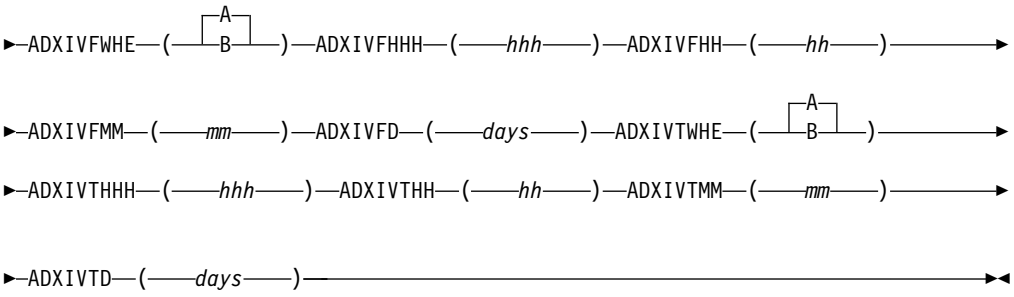
ADXIV

Purpose

Use the ADXIV statement to define the absolute or relative interval specified with the A or R value in the ADDEP PRECSEL parameter. Only one ADXIV can be used for each ADDEP statement. The statement must be nested within the ADDEP to which it refers.

Format





Parameters

ADXIVADID(*adid* **)**
The application name of the external predecessor to which the interval applies.

ADXIVFD(*days***)**
The start of the absolute interval in days. The allowed range is 0-7.

ADXIVFHH(*hh***)**
The start of the absolute interval in the HH format. The allowed range is 00-24. Goes together with ADXIVFMM. For example, if the absolute interval starts at 10:30 of the day before the input arrival time of the successor, it is defined by:

```
ADXIVFHH(10) ADXIVFMM(30) ADXIVFD(1) ADXIVFWHE(B)
```

ADXIVFHHH(*hhh***)**
The start of the relative interval in hours. The format is HHH and the allowed range is 0-167. Goes together with ADXIVFMM.

ADXIVFMM(*mm***)**
The *minutes* fraction of the start of the relative or absolute interval.

ADXIVFWHE(A | B)
Specifies if the start of the relative or absolute interval is before (B) or after (A) the input arrival time of the successor.

For relative intervals only, you can choose to make the interval start at an indefinite time in the plan (in this case the mechanism used is similar to that of the *closest preceding* predecessor). To do this, do not specify this parameter, nor any of the ADXIVF... ones.

ADXIVOPNO(*operation number***)**
The operation number of the external predecessor to which the interval applies.

ADXIVTD(*days***)**
The end of the absolute interval in days. The allowed range is 0-7.

ADXIVTHH(*hh***)**
The end of the absolute interval in the HH format. The allowed range is 00-24. Goes together with ADXIVTMM. For example, if the absolute interval ends at 12:30 two days after the input arrival time of the successor, it is defined by:

```
ADXIVTHH(12) ADXIVTMM(30) ADXIVTD(2) ADXIVTWHE(A)
```

ADXIVTHHH(*hhh***)**
The end of the relative interval in hours. The format is HHH and the allowed range is 0-167. Goes together with ADXIVTMM.

ADXIVTMM(*mm*)
The *minutes* fraction of the end of the relative or absolute interval.

ADXIVTWHE(A | B)
Specifies if the end of the relative or absolute interval is before (B) or after (A) the input arrival time of the successor.

ADXIVTYPE(A | R)
The interval type. Can be one of the following:

A Absolute interval. Must be defined by the following parameters: ADXIVFWHE, ADXIVFHH, ADXIVFMM, ADXIVFD, ADXIVTWHE, ADXIVTHH, ADXIVTMM, ADXIVTD.

R Relative interval. Must be defined by the following parameters: ADXIVFWHE, ADXIVFHHH, ADXIVFMM, ADXIVTWHE, ADXIVTHHH, ADXIVTMM.

ADXIVWSID(*workstation ID*)
The name of the workstation running the external predecessor to which the interval applies.

Examples

This example specifies the absolute interval where an occurrence of application PAYDAILY containing the operation 020, run by workstation CPU1, is to be searched as a matching predecessor for the successor (the PAYWEEK operation defined in a preceding ADOP statement). The interval starts at 9 the day before the input arrival time of PAYWEEK (12:00) and ends at 15:30 of the same day that PAYWEEK is supposed to run.

```
ADXIV   ADXIVADID(paydaily) ADXIVWSID(cpu1) ADXIVOPNO(020) ADXIVTYPE(A)
        ADXIVFWHE(B) ADXIVFHH(09) ADXIVFMM(00) ADXIVFD(1) ADXIVTWHE(A)
        ADXIVTHH(15) ADXIVTMM(30) ADXIVTFD(0)
```

This example specifies a relative interval to search the matching predecessor that resolves the same dependency of the previous example. The interval starts at an indefinite time before the input arrival time of PAYWEEK and ends 3 minutes before the input arrival time of PAYWEEK.

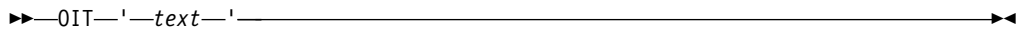
```
ADXIV   ADXIVADID(paydaily) ADXIVWSID(cpu1) ADXIVOPNO(020) ADXIVTYPE(R)
        ADXIVTWHE(B) ADXIVTHHH(000) ADXIVTMM(03)
```

OIT

Purpose

Use the OIT control statement to add one line of operator instruction text to the current operator instruction.'

Format



Parameters

'*text*' A line of text to be added at the end of the current operator instruction. You can have up to 443 lines in each instruction. Each line can be up to 66 characters and must be contained within single quotation marks.

Examples

```
OISTART ...
OIT 'Enter password for update'
OIT 'of IMS database'
```

OISTART

Purpose

Use the OISTART control statement to start the creation of a new operator instruction. The text contained in the OIT statements that follow it will form the new operator instruction.

To identify which AD the operator instruction relates to, supply the ADID keyword. To identify the operation within the AD, also specify at least one of the following:

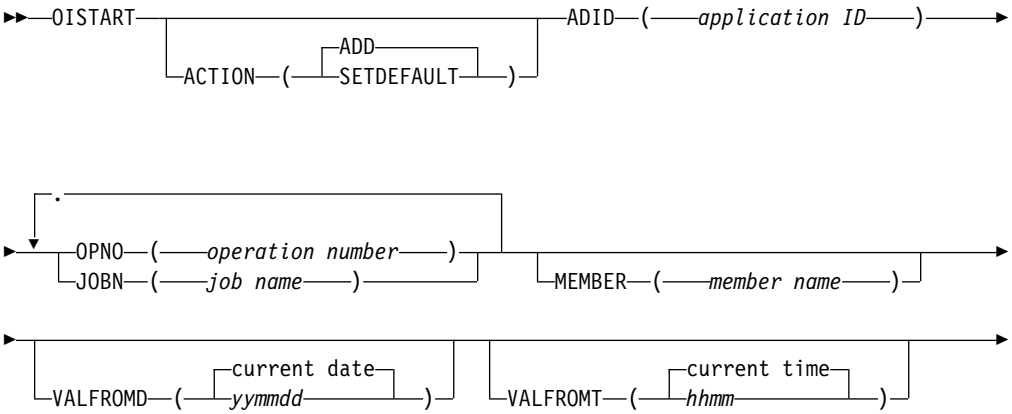
- Operation number (OPNO)
- Job name (JOBN)

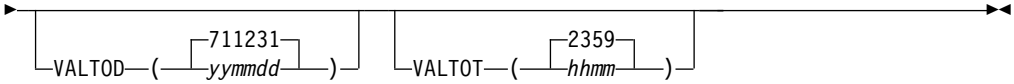
You must specify enough of these keywords to uniquely identify the operation. If more than one operation or no operations match your specification, an error message is issued and no OI is created. This also happens if an OI already exists for the same application ID and operation (with a validity time that overlaps the time specified by this request) unless REPLACE is specified on the OPTIONS statement.

If the output is directed to a VSAM data set, the operation can be defined by an ADOP statement occurring later in the input data set. This is because most validity checking occurs after all statements in the input data set are read.

If the output is directed to an active IBM Workload Scheduler for z/OS subsystem, the operation specified must already exist on the AD database. It cannot be defined later in the input data set.

Format





Restrictions

You cannot use ACTION(SETDEFAULT) to set default values for these keywords:

ADID
OPNO
JOBN
MEMBER

Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, the remaining keyword values that you specify on the OISTART statement become default values for all OISTART statements that follow. No OI is updated. Keywords that you do not specify are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

ADID (*application ID***)**
The identifier of the application. If you use DBCS characters, they must be entered as a quoted string started by a shift-out and ended by a shift-in.

You must specify ADID.

JOBN (*job name***)**
The job name of the operation that this OI is for.

MEMBER (*member name***)**
If you specify the MEMBER keyword, the OI text must reside in the partitioned data set (PDS) defined by the EQQOIPDS DD statement. It must be free format in columns 1 to 72. The MEMBER keyword specifies which member in the PDS contains the OI text.

OPNO (*operation number***)**
The operation number of the operation that this OI is for.

VALFROMD (*yymmdd* **| current date)**
The start date of validity of this OI. You must specify this in the format *yymmdd*. See the notes after VALTOT.

VALFROMT (*hhmm* **| current time)**
The start time of validity of this OI. You must specify this in the format *hhmm*. See the notes after VALTOT.

VALTOD (*yymmdd* **| 711231)**
The end date of validity of this OI. You must specify this in the format *yymmdd*. See the notes after VALTOT.

VALTOT (*hhmm* **| 2359)**
The end time of validity of this OI. You must specify this in the format *hhmm*. See the following notes.

Note:

1. If you do not supply any of these VAL keywords, IBM Workload Scheduler for z/OS assumes that the operator instruction is permanent.
2. IBM Workload Scheduler for z/OS interprets the *yy* part as follows:

YY	Year
72 - 99	1972 - 1999
00 - 71	2000 - 2071

Examples

In this example, the OISTART specifies that operator instruction text for operation 020 in the application PAYDAILY will follow this statement:

```
OISTART ADID(PAYDAILY) OPNO(020)
OIT ...
```

In this example, the OISTART specifies that operator instruction text for operation 020 in the application PAYDAILY is in the PAYDAILY member of the PDS defined by the EQQOIPDS ddname:

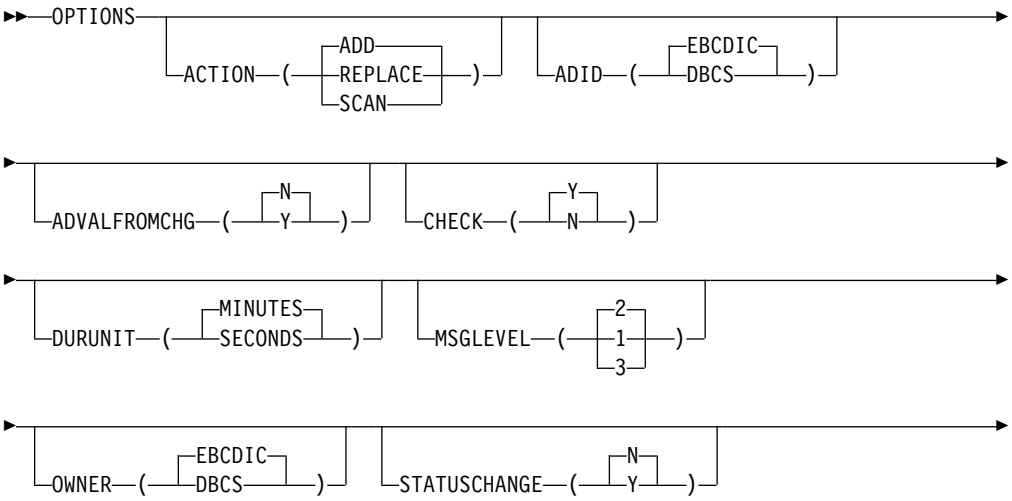
```
OISTART ADID(PAYDAILY) OPNO(020) MEMBER(PAYDAILY)
```

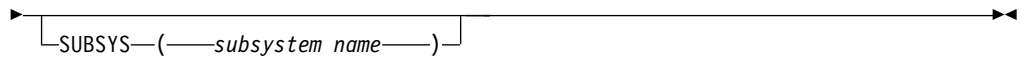
OPTIONS

Purpose

Use the OPTIONS control statement to define execution options for the batch loader. None of the keywords are required. It is no longer true that there can be only one options statement in the input data set and that it must be the first not commented card. It is now allowed to have more options statements in the sysin file, with the rule that the subsequent not commented card must be another options card or an ADSTART or an OISTART. Note that this does not mean that you can have different values of the options operands based on the position of the different options statements. If an operand of the options statement is present more than once in the sysin file, the entire processing will take place with the last value specified, not just from the point where the operand has been changed.

Format





Parameters

ACTION (SCAN | REPLACE | ADD)
If you specify ACTION(SCAN), only basic syntax validity checking is performed on the remaining control statements in the input data set. The batch loader does not produce any output other than error messages.

ACTION(ADD) specifies that you are adding new ADs and OIs. If you attempt to add an AD or OI that already exists in the database, an error message is produced, and the AD or OI is not added.

ACTION(REPLACE) specifies that ADs and OIs defined in the input data set can replace existing ones in the database if they have the same name.

ADID (DBCS | EBCDIC)
Specifies the format of the application ID data that you will use in ADID and PREADID keywords in your control statements. You specify whether you will use EBCDIC or DBCS characters. DBCS means that the application ID should consist of double-byte character set characters only. If you have specified the SUBSYS keyword, you must use the format specified for that subsystem. If you have not specified the SUBSYS keyword, EBCDIC will be the default.

ADVALFROMCHG (N | Y)
The ADVALFROMCHG keyword instructs the batch loader about whether to replace the existing version of an application description whose validity interval is defined by the ADVALFROM of the application being added through the ADSTART statement.

Specify ADVALFROMCHG(Y) if the existing version of the AD is to be replaced by the version created by the batch loader and ADVALFROM is to be changed accordingly. You cannot specify ADVALFROMCHG(Y) if ACTION(ADD) or STATUSCHANGE(Y).

The default is ADVALFROMCHG(N). The existing version of the application description is replaced only if the application ID, type, valid from date, and status are consistent. Otherwise, a new version is added.

CHECK (Y | N)
The CHECK keyword instructs the batch loader to perform validity checking for the application descriptions, for example by checking whether a workstation exists in the workstation database. If CHECK(Y) is specified and an error is found, the application description record is not updated. When CHECK(N) is specified, the application is updated regardless of errors.

CHECK(N) should be used with care, because it can result in storing invalid applications. This can cause problems in the long-term and current plans. If CHECK(N) is unavoidable, the application descriptions should be given a future valid-from date, using the ADVALFROM keyword of the ADSTART statement, that makes the applications unavailable to the long-term or current plans until the applications can be verified.

Validity checking (other than basic syntax checking) is not done when OPTIONS ACTION(SCAN) is specified, because no output data set is produced, so do not specify the CHECK keyword.

DURUNIT (MINUTES | SECONDS)
Sets the unit in which duration is entered. You specify whether you use MINUTES or SECONDS. DURUNIT(SECONDS) causes the value entered by means of the DURATION keyword of the ADOP statement to be treated as a number of seconds. If DURUNIT(MINUTES) is specified or DURUNIT is left out of the DURATION value of the ADOP statement, it is treated as a number of minutes.

MSGLEVEL (1 | 3 | 2)
Controls the messages generated by the batch loader:

Level 1
This is the lowest level. Error messages and exceptional information messages are written.

Level 2
Includes level 1. A message is also written each time the statement making up one record is received and the syntax has been checked and passed.

Level 3
Includes level 2. In addition, each statement is written to the message log when the statement is processed.

By setting MSGLEVEL to 3, the input SYSIN for the batch loader JCL is scanned twice; in this way, some inconsistencies found during the first scan might be removed. For example, if during the first scan the system finds a successor operation defined *before* its predecessor, the successor is not inserted into the AD and message EQQY221E is displayed. Continuing the first scan, the system finds the predecessor and adds it to the AD. By specifying MSGLEVEL(3), this inconsistency is resolved during the second scan of the input SYSIN, because when the system scans the successor operation, the predecessor is already in the AD.

OWNER (DBCS | EBCDIC)
Specifies the format of the owner data that you will use in the OWNER keyword of ADSTART control statements. You specify whether you will use EBCDIC or DBCS characters. DBCS means that the owner ID should consist of double-byte character set characters only. If you have specified the SUBSYS keyword, you must use the format specified for that subsystem. If you have not specified the SUBSYS keyword, EBCDIC will be the default.

STATUSCHANGE (N | Y)
Determines whether the application description record is modified according to a new version, or a new record is created. Generally, when the batch loader creates a new version of an application description whose ID, type, valid-to date, and status are already recorded, the application description record is updated. If you specify STATUSCHANGE(Y), the application description record is updated even if the application status is different, and the status itself is modified to the new value. This is true, only if another application with the same credentials and status does *not* already exist.

If you specify STATUSCHANGE(N), the application description already recorded is updated if all the credentials of the new application match, otherwise a new record is created. This is the default.

SUBSYS (*subsystem name***)**

The SUBSYS keyword indicates which IBM Workload Scheduler for z/OS subsystem the output will be directed to. If this keyword is not specified, output will be directed to the VSAM data sets defined by the EQQADDS and EQQOIDS DD statements. If the JCL includes either or both of these DD statements when output is directed to an IBM Workload Scheduler for z/OS subsystem, they are ignored.

Note: Do not use the data sets defined by EQQADDS and EQQOIDS if they are allocated to an active subsystem, otherwise the files might become corrupted.

Examples

In this example, the batch-loader output is directed to a subsystem called OPC1. Default values selected are ACTION(ADD), CHECK(Y), ADID(EBCDIC), OWNER(EBCDIC), MSGLEVEL(2), and DURUNIT(MINUTES).

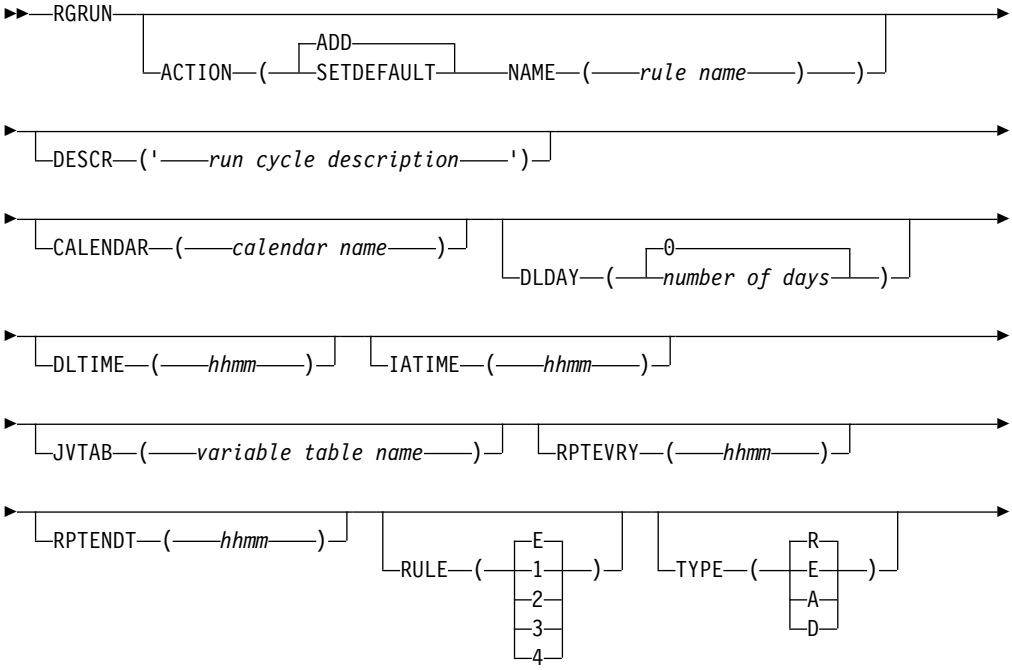
```
OPTIONS SUBSYS(OPC1)
```

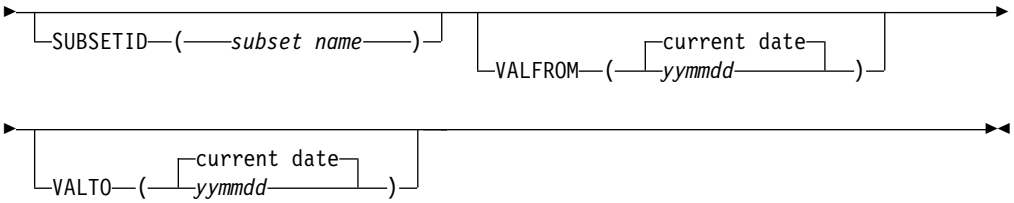
RGRUN

Purpose

Use the RGRUN control statement to add a run cycle specification within a run cycle group. RGRUN statements follow the RGSTART statement that defines a run cycle group and are followed each by the ADRULE statement that defines the run cycle rule.

Format





Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, the remaining keyword values that you specify on the RGRUN statement become default values for all RGRUN statements that follow. No application description is updated. Keywords that you do not specify are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

CALENDAR (*variable table name*)
The name of the calendar used by this run cycle. The name can be of up to 16 characters. If it is not specified, the run cycle uses the calendar specified for the run cycle group.

JVTAB (*variable table name*)
The name of the JCL variable table to be used for the occurrences generated. The name can be of up to 16 characters. If it is not specified, the run cycle uses the variable table specified for the run cycle group.

DESCR (*'run cycle description'*)
A free-format description of the run cycle, up to 50 characters and enclosed in single quotation marks.

DLDAY (*number of days* | 0)
The number of days (from 1 to 99) from the input arrival day that the application should be completed in: 0 means that the deadline is on the same day as the input arrival day. This must be an integer.

A value specified here overrules for this run cycle any value defined with RGDLDAY for the entire group.

DLTIME (*hhmm*)
The deadline time that the application should be completed by, in the format *hhmm*.

A value specified here overrules for this run cycle any value defined with RGDLTIME for the entire group.

IATIME (*hhmm*)
The time, in the format *hhmm*, that the application is to arrive at the first workstation. If it is not specified here, the run cycle uses the input arrival time specified for the run cycle group.

NAME (*rule name*)
The run cycle name. It can be of up to 8 characters.

RPTENDT (*hhmm*)
The repeat end time for the EVERY options, in the format *hhmm*. It must be a time between the IA time of the run cycle and the calendar work day end time of the application.

RPTEVRY (*hhmm*)
The repeating frequency for the EVERY options, in the format *hhmm*. It specifies that the application has an occurrence in the long-term plan every *hhmm*, starting from the IA time to the repeat end time (RPTENDT keyword). If this keyword is not set, only the occurrence related to the IA time is added to the long-term plan.

RULE (*1* | *2* | *3* | *4* | E)
Defines which free-day rule is in effect. See "Selecting a free-day rule" on page 139.

SUBSETID (*subset name*)
The run cycle subset identifier. If the run cycle is part of a subset in the run cycle group (this is useful to match more run cycles against negative rules or to use the logical AND condition), enter the name of the subset. It must be from 1 to 8 alphanumeric characters long and must start with a letter or national character.

TYPE (A | D | E | R)
Specify the type of rule-based run cycle. R (regular) means that the ADRULE statement specifies days when the application should be scheduled. E (exclusion) means that the ADRULE statement specifies days when the application should not be scheduled. A (regular for subsets) means that the ADRULE statement specifies days when the application should be scheduled if they match all A types of the set of run cycles belonging to *SUBSETID*. D (exclusion for subsets) means that the ADRULE statement specifies days when the application should not be scheduled if they match all D types of the set of run cycles belonging to *SUBSETID*.

VALFROM (*yymmdd* | current date)
The start date of the validity of this run cycle, in the format *yymmdd*.

VALTO (*yymmdd* | current date)
The end date of the validity of this run cycle, in the format *yymmdd*.

Example

In the following sample, the run cycle is type A, a regular run cycle that is part of the run cycle group subset named FIRSTH13, and is valid for the month of JANUARY 2013. The ADRULE statement immediately following this statement specifies that the application must run on every other work day of the ones specified in the CAL2013 calendar. The deadline for the application is 15.00 on the same day. The input arrival time is 10.30, but this is not necessarily the time that the application will start.

```
RGRUN NAME(RC1PP13) IATIME(1030) DLTIME(1500) TYPE(A) RULE(1) VALFROM(130102)
VALTO(130201)CALENDAR(CAL2013) SUBSETID('FIRSTH13')
ADRULE EVERY(2) DAY(WORKDAY) MONTH(JANUARY)
```

RGSTART

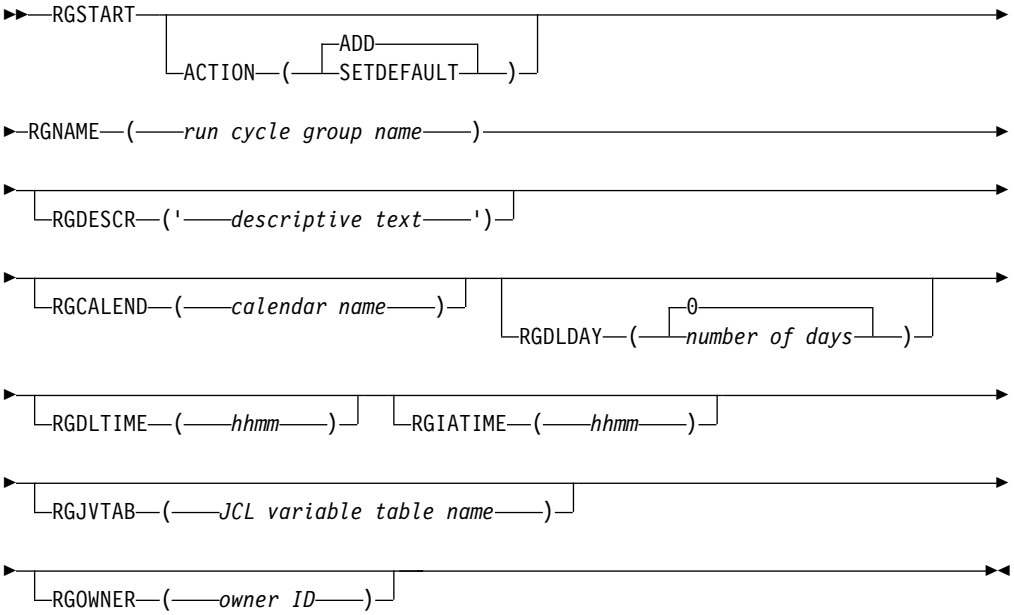
Purpose

Use the RGSTART control statement to signal the start of a run cycle group definition. When this statement is found in the input data set, it signals the batch loader to complete the preceding AD, OI, or RG being built and write it to the database.

After a RGSTART control statement there are one or more RGRUN control statements, one for every run cycle of the run cycle group.

The ADRULE control statement must immediately follow the RGRUN statement.

Format



Parameters

ACTION (SETDEFAULT | ADD)
If you specify SETDEFAULT, the remaining keyword values that you specify on the RGSTART statement become default values for all RGSTART statements that follow. No run cycle group definition is updated. Keywords that you do not specify are assigned their standard defaults.

If you specify ADD or use it by default, the statement can result in an update of the database.

RGCALEND (*calendar name*)
The name of a calendar used by the entire group (of up to 16 characters). This field is optional. The run cycle group calendar is superseded by the calendar name specified for each run cycle, if any. If none is specified, the DEFAULT calendar is used.

RGDESCR (*'descriptive text'*)
A description of up to 50 characters. This field is optional.

RGDLDAY (*number of days* | 0)
The number of days (from 1 to 99) from the input arrival day that the application should be completed in: 0 means that the deadline is on the same day as the input arrival day. This must be an integer.

This value becomes the default deadline day for the entire group. It is overruled at run cycle level by a value in the DLDAY keyword of RGRUN.

RGDLTIME (*hhmm*)
The deadline time that the application should be completed by, in the format *hhmm*.

This value becomes the default deadline time for the entire group. It is overruled at run cycle level by a value in the DLTIME keyword of RGRUN.

RGIATIME (*hhmm*)
The default input arrival time that will be generated by this run cycle group in the *hhmm* format. This field is optional, but if you do not specify here a value for the whole group, you must specify input arrival times for each run cycle of the group in the RGRUN control statement.

RGJVTAB (*JCL variable table name*)
The name of the JCL variable table associated with the run cycle group (up to 16 characters). This field is optional. The run cycle group variable table is superseded by the variable table specified for each run cycle, if any.

RGNAME (*run cycle group name*)
The name of the run cycle group. The name must be from 1 to 8 alphanumeric characters long and must start with a letter or national character. This field is required.

RGOWNER (*owner ID*)
The run cycle group owner's name (from 1 to 16 characters). This field is optional.

Examples

This example sets defaults for all following RGSTART statements:

```
RGSTART  ACTION(SETDEFAULT) RGOWNER(PAYGRP) RGCALEND(PRPCAL)
     RGJVTAB(PRPTABLE)
```

In this example, the batch loader will create the PERPAY13 run cycle group. This statement must then be followed by a number of RGRUN statements (one for each run cycle that will be in the PERPAY13 run cycle group) which in turn must be followed by their own ADRULE statement.

```
RGSTART  RGNAME(PERPAY13) RGDESCR('Run cycles for periodic payments of 2013')
         RGCALEND(PERCAL13) RGJVTAB(PRPTABLE) RGOWNER(PAYGRP) RGDLDAY(1)
         RGDLTIME(12.00)
 RGRUN NAME(RC1PP13) DESCR('Run cycle 1 of rcgroup PERPAY13')...<other keywords>
  ADRULE <keywords>
 RGRUN NAME(RC2PP13) DESCR('Run cycle 2 of rcgroup PERPAY13')...<other keywords>
  ADRULE <keywords>
 ...
 RGRUN NAME(RCnPP13) DESCR('Run cycle n of rcgroup PERPAY13')...<other keywords>
  ADRULE <keywords>
```

Chapter 10. Overview of the long-term and current plans

Once you have described your installation to IBM Workload Scheduler for z/OS and defined your work in the application description (AD) database, IBM Workload Scheduler for z/OS can build the plans required to control your production workload. The *long-term plan* (LTP) contains a high-level description of the work scheduled for the coming weeks or months. The *current plan* (CP) is the IBM Workload Scheduler for z/OS schedule, providing the detail required to control the processing. The current plan is derived from a section of the long-term plan and contains the work that IBM Workload Scheduler for z/OS will run. As your batch processing is submitted and run, the current plan is updated to reflect the actual status of the work. This chapter describes the two plans and provides some guidelines for creating and maintaining them.

When you create an application, it is stored in the AD database. The database contains information on the operations that make up an application and describes how often the operations should run. This data is used by the batch planning functions to schedule the application or job description on the required days, at the specified time.

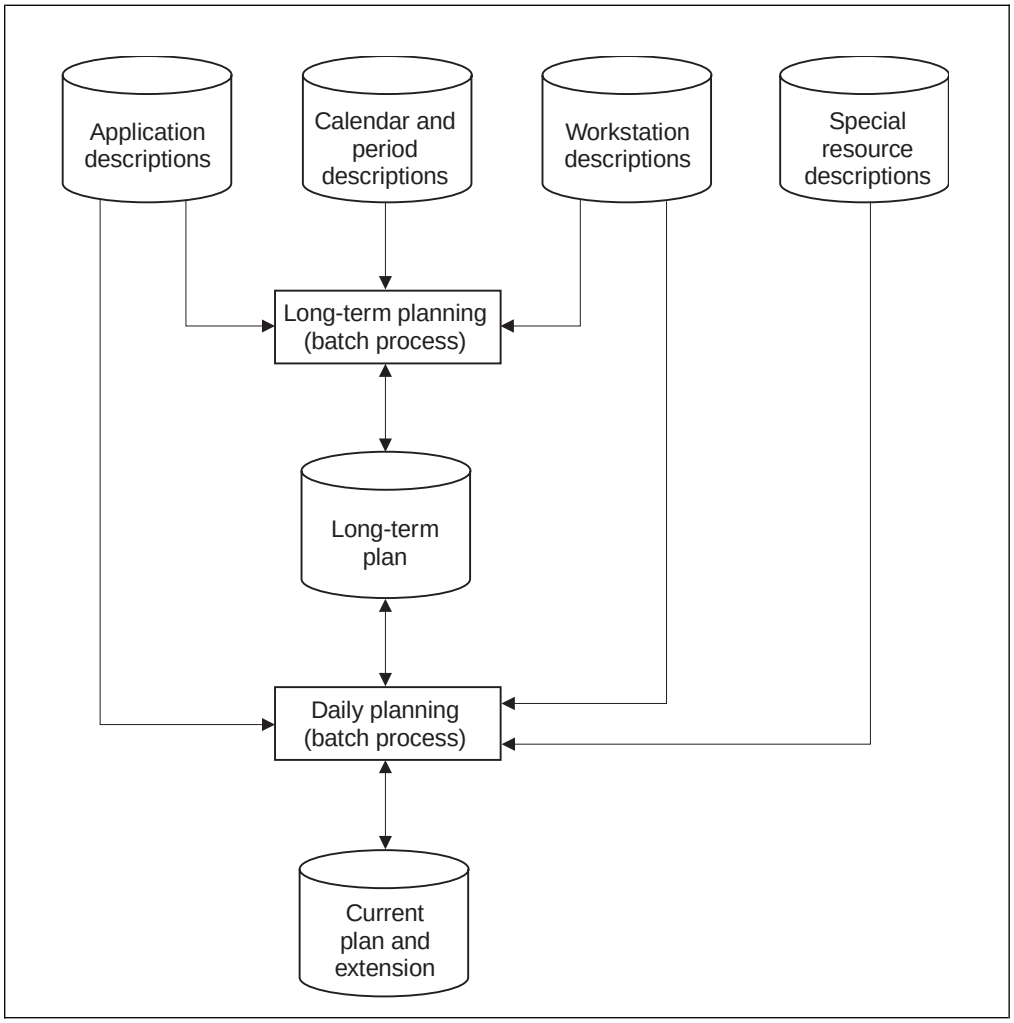


Figure 126. The relationship between the database and the plans

Figure 126 shows the relationship between the database information and the planning processes.

The task of creating the long-term plan and current plan is normally performed once. After creation, the plans are continually extended using batch functions.

When you make changes to the IBM Workload Scheduler for z/OS database, such as creating a new application, this is not reflected in the plans until you have incorporated the changes into the long-term plan and current plan. However, last-minute or unplanned changes can be made directly to the plans using the panels.

The plans can be used to produce reports which can help you:
- Reach service level agreements with your customers
- Measure the slack time in your batch window
- Assist workload management and tuning exercises
- Forecast and plan for the effect of heavy processing periods
- Demonstrate the effect on the batch window if more or fewer resources are available

When creating the long-term plan and current plan, IBM Workload Scheduler for z/OS calculates planned start and end times based on completion of predecessor

processing and resource availability. In addition, the *latest out* time is calculated. This is the latest possible time the operation can start, to meet the deadline time. Operations that run close to their deadlines are given priority when competing for resources. If you have defined accurate resource usage and deadline times in the application description, IBM Workload Scheduler for z/OS is in the best position to schedule your work and optimize the use of resources.

The IBM Workload Scheduler for z/OS planning functions are powerful; problems that affect the batch window can be highlighted before service levels are missed. Careful examination of plan output can give you the opportunity to prevent such problems.

Long-term plan

The long-term plan is a high-level plan that can cover a length of time from 1 day up to 4 years. You produce the long-term plan using IBM Workload Scheduler for z/OS batch jobs, which are usually submitted from the panels. The batch jobs use data from:

- The application description database
- Calendar and period definitions
- The current long-term plan, if one exists

When an application or job description is scheduled in the long-term plan or current plan, it becomes an *occurrence*. Every occurrence is uniquely identified by its name, input arrival date, and time.

IBM Workload Scheduler for z/OS examines every application and job description to determine if an occurrence should be generated in the long-term plan. An occurrence is generated if an active application has a run cycle with a period and calendar combination that falls within the long-term plan range. If an application or job description has been specified as belonging to a group definition, the run cycles and calendar definition are extracted from the group definition, and an *occurrence group* is created in the long-term plan. An occurrence group consists of application occurrences that reference a group definition and have the same input arrival date and time.

Occurrences from the old long-term plan that you have added, deleted, or changed manually are carried over to the new long-term plan, except when IBM Workload Scheduler for z/OS is creating a new long-term plan.

Figure 127 on page 280 describes the data required for the long-term planning process.

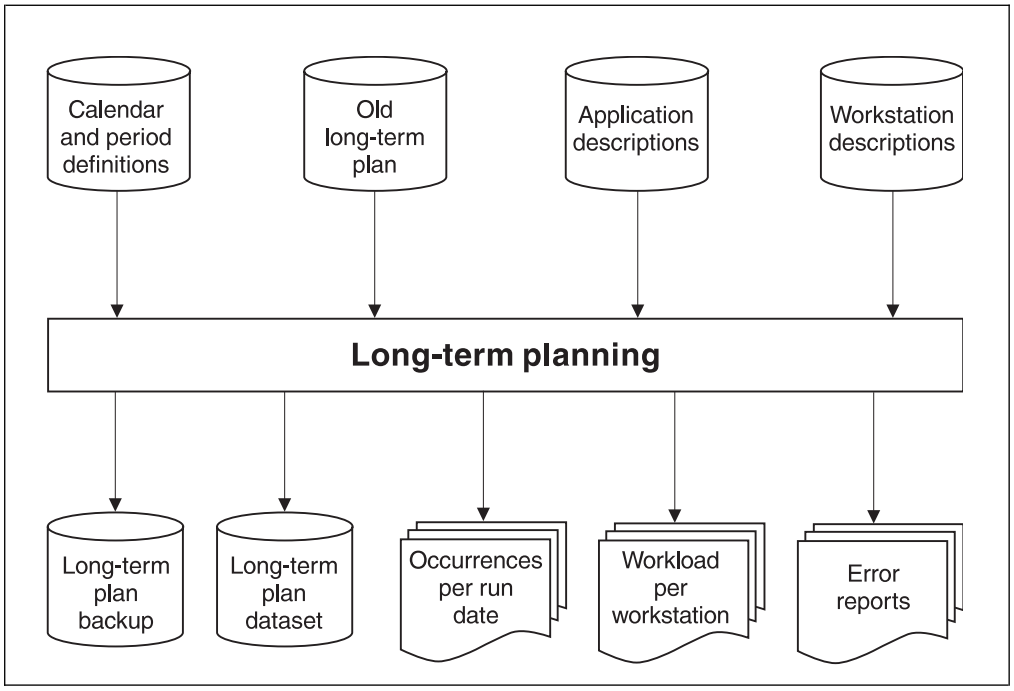


Figure 127. Production of the long-term plan

The long-term plan contains an occurrence entry for every planned run of an application. Most applications generate several occurrences in the long-term plan; for example, applications that are required daily or weekly. Every occurrence in the long-term plan is uniquely identified by the occurrence name, input arrival date, and time. The input arrival time is calculated from the run cycle defined to the application or job description or from the group definition if the application is a member of a group.

The long-term plan also contains external dependency information produced from data in the AD database. It does not, however, know the relationships between operations making up an application.

As time goes on, you must extend the long-term plan to cover future periods. For example, if you wanted to plan for 4 weeks, you could initially set up the long-term plan to cover a period of 35 days into the future. You could then extend the long-term plan by an additional 7 days every week. Your long-term plan would always stretch at least 28 days into the future.

When you create your long-term plan, you specify the start date. Although this information is recorded and shown as the long-term plan start date in the IBM Workload Scheduler for z/OS panel, occurrences are not maintained as far back as this date. If this were the case, the long-term plan data set would expand indefinitely. When you create a *new current plan* (NCP) part of the process is to update the long-term plan with any occurrences that are now eligible for removal from the current plan. For details, refer to "Removing data from NCP by running daily planning" on page 282.

The length of the long-term plan is calculated from the date of the earliest occurrence it contains, that is, from the date of the *earliest uncompleted occurrence*. The long-term plan length is not calculated from the long-term plan start date.

IBM Workload Scheduler for z/OS does not delete occurrences from the long-term plan that are uncompleted or any occurrences that follow an uncompleted occurrence. IBM Workload Scheduler for z/OS deletes occurrences on a day-by-day basis. That is, all occurrences—or none—are removed for a particular day. This means that if you have occurrences in your long-term plan that are not completed, all occurrences scheduled for that day and all following days are retained, whether the occurrences are completed or not. As part of IBM Workload Scheduler for z/OS maintenance, you should assess such uncompleted occurrences and take suitable action. For example, you can manually mark the occurrences as complete, or delete the occurrences if they are not required. This saves space in the VSAM data set that the long-term plan is stored in and reduces the time and resources required to perform long-term plan batch and panel functions.

The long-term plan contains run time and external dependency information for application occurrences. The current plan, which is the IBM Workload Scheduler for z/OS detailed schedule, is based on the occurrence information stored in the long-term plan.

Current plan

The long-term plan does not contain all the information that IBM Workload Scheduler for z/OS needs to submit work to your system. Before IBM Workload Scheduler for z/OS can schedule work, you must produce a detailed plan, called the current plan. The process of producing the current plan is called *daily planning* (see Chapter 12, “Producing the current plan,” on page 299).

The current plan covers a section of the long-term plan. Typically, the current plan covers a period of 24 hours, although it can range from 1 minute to 21 days. IBM Workload Scheduler for z/OS expands the information held in the long-term plan, using the workstation description data and the operation data specified in the application description database. If a current plan already exists, the planning process carries forward any uncompleted occurrences into the new plan.

IBM Workload Scheduler for z/OS creates networks of operations using the dependency information for each operation. Planned start and end times are calculated for each operation. This calculation is based on completion of predecessors, resource availability, and occurrence input arrival time. In addition, when you are scheduling jobs in the IBM Workload Scheduler environment, the current plan also includes information for the Symphony file. For more information, see “Renewing the symphony file” on page 305.

When the current plan is created, it is updated in real time by events produced by the SMF and JES exits. User programs can automatically report status of operations by calling an IBM Workload Scheduler for z/OS routine, or TSO users can issue the OPSTAT command. The current plan can also be updated from the IBM Workload Scheduler for z/OS panel. Users with sufficient authority can add, change, complete, or delete operations and occurrences. Work running outside IBM Workload Scheduler for z/OS control can trigger an application occurrence to be included in the current plan. Figure 128 on page 282 shows the data used in daily planning.

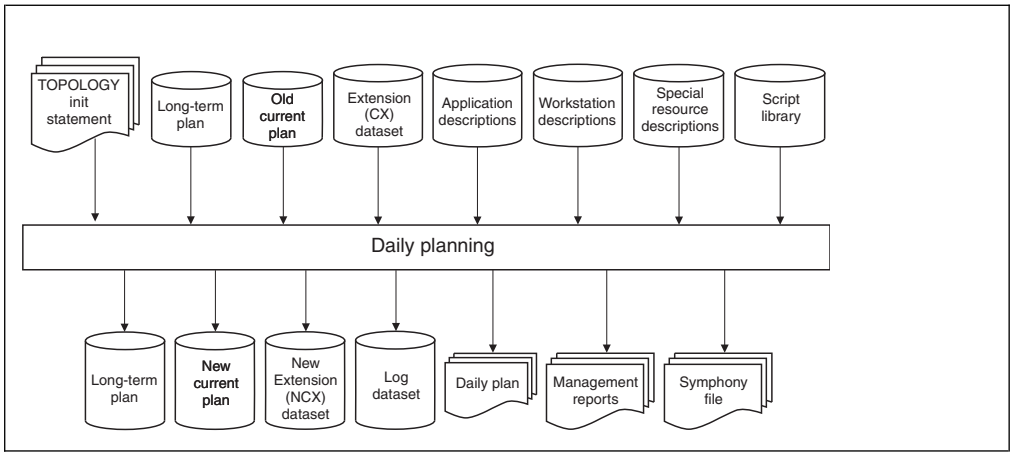


Figure 128. Current plan production

Managing a current plan with more than one million operations

When your current plan includes more than one million operations, the scalability, reliability, and efficiency of processing can be significantly optimized by extending the available storage of both controller and daily plan batch. By setting the required parameters in the BATCHOPT and JTOPTS statements, two data spaces are created and used as an additional support to the available storage. These data spaces are designed to temporarily contain a portion of the processed data (operations and occurrences) at current plan generation time, and when the CP is dynamically modified (MCP).

If your current plan includes more than one million operations, you optimize data processing by:

- Setting CPDATASPACE(YES) in the BATCHOPT statement to load portions of the in-storage operations and occurrences into a data space when the current plan is generated. For details about this parameter, see *Customization and Tuning*.
- Setting MCPDATASPACE(YES) in the JTOPTS statement to load portions of the in-storage operations and occurrences into a data space when the current plan is dynamically modified. For details about this parameter, see *Customization and Tuning*.
- Allocating the following data sets as extended VSAM:
  - EQQACPDS
  - EQQCP1DS
  - EQQCP2DS
  - EQQNCPDS
  - EQQSCPDS
- In the batch jobs of the daily plan, allocate the EQQDIN data set with DSTYPE LARGE.
- In the batch jobs of the long-term plan, allocate the LTOCIN and LTOCOUT data sets with DSTYPE LARGE.

Removing data from NCP by running daily planning

When creating an updated current plan, daily planning removes selected objects that do not require further processing. These objects are:

- Any completed occurrence and any occurrence in error status including only operations in one of the following statuses:
  - Complete.
  - Suppressed by condition.
  - Ended-in-error, with the `RECOVERED BY CONDITION` field set to Y.
- Following kinds of dependencies:
  - Standard dependencies on completed predecessors.
  - Evaluated condition dependencies belonging to evaluated conditions.

    Daily planning does not remove any evaluated condition dependency that belongs to an undefined condition. It applies also if daily planning removed the predecessor that the condition dependency refers to. In this case, the predecessor appears as removed when monitoring condition dependencies in the current plan.
  - Evaluated conditions.
  - Conditions defined for operations in suppressed by condition status.

Resolving pending occurrences

To handle occurrences that extend beyond the current plan and dependencies whose predecessors are not yet in the current plan, IBM Workload Scheduler for z/OS uses *tail plans* and *pending occurrences*.

Tail plans

If an occurrence in the long-term plan has an input arrival time within the date range of the current plan, it is included in the current plan when the plan is created or extended. If the occurrence cannot be completed before the end of the current plan, the current plan is extended internally, up to 28 days beyond the start of the specified planning period to include the entire occurrence. This period beyond the end of the normal plan is called the *tail plan*.

The tail plan includes work that is planned to start during or before the current planning period, but is not planned to complete before the end of the planning period. New applications with input arrival during the time covered by the tail plan are not included; instead, these will be added by the subsequent daily plan. These applications are included in the current plan as usual when you extend the current plan beyond their input arrival times.

Operations that belong to included occurrences, but are not scheduled to start within the period of the tail plan, are given the date and time of the end of the tail plan as a start date and time.

Pending occurrences

If an operation in an occurrence has an external predecessor, the dependency is resolved when the long-term plan is created or extended. That is, the link is established between the two dependent occurrences.

Although the dependency has been resolved in the long-term plan, it can sometimes happen that the successor of a dependency relationship is included in the current plan but the predecessor is not. This can occur, for example, when a dependency is added manually to the long-term plan. To ensure that the dependency is honored, IBM Workload Scheduler for z/OS creates a dummy occurrence in the current plan, called a *pending occurrence*. The successor operation

is temporarily made dependent on this pending occurrence. When the true predecessor of the operation is included in the current plan, the pending occurrence is replaced.

In Figure 129, the application A is included in the new current plan because its input arrival time X falls within the period of the current plan. So the operation Y is also in the current plan. Operation Y has a predecessor Z in application B (dependency D), but application B is not in the current plan, because its input arrival time is later. So Y has a predecessor Z that is not in the current plan, and a pending occurrence is created in the current plan until application B is included.

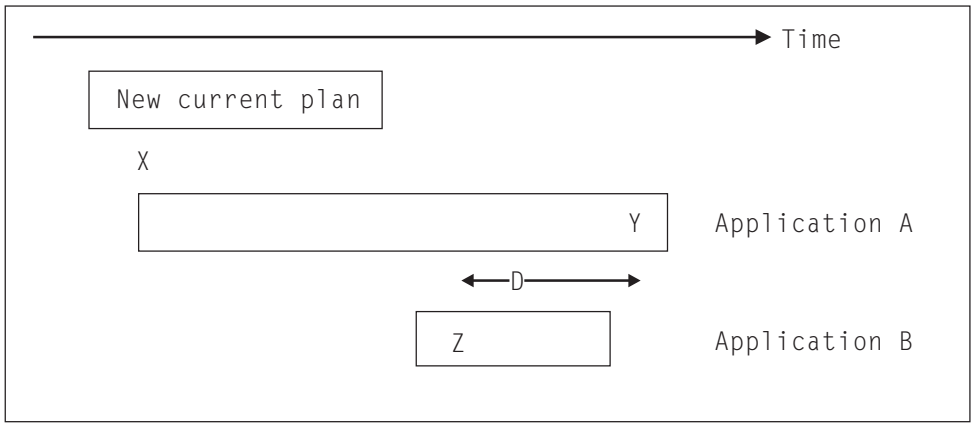


Figure 129. Example of a missing predecessor

Creating the plans for the first time

About this task

See "Creating plans" on page 26 for an example of creating plans for the first time. This is a summary of the steps:

1. Decide how far the long-term plan will extend.

   The long-term plan can span 1 day to 4 years from the date of the last uncompleted occurrence. If you begin with a plan covering too long a period, the task of creating the plan can become unnecessarily cumbersome. However, if you do not look far enough ahead, you will not benefit from the planning functions of the long-term plan.

   A good compromise is 5 weeks or 75 000 occurrences, whichever is less. It provides planning capabilities for the near future without being too great. This can be particularly useful, for example, at end-of-month or holiday processing. With this period, the long-term plan can be extended every 7 days for 7 days and will always cover a calendar month. However, if 5 weeks proves to be too short or too long, you can always adjust the look-ahead period to a more suitable length.

2. Decide when the current plan will start.

   The current plan is a second-by-second schedule of all operations. It drives all automatic IBM Workload Scheduler for z/OS activities, such as:
   - Submitting and tracking of jobs and started tasks
   - Completing operations on nonreporting workstations
   - Providing information to workstation operators

- Recovering failed jobs

When you decide the start time for the current plan, you should note that:

- All scheduled jobs with no predecessors are normally submitted immediately by IBM Workload Scheduler for z/OS when the plan is created, unless they are time-dependent operations.
- Long-term plan occurrences with input arrival time before the current plan start time but deadline time after the current plan start time, are given the status UNDECIDED. IBM Workload Scheduler for z/OS does not automatically submit jobs with this status. This situation applies only when a current plan does not yet exist.
- A long-term plan occurrence with input arrival time before the current plan start time and deadline time also before the current plan start time is assumed by IBM Workload Scheduler for z/OS to have completed. It will be marked as completed in the long-term plan and excluded from the current plan. This situation applies only when a current plan does not yet exist.

Avoid scheduling occurrences in the long-term plan before the start of your first current plan. The current plan can then start at the date and time that you want IBM Workload Scheduler for z/OS to begin its scheduling activities.

3. Decide how far the current plan will extend.

   The current plan can span from 1 minute to 21 days from the time of its creation or extension. IBM Workload Scheduler for z/OS brings in from the long-term plan all occurrences with an input arrival time that is within the period you specify. IBM Workload Scheduler for z/OS then creates a detailed schedule for the operations that are contained in these occurrences.

   If you are extending the current plan, IBM Workload Scheduler for z/OS also carries forward, into the new plan, any uncompleted occurrences in the existing plan. Therefore, the current plan could contain information on occurrences back to the creation of the plan if there are uncompleted occurrences.

   To decide what time span your current plan should have, consider:

   - The longer the plan, the more computing resources required to produce it.
   - Changes in the long-term plan are reflected in the current plan only after the current plan is extended.
   - You cannot amend occurrences in the long-term plan that have an input arrival time before the end of the current plan.
   - Plans longer than 24 hours will contain two occurrences of daily applications and can cause confusion for your operations staff.
   - Short plans must be extended more frequently.
   - The current plan can contain a maximum of 32 760 application occurrences.

   Normally, a plan of 24 hours is a good compromise. However, in very large installations, 24 hours might be too long. You might then consider a current plan covering one shift.

4. Create the plans as described in “Creating plans” on page 26.
5. Consider getting IBM Workload Scheduler for z/OS to schedule the batch jobs that extend the plans. For example, you could run the job that extends the current plan every day at 06.00, and run the job to extend the long-term plan weekly.
6. Extend the current plan a few hours before it ends, so you have time to look at the reports.

The following steps describe what to do when you make changes:

1. Is the change temporary?

a. Yes: continue with step 2.
b. No: change the application database. Do you want the change to affect the current plan?
   1) Yes: continue with 1c.
   2) No: modify or extend the long-term plan.
c. Are you adding or deleting occurrences that are in the current plan?
   1) Yes:
      - Modify or extend the long-term plan.
      - Use the MCP panel to add or delete occurrences.
      - Replan or extend the current plan.
   2) No:
      - Modify or extend the long-term plan.
      - Replan or extend the current plan.

2. Does the change affect the current plan?
   a. Yes: use the MCP panel.
   b. No: modify the long-term plan online.

Chapter 11. Producing and modifying the long-term plan

You can use IBM Workload Scheduler for z/OS to perform these tasks:

- Create a long-term plan, if one does not exist.
- Extend the long-term plan, if the time period covered by the plan is not far enough into the future.
- Create a trial long-term plan.
- Produce reports on all or part of the long-term plan.
- Check the contents of the long-term plan online.
- Change the long-term plan to fix errors or include last-minute changes.
- Prepare job control language (JCL) for computer operations belonging to occurrences in the long-term plan.
- Modify the long-term plan to reflect changes in the IBM Workload Scheduler for z/OS databases.

You access the long-term plan by selecting option 2 from the main menu. The MAINTAINING THE LONG TERM PLAN menu is displayed (Figure 130).

```
EQQLTOPP -------------- MAINTAINING THE LONG TERM PLAN ------------------------
Option ===>

Select one of the following:

1 ONLINE          - Occurrence utility:
                      Browse, Create, Delete, List, and Modify
                      Occurrences and Dependencies in the long term plan.
                      Job setup for occurrences in the long term plan.

2 BATCH           - Plan utilities:
                      Modify, Create and Extend the long term plan
                      from run-cycle information.
                      Make a Trial long term plan.
                      Print long term plan.

3 ADD             - Create an occurrence in the long term plan

4 STATUS          - Display status of the long term plan

5 SET DEFAULTS    - Set defaults to be used for browsing long term plan
```

Figure 130. EQQLTOPP - Maintaining the long-term plan panel

This menu presents you with a list of functions, divided between those that run batch jobs and those that perform online updates.

You use the APPLICATION DESCRIPTION panel to change the AD database. This might cause changes in the run dates, input arrival times, or dependencies of occurrences that are included in the long-term plan. These changes are not reflected in the schedule until the long-term plan and current plans have been updated. You do not need to discard your long-term plan completely. Instead, you can change the long-term plan to reflect these changes. See "Modifying the long-term plan in batch" on page 291 for details. Then use the DAILY PLANNING panel to amend the current plan to include these changes. See Chapter 12, "Producing the current plan," on page 299 for details.

Running long-term plan batch jobs

For some functions, such as creating or printing the long-term plan, the panel submits a batch job. You can save the job and submit it outside the IBM Workload Scheduler for z/OS panels. You can use IBM Workload Scheduler for z/OS to schedule and submit the long-term plan extend job. This ensures that the long-term plan is always updated at the correct time and on the correct date.

The batch jobs normally affect all occurrences in the long-term plan. If you specify the MODIFY ONE or PRINT ONE options, however, only the selected occurrences are modified or printed. Run long-term plan batch jobs by selecting option 2 (BATCH) from the MAINTAINING THE LONG TERM PLAN menu. You see the menu shown in Figure 131.

```
EQQLBATP ------------- SELECTING LONG TERM PLAN BATCH JOB --------------
Option ===>

Select one of the following:

1 MODIFY          - Modify the long term plan for all applications
2 MODIFY ONE      - Modify the long term plan for one application
3 EXTEND          - Extend the long term plan
4 TRIAL           - Make a trial long term plan
5 PRINT           - Print the long term plan for all applications
6 PRINT ONE       - Print the long term plan for one application
7 CREATE          - Create a new long term plan
```

Figure 131. EQQLBATP - Selecting long-term plan batch job

The long-term plan data sets

The long-term-planning function creates or modifies the long-term plan data set. The long-term plan is stored in a VSAM data set that is defined when IBM Workload Scheduler for z/OS is installed. The long-term plan is referenced in the long-term planning jobs and by the IBM Workload Scheduler for z/OS address space by ddname EQQLTDS.

The long-term plan VSAM data set does not require regular reorganization because the entire data set is rewritten by long-term plan batch create, modify, and extend functions. A VSAM work data set (ddname EQQLDDS) and a backup data set (ddname EQQLTBKP) are used by the long-term plan batch jobs during the planning process.

Long-term plan messages

Many messages issued by the long-term planning process can be dismissed immediately; others will require action. For example, a message indicating that a daily application could not find a once-a-year dependency is not considered an issue for 364 days of the year. Warning messages are generated for all occurrences that have been manually added or changed. Messages are also generated if the long-term plan planning process detects a period definition that has no future origin dates.

Warning messages are generated for all run cycles with an EVERY end time inconsistent with the application calendar work day end time. In this case, the EVERY end time is automatically reset by the long-term plan batch job to the latest valid value possible. For details, see “Specifying the EVERY options for a run cycle” on page 143.

Messages are written to the message-log data set defined by the EQQMLOG DD statement.

How a long-term plan is created

IBM Workload Scheduler for z/OS examines every application and job description. If an application is a member of a group, IBM Workload Scheduler for z/OS extracts the run cycle and calendar information from the group definition.

When the planning process finds a valid run cycle, it checks for generated dates within the long-term plan range. The planning process must check the defined calendar to determine if the *free-day rule* should be applied. See "Selecting a free-day rule" on page 139 for details. IBM Workload Scheduler for z/OS also checks the workday end time on the calendar; the next day does not start until that time is reached. For example, if you specified a work-day end time of 06:00 hours, a free day following a work day would not start for IBM Workload Scheduler for z/OS purposes until 06:00. This means that work might be scheduled on a free day. See "Creating the default calendar" on page 98 for more information.

IBM Workload Scheduler for z/OS ignores multiple occurrences that fall on the same day with the same input arrival time because of the free-day rule. It schedules only one occurrence and writes a warning message to EQQMLOG.

IBM Workload Scheduler for z/OS creates an occurrence in the long-term plan for each required instance of the application or job description. Application occurrences that are part of an occurrence group are uniquely identified by a reference to the group definition and by a common input arrival date and time.

IBM Workload Scheduler for z/OS detects and reports a duplicate occurrence , but does not store it in the long-term plan. This can happen when the run cycles for an application specify that an occurrence should be generated every Friday and also on the last day of the month. In this example, when the last day of the month is also a Friday, only one occurrence of the application is stored in the long-term plan; the other occurrence is canceled because it is a duplicate.

When the planning process creates an occurrence, the operations are examined. If an operation has one or more external predecessors, the planning process tries to make the dependency in the long-term plan. The dependency links the closest occurrence, that is, the occurrence with an equal or the nearest earlier input arrival time. If a predecessor application occurrence does not exist in the long-term plan, no dependency is created. In this case, the planning process issues a message to indicate a potential problem.

Creating the long-term plan

Create a new long-term plan by selecting option 7 from the SELECTING LONG TERM PLAN BATCH JOB menu (Figure 131 on page 288).

```
EQQLCREP ---------------- CREATING THE LONG TERM PLAN ------------------
Command ===>

Enter/Change data below:

Long term plan:

 START             ===>  13/01/27   Date in format YY/MM/DD

 END               ===>  13/04/30   Date in format YY/MM/DD
```

Figure 132. EQQLCREP - Creating the long-term plan

See "Creating the plans for the first time" on page 284 for general guidance on creating the first plan. When creating the long-term plan, you specify the start and end date of the period that the plan is to cover on the CREATING THE LONG TERM PLAN panel (see Figure 132.)

If a long-term plan already exists, you will receive a warning message when creating a new long-term plan. If occurrences in the existing long-term plan still exist in the current plan and are not yet complete, you cannot use the create function. To create a long-term plan in this situation, you must refresh the long-term plan. You perform an LTP REFRESH from the SERVICE FUNCTIONS panel (option 9 from the main menu), not from the LTP panel.

Attention: A REFRESH of the long-term plan deletes your current plan and you can lose the statuses of occurrences in the long-term plan. When you create the current plan, the status of uncompleted operations might be undecided.

A batch job that you can edit, or submit directly, is generated when you specify the required dates on the CREATING THE LONG TERM PLAN panel. If a long-term plan already exists, you can specify an end date earlier than that of the old long-term plan.

The create job does not use the existing long-term plan as input. Therefore, any occurrences or occurrence groups that are manually added are not included in the new long-term plan. Nor will manual updates that have deleted or changed occurrences be reflected in the new long-term plan. The long-term plan-create batch job performs the planning process as described in "How a long-term plan is created" on page 289.

To decide what time span your long-term plan should have, consider:

- The longer the plan, the more computing resources required to produce it.
- A long long-term plan probably has many occurrences and operations, so there can be a long response time when you edit the long-term plan with the panel.

Extending the long-term plan

Extend the long-term plan by selecting option 3 from the SELECTING LONG TERM PLAN BATCH JOB menu, shown in Figure 131 on page 288. The EXTENDING THE LONG TERM PLAN panel, shown in Figure 133 on page 291, is displayed.

```
EQQLEXTP ---------------- EXTENDING THE LONG TERM PLAN -----------------
Command ===>

Enter/Change data below:

Current end           : 13/04/30

NEW END DATE       ===> ________    New long term plan end date
                                   in format YY/MM/DD

EXTENSION LENGTH   ===> 28__        DDDD      Extend plan by
```

Figure 133. EQQLEXTP - Extending the long-term plan

To extend the long-term plan, specify a new end date, or extension length in days, for the long-term plan. IBM Workload Scheduler for z/OS generates a batch job that you can edit or submit directly. Long-term planning adds only occurrences that have input arrival times outside the period covered by the current plan. When resolving dependencies, IBM Workload Scheduler for z/OS uses the long-term plan that already exists. Occurrences that fall within the current plan are also considered in the dependency resolution process.

This procedure is part of your normal maintenance of IBM Workload Scheduler for z/OS; extend the long-term plan at regular intervals. Because IBM Workload Scheduler for z/OS can schedule the job of extending the long-term plan in the same way as any other job in your system, consider using IBM Workload Scheduler for z/OS to regularly schedule a job that extends the long-term plan by a fixed duration each time it runs.

Modifying the long-term plan in batch

You can modify the long-term plan to reflect the latest data available in the IBM Workload Scheduler for z/OS database by selecting option 1 from the SELECTING LONG TERM PLAN BATCH JOB panel (see Figure 131 on page 288). This generates modify-long-term plan JCL to execute the planning process. Only occurrences that have input arrival times after the end of the current plan are modified.

Occurrences that have been changed in any way through the LTP panel function are left unchanged by the modify process. This includes manually deleted occurrences. If you delete an occurrence, this is noted in the long-term plan. The same occurrence (that is, an occurrence with the same application ID, input arrival date, and input arrival time) will not then be re-created by the modify-long-term plan batch job.

Any occurrences that are involved in a manually added dependency chain are also left unmodified. A note is also made of manually deleted *dependencies*. Modifications that would reinstate such deleted dependencies are not permitted.

MODIFY can be performed for a single application by selecting option 2 MODIFY ONE from the SELECTING LONG TERM PLAN BATCH JOB menu (Figure 131 on page 288). If you perform a MODIFY ONE, dependencies are not resolved and any variable durations or variable deadlines that you defined are not taken into account.

Creating reports about the long-term plan

The long-term planning batch programs generate these reports:
- A list of occurrences by run date
- Workload by workstation
- Run date and error reports

You can also produce reports from the long-term plan by selecting option 5 (print) or option 6 (print one) from the SELECTING LONG TERM PLAN BATCH JOB menu (Figure 131 on page 288). Both functions extract data from the long-term plan and produce a report showing occurrences of the selected applications. Option 5 generates a batch job that produces a report for all occurrences in the long-term plan, whereas option 6 produces a report for one application.

```
EQQLPRAP ------- PRINTING THE LONG TERM PLAN - ALL APPLICATIONS --------
Command ===>

Enter/Change data below:

Long term plan start  : 13/01/27
Long term plan end    : 13/04/30


Start of print:
 DATE              ===>  13/02/03   Date in format YY/MM/DD
 TIME              ===>  23.14      Time in format HH.MM

End of print:
 DATE              ===>  13/04/30   Date in format YY/MM/DD
 TIME              ===>  24.00      Time in format HH.MM

REPORT TYPE        ===>  F          F - Full report
                                    D - Dependencies only

SORT ORDER         ===>  I          I - Input arrival date
                                    O - Owner id and input arrival date
                                    A - Owner id and application id
```

Figure 134. EQQLEXTP - Printing the long-term plan, all applications

The report provides detailed information that you can inspect before using the long-term plan as input to daily planning.

The full report lists all occurrences in the long-term plan. It shows application IDs, owner IDs, input arrival times and deadlines for the application, priorities, application text, and external dependencies. This report also lists the total duration of the work that is planned for each workstation.

You can request two types of report. Specify `F` for a full report, or `D` (dependencies) for a report on predecessors and successors. For each dependency, the dependency report contains the optional text string called *reason for dependency*. In the application description, you can specify whether this string should always be printed or should be printed only when the dependency is resolved between occurrences on different dates.

You can specify these sort orders:

I Run date, input arrival time, application ID

O Owner ID, run date, input arrival time, application ID

A Owner ID, application ID

When you request a printout of the long-term plan, you also get histograms showing the planned workstation usage for the period of the printout for each workstation.

See "Long-term plan reports" on page 802 for examples of the various reports that are generated.

Generated comments in long-term plan reports

The long-term plan reports include information that IBM Workload Scheduler for z/OS adds about the way each occurrence has been planned. IBM Workload Scheduler for z/OS can add these comments:

DEADLINE – START > 24 HRS
There are more then 24 hours between occurrence input arrival and deadline. The application description perhaps should be split into multiple applications, which could be planned more efficiently.

MOVED (FREE DAY RULE)
An occurrence that would otherwise have been scheduled on a free day has been moved by the free-day rule specified in the run cycle for the application description.

AD NOT FOUND ON AD FILE
The application is not in the application description data set. Some fields in the long-term plan report for this application will be blank.

SCHEDULED ON FREE DAY
The occurrence has been scheduled on a free day. This comment is issued when you are printing the long-term plan sorted by owner ID.

DEPENDENCY CHANGED
The dependency printed on this line has been changed manually using the panels.

ENTERED MANUALLY (ONLINE)
This occurrence has been added manually using the panels or PIF.

CHANGED MANUALLY (ONLINE)
This occurrence has been modified using the panels or PIF.

ERROR CODE = *xxxx*
Where *xxxx* is an error code. This error code was added manually using the panels when the occurrence was modified.

Creating a trial long-term plan

When you want to study schedules in detail without changing the production plans, create trial plans. Trial plans are particularly useful:

- During peak workload periods (for example, year end processing) to study the capacity problems that might occur at these times
- When you bring in a new application that could cause changes to the workload
- When overload problems are detected

Create trial long-term plans by selecting option 4 from the SELECTING LONG TERM PLAN BATCH JOB menu (Figure 131 on page 288).

```
EQQLTEXP --------------- MAKING A TRIAL LONG TERM PLAN -----------------
Command ===>

Enter/Change data below:

Current end           : 13/04/30

NEW START DATE     ===> ________    New trial plan start date
                                   in format YY/MM/DD

NEW END DATE       ===> ________    New trial plan end date
                                   in format YY/MM/DD

EXTENSION LENGTH   ===> 28__        DDDD      Extend plan by
```

Figure 135. EQQLTEXP - Making a trial long-term plan

You can produce a trial long-term plan to check the validity of any database changes that you make. This process produces a print of the long-term plan in the same format as reports on the active long-term plan, but the long-term plan file is not updated.

Depending on the day and date information that you specify on the MAKING A TRIAL LONG TERM PLAN panel, IBM Workload Scheduler for z/OS produces one of three possible trial plans:

- If you do not specify anything in the fields, IBM Workload Scheduler for z/OS produces a *modify all* trial plan. This simulates modifying the long-term plan, which is described in "Modifying the long-term plan in batch" on page 291.
- If you specify a start date and an end date, IBM Workload Scheduler for z/OS simulates a long-term plan *create*, which is described in "Creating the long-term plan" on page 289.
- If no start date is specified but an end date or an extension length is specified, IBM Workload Scheduler for z/OS simulates a long-term plan *extend*, which is described in "Extending the long-term plan" on page 290.

Displaying the status of the long-term plan

You can display the status of the long-term plan by selecting option 4 STATUS, from the MAINTAINING THE LONG TERM PLAN menu (Figure 130 on page 287). The STATUS OF THE LONG TERM PLAN panel, shown in Figure 136, is displayed.

```
EQQLSTAP --------------- STATUS OF THE LONG TERM PLAN ------------------
Command ===>

View data below:

Long term plan start  : 06/12/16

Earliest non-completed
 occurrence in
 current plan         : 13/02/03

Latest update of
 long term plan       : 13/02/06

Current plan end      : 13/02/07

Long term plan end    : 13/04/30
```

Figure 136. EQQLSTAP - Status of the long-term plan

This panel displays key information about the long-term plan. The `Earliest non-completed occurrence in current plan` field is maintained by the daily planning process. The long-term plan contains occurrences between the dates which are indicated by the fields `Earliest non-completed occurrence in current plan` and the `Long-term plan end`.

Setting default successor and predecessor workstations

You can change the default workstations that IBM Workload Scheduler for z/OS uses to resolve external dependencies in the LTP panel by selecting option 5 (SET DEFAULTS) from the MAINTAINING THE LONG TERM PLAN menu (Figure 130 on page 287). The SETTING DEFAULT FOR BROWSE panel, shown in Figure 137, is displayed.

```
EQQLBDWP ---------------- SETTING DEFAULT FOR BROWSE  ----------------------
Command ===>

Enter/Change data below:

PREDECESSOR WS     ===> ____             Default predecessor work station
SUCCESSOR WS       ===> ____             Default successor work station

The values set on this panel are used only by the long term plan dialog.
```

Figure 137. EQQLBDWP - Setting default for browse

When you create a dependency in the long-term plan using the LTP panel, the dependency is between two application occurrences. IBM Workload Scheduler for z/OS only recognizes dependencies between operations, so it must choose operations in the predecessor and successor occurrences that the dependency will actually be between. To do this, the LTP panel uses the information on the SETTING DEFAULT FOR BROWSE panel. If you have not defined an operation in the application on the default workstation, IBM Workload Scheduler for z/OS uses the last operation in the application for the dependency.

The values set in the panel are used only by the LTP panel. The LTPDEPRES parameter of the BATCHOPT statement specifies the corresponding defaults for the long-term plan extend and other batch jobs. For details about BATCHOPT, see *Customization and Tuning*.

Note: Use the OPTIONS panel to set the default calendar for online changes that you make to occurrences in the long-term plan.

Amending applications in the long-term plan online

You can modify or browse individual occurrences of an application in the long-term plan by using the ONLINE option from the MAINTAINING THE LONG TERM PLAN panel. You can:

- Add an application occurrence to the plan
- Delete an application occurrence from the plan
- Remove an occurrence from an occurrence group
- List all the occurrences of an application in the plan
- List all members of an occurrence group
- Browse individual application occurrences in the plan
- Browse the dependencies of application occurrences in the plan
- Change application occurrences in the plan
- Change the dependencies of application occurrences in the plan. You can:
  - Create or delete non-conditional dependencies.

  - Delete conditional dependencies.
- Prepare job statements for an occurrence in the plan
- Delete, complete, or add an occurrence group

When you modify the long-term plan with these panel functions, IBM Workload Scheduler for z/OS updates the plan online, so there is no need to run any batch jobs to carry out your changes. However, if you have made many manual changes, run a print of the long-term plan to verify that the changes are accurate.

A dependency in the long-term plan is between application occurrences. The long-term plan itself does not contain any operations or any operation-level information. When you browse dependencies on an operation level in the LTP panel, the displayed information is therefore only an estimation of how the operations will actually be connected when the current plan is extended.

Modifying occurrences in the long-term plan

Sometimes, you will need to make one-off changes to a particular occurrence of an application. For example, you might need to put a DASD space override in the job for end-of-year processing, or you might need to add some predecessors. Changes to long-term plan occurrences can be performed by selecting the ONLINE option from the MAINTAINING THE LONG TERM PLAN panel. After selecting the occurrence or list of occurrences you want to work with, you can:

- Modify operation data: change the operation text, operation level input arrival and deadline times, or prepare job statements
- Modify dependencies: delete an existing dependency, create new predecessors or successors
- Modify occurrence data: change priority, job variable tables, occurrence level input arrival and deadline times

If you change an individual occurrence and then modify the application description that gave rise to that occurrence, IBM Workload Scheduler for z/OS does not change the manually altered occurrence when the long-term plan is extended. IBM Workload Scheduler for z/OS issues a warning message to indicate that this occurrence has not been changed in line with the modified application description. IBM Workload Scheduler for z/OS assumes that any manual changes you have made should override any automatically generated changes.

The long-term plan does not include all operation detail. If you want to make changes to dependencies in the long-term plan, IBM Workload Scheduler for z/OS lets you establish the dependency to an occurrence, not to a particular operation within an occurrence. For more information see “Setting default successor and predecessor workstations” on page 295.

You can change the input arrival date or time of occurrences that are members of an occurrence group. When you modify the input arrival for an occurrence that is a member of a group, the occurrence is removed from that group. If the new input arrival corresponds to an existing occurrence group, the occurrence will become a member of that group. If there is no existing occurrence group with the new input arrival a new occurrence group will be created. Group members cannot be individually deleted from the long-term plan until they are removed from the occurrence group.

Note: If you edit a job using the LTP panel, the job is saved in the JCL repository data set EQQJSnDS, even if you make no changes, and subsequent changes to the job in EQQJBLIB will not take effect for that occurrence. So be sure to cancel the

edit, or use the Browse command, unless you really mean to save the job statements for that particular occurrence in the repository data set.

Modifying dependencies in the long-term plan

Specify option 1 (ONLINE) from the main menu of the LTP panel. The LONG TERM PLAN OCCURRENCES panel, shown in Figure 138, is displayed.

```
EQQLSTOL ---------- LONG TERM PLAN OCCURRENCES (left part) - ROW 1 TO 14 OF 446
Command ===>                                                  Scroll ===> PAGE

Enter the CREATE command above to create a new occurrence or
enter the GRAPH command above to view occurrences graphically or
scroll right, or, enter any of the commands below:
B - Browse, D - Delete, J - Job setup, M - Modify, RG - Remove from Group

Row Application id   Input arrival  Deadline       P C Pre Suc Cond Cond Pnd
cmd                  date     time  date     time              Pre  Suc  Man
                                                                     Pre
'' CP                13/06/05 12.00 13/06/05 16.00 7 Y   1   0   0    0    0
'' MEME              13/06/05 09.00 13/06/05 10.00 5 Y   0   0   0    0    0
'' PAYBACKP          13/06/05 12.00 13/06/06 06.00 5 Y   3   0   0    0    0
'' PAYDAILY          13/06/05 12.00 13/06/05 16.00 5 Y   0   2   0    0    0
'' PAYW              13/06/05 12.00 13/06/05 16.00 5 N   1   1   0    0    0
'' CP                13/06/06 12.00 13/06/06 16.00 7 Y   1   0   0    0    0
'' MEMEWEEK          13/06/06 09.00 13/06/06 10.00 5 N   0   0   0    0    0
'' PAYBACKP          13/06/06 12.00 13/06/09 06.00 5 Y   3   0   0    0    0
'' PAYDAILY          13/06/06 12.00 13/06/06 16.00 5 Y   0   1   0    0    0
'' CP                13/06/09 12.00 13/06/09 16.00 7 Y   1   0   0    0    0
'' MEME              13/06/09 09.00 13/06/09 10.00 5 Y   0   0   0    0    0
'' MEMEWEEK          13/06/09 09.00 13/06/09 10.00 5 N   0   0   0    0    0
'' MEME66            13/06/09 00.01 13/06/09 10.00 5 N   0   0   0    0    0
'' PAYBACKP          13/06/09 12.00 13/06/10 06.00 5 Y   3   0   0    0    0
```

Figure 138. EQQLSTOL - Long-term plan occurrences

To display the application owner ID, scroll the list right.

If you want to make the 13/06/05 occurrence of PAYW not dependent on PAYDAILY, for example, type `m` beside the row and press Enter. The MODIFYING AN OCCURRENCE panel, shown in Figure 139 on page 298, is displayed.

```
EQQLCHGP ------------------ MODIFYING AN OCCURRENCE ---------------------
Option ===>

Select one of the following:

1 OPERATIONS      - Modify operation data
2 DEPENDENCIES    - Modify dependencies
3 OCCURRENCE      - Modify occurrence data


Application           : PAYW             weekly payroll jobs
Input arrival         : 13/06/05 12.00
Deadline              : 13/06/05 16.00
Owner                 : SAMPLE           payroll application
Priority              : 5
Error code            :
Generating run cycle  : RUNEVERY
Variable table        : PAY
Successors            : 1
Predecessors          : 1
Cond Successors       : 0
Cond Predecessors     : 0
Manually created      : No
Group Definition      : GPAYW
```

Figure 139. EQQLCHGP - Modifying an occurrence

Specify option 2 and press Enter. The MODIFYING DEPENDENCIES panel, shown in Figure 140, is displayed.

```
EQQLCDPL ------------------- MODIFYING DEPENDENCIES ---------  ROW 1 TO 1 OF 1
Command ===>                                                 Scroll ===> PAGE

Enter the CREATE command above to create a new dependency or
enter any of the commands below:
B - Browse, D - Delete

Application           : PAYW             weekly payroll jobs
Input arrival         : 13/06/05 12.00
Deadline              : 13/06/05 16.00

Row Dep     Application id   Input arrival   Complete  Manually Deleted Pend
cmd Type                     date     time             Created          Mand
                                                                       Pred
'   P       PAYDAILY         13/06/05 12.00  N         N        N       N
'   S             CP         13/06/05 12.00  N         N        N       N
****************************** BOTTOM OF DATA ******************************
```

Figure 140. EQQLCDPL - Modifying dependencies

To remove the dependency, type the D command beside the PAYDAILY row, and press Enter. Dependencies that you have deleted previously are shown marked with D (the deleted dependency stays in the plan to stop it being restored when the plan is extended).

Chapter 12. Producing the current plan

This chapter shows you how to maintain the current plan (CP), which is the heart of IBM Workload Scheduler for z/OS processing. It drives your production workload and provides feedback about the current status of batch work.

During normal processing, the current plan can be updated by job-tracking events, panel users, the program interface, the automatic recovery function, and the event-triggered tracking function. Depending on your workload, the current plan could be updated several times per second. For this reason, and because the current plan is such a critical resource, IBM Workload Scheduler for z/OS handles it in a different way from the other databases and data sets. The physical structure of the current plan and the backup process used to ensure integrity are explained in "Organization and integrity of the current plan" on page 312.

Daily planning is the process of producing and maintaining the current plan, which is the detailed schedule of the work that IBM Workload Scheduler for z/OS will carry out on your system.

When scheduling jobs in the IBM Workload Scheduler environment, current plan processing also includes the automatic generation of the Symphony file. The Symphony file contains the necessary details for scheduled jobs on distributed agents.

You create and maintain the current plan using these options on the main menu:

Daily Planning
Produce current plans, real and trial.

This chapter describes this panel. As with long-term planning, certain functions take effect online, whereas others are performed by batch jobs submitted from the panel. In certain recovery situations, you might also need to renew the Symphony file.

MCP Modify the Current Plan.

Information used by daily planning

Daily planning uses data from several IBM Workload Scheduler for z/OS data sets:

- The long-term plan (LTP), which contains a list of application occurrences to run each day. The long-term plan details the input arrival and deadline times as well as external dependencies for every occurrence.
- The existing current plan. Uncompleted applications need to be included in the new plan, and completed applications are reported on.
- The application description database, which contains the detail of applications at operation level.
- The workstation description database, which shows the open intervals, parallel servers, and fixed resources available at each workstation.
- The resource description database, which has details of special resources.
- The script library, which is used in the creation of the Symphony file.

- The TOPOLOGY initialization statement, which is used for the Symphony file. For more information about the TOPOLOGY statement, see *Customization and Tuning*.

The data is collected and used to update the relevant data sets and produce the current plan reports. The daily planning process involves:

- Update of the long-term plan for occurrences that are marked complete or have been deleted in the existing current plan
- Creation of an updated current plan, called the *new current plan* (NCP), that contains:
  - Uncompleted operations from the existing current plan.
  - New occurrence selections from the long-term plan according to the specified end date. See Chapter 11, "Producing and modifying the long-term plan," on page 287.
  - Potential predecessor records for each occurrence. The records are used to establish a list of candidates for successor resolution when an occurrence is added to the current plan using the panel, the program interface, or event-triggered tracking.
- Optional copy of the job-tracking archive log
- Creation of daily planning reports
- Creation of the Symphony file for the distributed agents

Figure 141 shows the required data.

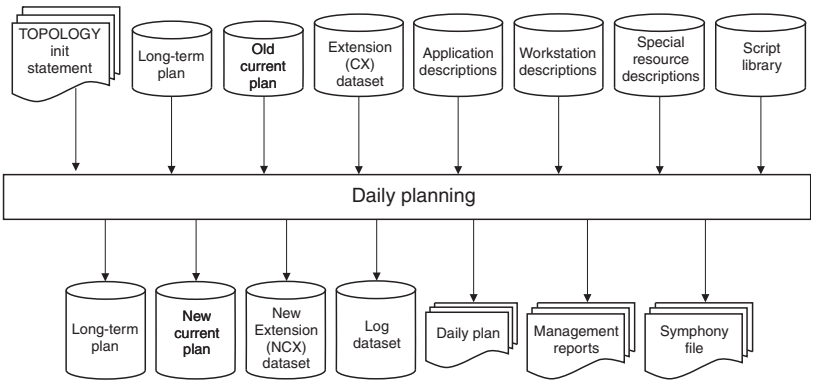


Figure 141. Data required by the daily planning process

The daily planning process writes messages to the EQQMLOG and SYSPRINT data sets. Error and warning messages are indicated by a nonzero return code from the batch job. These messages should be investigated immediately; they can indicate a potential problem in the new plan.

In some cases, where the error is severe, the daily planning process does not create a new current plan. For example, if the daily planning process detects a loop in a chain of dependent operations, a new current plan is not created. "Analyzing problems reported by daily planning" on page 309 details how daily planning analyzes dependency loops.

Creating and extending the current plan

About this task

You must create a current plan before IBM Workload Scheduler for z/OS can schedule work. You must also create a new plan if you have performed a refresh of the long-term plan (see "Creating the long-term plan" on page 289). Once you have created the current plan, you continually extend it.

Follow these steps to create the current plan:

1. Before you can create a current plan, you must create the long-term plan that is used as input to the daily planning process. See Chapter 11, "Producing and modifying the long-term plan," on page 287.
2. Select option 3 (DAILY PLANNING) from the main menu. The PRODUCING IWSz DAILY PLANS menu, shown in Figure 142, is displayed.

```
EQQDPLNP --------------- PRODUCING IWSz DAILY PLANS -----------------------
Option ===>

Select one of the following :

1 REPLAN           -  Replan current planning period
2 EXTEND           -  Extend the current planning period
3 TRIAL            -  Produce a trial plan
4 PRINT CURRENT    -  Print statistics for current planning period
5 SYMPHONY RENEW   -  Create Symphony file starting from Current Plan
```

Figure 142. EQQDPLNP - Producing daily plans

3. Select option 2 (EXTEND).
4. Specify a start date and time, and the end date and time of the planning window required, or the length, in hours and minutes. If you specify a length (extension period), you have the option of counting all days or only work days as part of the extension. For example, assume that Sunday is the only free day in your calendar, and you extend the current plan at noon on Saturday by 24 hours. If you include all days in the extension, by specifying `A` in the TYPE field, the plan is extended to noon on Sunday. If, however, you specify `W` in the TYPE field, the plan is extended to noon on the following *Monday*. Because Sunday is a free day, IBM Workload Scheduler for z/OS ignores this day when it calculates the end of the current plan.

   When creating a new plan, it is best to choose a future start date and time, so that jobs do not start running before you have time to check the messages, and so that operations do not have UNDECIDED status.
5. Create a report on the contents of the plan. See "Producing reports using daily planning" on page 305 for details of report options.
6. Inspect the plan, and use the MCP panel to manually correct any differences between the intended and actual plan contents. The first time you create the plan for a production environment, such differences are likely to occur for the applications that are planned to run at the start of the period. This is especially true if these applications are already running but are not controlled by IBM Workload Scheduler for z/OS. In this case, IBM Workload Scheduler for z/OS might mark an occurrence as completed before full control of workload submission is in place.
7. Use the MCP panel to display a list of the occurrences with UNDECIDED status.

8. Select the occurrences one by one, and either assign the proper status to them or delete them.
9. Obtain a list of all other occurrences that you suspect might have an incorrect status and correct them.
10. Submit a REPLAN job. This updates the long-term plan with the new occurrence data and lets IBM Workload Scheduler for z/OS recalculate the input arrival times of the remaining occurrences with the new current plan data.

Extending the current plan

The current plan should always stretch for some hours or days into the future. Extend the current plan at regular intervals, using the EXTEND option of the DAILY PLANNING menu. You can extend the current plan up to 21 days, although one day is more usual. The panel creates a batch job, which you can then submit. You can extend the current plan to a fixed date and time in the future, or you can extend it by a period of hours and minutes.

Figure 2 on page 4 shows a 48-hour current plan. The initial current plan extended 48 hours into the future: every morning the current plan is extended by a further 24 hours.

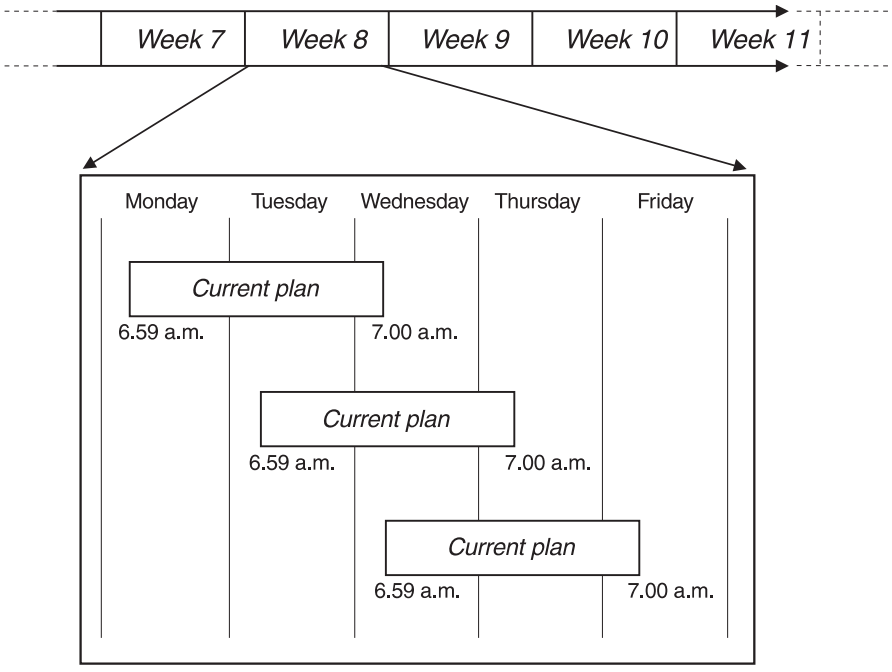


Figure 143. Extending the current plan

Input is taken from both the long-term plan and from the present current plan. The planning performed on Tuesday for Tuesday's work considers the actual situation (both completed and outstanding work) as reflected in the current plan.

Normally, you extend the current plan so that it stretches 24 hours from the end of the previous plan. If you do this every 12 hours, the current plan always extends at least 12 hours into the future. For instance, you could extend the plan by 24 hours at midnight and at noon. The same rules for free days and work days that apply to the creation of the current plan also apply to its extension. See “Creating and extending the current plan” on page 301.

You can automate this process by scheduling the batch job as an operation in an application. If you specify an extension length rather than a fixed date and time in the extend job, the same JCL can be submitted repeatedly to extend the plan.

When the current plan is extended and a new plan is created, all uncompleted work is carried forward into the new plan. New work is brought into the plan from the long-term plan (that is, occurrences whose input arrival times fall within the new planning period). All these operations are competing for time on workstations. The open intervals and resources for the workstations might have changed between the creation of the old and new plans, or operations might have finished late. IBM Workload Scheduler for z/OS must therefore recalculate its schedules in light of the new information now available to it. This can mean that the planned start and end times for some operations might differ in the new plan from those in the old plan.

Planned start times are system calculations of when operations will start, based on estimated duration and input arrival time. An operation might actually start before or after its planned start time, depending on conditions in the system. For example, a job might take less time to run than you estimated when setting up the operation, or your system might have been unavailable for some time. The planned start time is an estimate for your forward planning purposes; IBM Workload Scheduler for z/OS does not use it to schedule work.

The daily planning process also calculates a *latest out* time for each operation. This is the latest time an operation can start in order to meet the stated deadline. If there is contention for resources, IBM Workload Scheduler for z/OS allocates the resource to the operation that has the *earliest* latest out time. The latest out time can also be used to generate alert messages when IBM Workload Scheduler for z/OS determines that a deadline is in danger. For more information about the alerts that can be generated, see *Customization and Tuning*.

When the occurrences for the new plan are determined, the application database is used to generate potential predecessor records for every occurrence. Normally, external dependencies that are satisfied because the predecessor operation is completed, are removed from the current plan when the plan is extended. However, you can modify this behavior so that dependencies are maintained. This could prove useful in a case where the occurrence needs to be rerun. See *Customization and Tuning* for information about setting the *KEEPCOMPDEPS* parameter in the **BATCHOPT** initialization statement.

EXTEND also updates the long-term plan with information about occurrences that are not carried forward into the new plan.

When you extend the current plan, you have the option of producing reports on the contents of the plan. For details, see “Producing reports using daily planning” on page 305.

Recreating the current plan

You can use the REPLAN option of the DAILY PLANNING menu to update your existing current plan. This option performs the same functions as the EXTEND option, except that the current plan continues to cover the same time interval as before. No new occurrences can be included in the current plan by a REPLAN. This is because IBM Workload Scheduler for z/OS does not let you add to the long-term plan any occurrences that have an input arrival time before, or within, the period covered by the current plan.

Planned start and end times and the latest out time are recalculated when a REPLAN is performed. Any changes in workstation resources or open intervals are also considered. The application database is not used by the REPLAN process to determine the structure of the occurrences; they are copied directly from the old current plan. When the list of occurrences is determined, the application database is used to generate potential predecessor records for every occurrence.

When you REPLAN the current plan, you have the option of producing a report on the contents of the plan. See "Producing reports using daily planning" on page 305 for details.

Creating a trial current plan

About this task

Before you create, extend, or replan the current plan, you can create a trial plan to simulate the effect. A trial plan can reveal potential problems and provide the opportunity to avoid such problems before they affect your business systems. You should make a trial plan before every daily plan extend, this acts as an early-warning system.

To run a trial plan that uses VSAM copies as input, you need to follow these steps:

1. Run the EQQPCS03 sample to allocate/delete the data sets intended to contain the VSAM copies.
2. Select the TRIAL option from the DAILY PLANNING menu.
3. Specify which input data sets should be VSAM copies.

Step 1 can be performed only once. Steps 2 and 3 are repeated each time a trial plan is made.

When a trial plan with VSAM copies selected is made, the submitted job will have, in addition to the normal trial job, a first step that will invoke the EQQDPCOP routine to run the selected VSAM copies. This step will always empty and then refill the previously allocated VSAM (EQQPCS03).

If you want to run several TRIAL plans using already existing VSAM copies obtained in a first TRIAL plan, then you need to:

- Select YES on the EQQDTTRP panel in the 'Copy VSAM' field.
- Edit the trial job to be submitted.
- Manually delete the first step in the job (COPYVSM EXEC PGM=EQQBATCH, PARM='EQQDPCOP').

The skeleton member corresponding to the trial plan is EQQDPTRZ.

When VSAM copies are no longer needed, just run EQQPCS03 and remove the comments from the delete part.

Note: EQQPCS03 has intentionally been kept separate from EQQDPTRZ to avoid repeatedly having to allocate and delete VSAM data sets each time a trial plan is created.

When a trial plan is produced, the plan is not updated, but you get a report.

For end-to-end scheduling with fault tolerance capabilities

In an end-to-end with fault tolerance capabilities environment, you can run a trial plan to detect potential errors in the SCRIPT library members. Error messages are displayed to help you taking the appropriate actions and prevent the system from having problems.

You can perform a syntactic check of all the script library members by using the EQQSLCHK sample job. This sample runs in stand-alone mode, without interacting with the CP database. For detailed information about how to use and customize the EQQSLCHK sample Job, see the *Customization and Tuning* manual.

Renewing the symphony file

You can use the SYMPHONY RENEW option of the DAILY PLANNING menu to recover from error situations. In normal situations, the Symphony file is automatically generated during the daily plan processing. Some examples of error situations include the following:

- There is a non-valid job definition in the script library.
- The workstation definitions are incorrect.
- An incorrect Windows user name or password is specified.

But, there are regular operation situations when you need to renew the Symphony file:

- When you make changes to the script library or to the definitions of the TOPOLOGY statement
- When you add or change information in the current plan, such as workstation definitions

Producing reports using daily planning

When creating, extending, or replanning the current plan, you can produce reports on the results. The contents of these reports are determined by the options you select. See “Daily planning reports” on page 807 for examples of the reports. You can also produce a report on completed operations and operations in the existing plan that ended in error, by using the PRINT CURRENT option of the DAILY PLANNING menu. If you need information on the current plan, you can use the QCP option on the main menu to obtain an online view of the current plan.

Daily planning provides two printed outputs:
- Plans
- Management reports

Plan reports

You can produce the following plan reports:

Workstation summary histograms
Show the planned use of the workstation and of the two workstation resources.

Daily operating plan
Show all operations and occurrences to be processed.

Special resource planned utilization report
Shows, by interval, the availability of each resource, and possible allocation problems.

Workstation plans
Can be provided for all workstations, or for non-reporting workstations only. They list all operations to be performed at each workstation, in order of planned start time.

Input arrival lists
List all operations to be performed at each workstation, in order of input arrival time.

Management reports

Management reports can be created for the current period and for the previous period.

Current period

Current period results are obtained by specifying Y for the *Current Period* report option when submitting a job to REPLAN or EXTEND the current plan. You can also obtain current period results by submitting the PRINT CURRENT batch job. These reports are included:

Completed applications
This report shows all applications that have been completed or deleted in the given period. Also, each operation that has a specified input arrival or deadline is printed in the report.

The report includes any error code specified when adding an occurrence to the long-term or current plan. An application added with an error code is considered an occurrence rerun, and is reported here, whereas a rerun of one or more operations in an application is reported in the error statistics report.

Operations ended in error
This report lists all operations that have ended abnormally and that have not yet been fixed.

Previous period

You can also produce reports for a period before a REPLAN or EXTEND of the current plan. See “Reports for a previous planning period” on page 815 for examples of the reports.

The previous period is the latest complete 24-hour period starting at the hour specified by the PLANHOUR keyword of the BATCHOPT statement. The default hour is 06:00. Previous period results are stored in the current plan if the PREVRES keyword of BATCHOPT has the value YES, which is the default value. The data is kept in the current plan until the next REPLAN or EXTEND job has reported on the data, and it is then deleted. For example, if you have specified PLANHOUR as 08:00 and you are running EXTEND at 07:00 on Wednesday morning, you will get reports from the interval 08:00 Monday to 08:00 Tuesday, and this data is deleted (if you run another extend at 07:30, there is no previous period report). If you then run REPLAN at noon Wednesday, you will get the reports from 08:00 Tuesday to 08:00 Wednesday. If you wait two days before the next EXTEND or REPLAN, you get a report for the previous two 24-hour periods, because the data is kept until reported on. For details about the BATCHOPT statement, see *Customization and Tuning*.

Previous period reports include:

Summary of completed applications
The report shows the number of applications processed in the period and gives the number of applications:
- With late input arrival, showing the average input delay
- That missed their deadlines, showing the average deadline delay
- That completed before their deadlines, showing the average deadline earliness
- That were rerun
- That were deleted

Completed applications
This report has statistics for each application.

Operations ended in error
This report shows the operations that ended in error and have not yet been fixed.

Special resource actual utilization report
Shows, by interval, the availability of each resource, the percentage of time that the resource was not being used, and the percentage of time that operations were waiting.

Error statistics on completed applications
This report (in error-code order) shows:
- Applications that have had one or more operations rerun because of an error and that have now completed successfully (these applications do not appear on the Completed Applications report).
- The error duration (time lost due to errors), if it is not zero.
- The rerun duration (time lost when rerunning completed applications), for any application that has been added to the long-term plan or current plan with a rerun (error) code.
- The total error duration for each error code.
- The total rerun duration for each error code.
- The number of errors for each error code.
- The total number of errors.

Note: An application or operation cannot appear in both the reports Completed Applications and Error Statistics on Completed Applications in any period.

Workstation histograms - actual utilization
The report shows the actual use of workstations for the given period. Completion-only and non-reporting workstations are not included in this report. These histograms can be compared with the planned usage.

Missed feedback report
The missed feedback report is created by a REPLAN or EXTEND job only if missed feedback data has been created. The report lists all operations and occurrences where the feedback of the actual duration and deadline to the application description database was not possible.

Critical path report
The critical path report is created by a REPLAN, EXTEND, or TRIAL job only if critical job data has been created. The report lists all the critical jobs, assigning one of the following CRIT TYPE values:

ORIG The job has the CRITICAL field set to P.

PRED The job was identified as critical by running the daily planning batch job. This happens when the job is a predecessor of a critical job.

Creating a track log

When you run the daily planning process, you can create a track log data set. The track log contains the job-tracking and auditing records from the previous planning period. The track log records are written to the EQQTROUT data set. The track log can be used as an auditing trail, because all updates to the plans and databases can be logged in the data set.

The sample library contains an auditing package, which can be used to create reports from the track log, job-tracking, or extended-auditing data sets. For more information about the AUDIT statement and the sample auditing package, see *Customization and Tuning*.

You can use the Performance Reporter for z/OS licensed program product to create reports using the track log.

Logging extended-auditing information to record updates to the database

In addition to logging updates to the current plan and recording auditing information for the requested files, you can also choose to log updates to the databases and record information for the requested files. You activate this extended-auditing function by setting AMOUNT(EXTENDED) in the AUDIT initialization statement (for details, see *Customization and Tuning*).

The extended-auditing data is written to the EQQDB*nn* data sets, which are created by the EQQPCS14 sample. The extended-auditing records show the values that were set before and after the database was changed. Extended-auditing information can be requested only for the following files:

- AD
- CAL
- JV
- OI
- PER
- RD
- RG
- WS

The sample library contains an auditing package, which can be used to create reports from the extended-auditing data sets. For more information about the IBM Workload Scheduler for z/OS auditing package, see *Customization and Tuning*.

Resolving dependencies between operations

The rules used by the daily planning process for resolving external dependencies between operations are:

Case A:

The successor operation has no input arrival time specified. An external dependency to an operation in the predecessor occurrence is created if the input arrival time of the predecessor occurrence is earlier than, or equal to, the input arrival time of the successor occurrence.

Case B:

The successor operation has input arrival time specified. An external dependency to an operation in the predecessor occurrence is created if the input arrival time of the predecessor occurrence is earlier than, or equal to, the input arrival time of the successor **operation**.

When the current plan is extended, dependencies between new occurrences and existing occurrences that are carried forward from the old plan are resolved only if the dependency is in the long-term plan when the current plan is extended. An occurrence added by the daily planning process from the long-term plan will not be made a successor to an occurrence added by automatic job recovery, PIF, ETT, or the MCP panel, even if normal dependency criteria are met. For example, consider this case:

1. Application A is run daily. It has an input arrival time of 09:00 and contains one operation, A1. Application A exists in the long-term plan.
2. Application B is run daily. It has an input arrival time of 16:00 and contains one operation, B1. B1 has A1 defined as an external predecessor in the application description database. Application B exists in the long-term plan.
3. An occurrence of application A is added to the current plan from the MCP panel at 12:00. The occurrence input arrival is 12:00.
4. The daily planning batch job is run at 15:00 to extend the current plan. Application B is added to the current plan by daily planning and is given a dependency on the 09:00 occurrence of application A. The external dependency is not resolved to the 12:00 occurrence of application A.
5. If another occurrence of application B is added to the current plan at 16:15 using the MCP panel, with an input arrival time of 16:15, the external dependency is resolved on the 12:00 occurrence of application A.

If you need to change or add dependencies in the current plan, use the MODIFY CURRENT PLAN panel, which is described in "Changing and adding dependencies" on page 596.

Analyzing problems reported by daily planning

When the daily planning process detects a severe problem, it does not create a new plan, but writes messages that describe the problem and sets a nonzero return code. Messages are written to the message-log data set defined by the EQQMLOG DD statement and to the daily plan printout data set defined by the SYSPRINT DD statement. In most cases, the problem is easily solved, such as when an operation refers to a deleted workstation definition. In the case of a dependency loop, however, the problem can be complex; you must check the messages carefully and correct the problem.

A dependency loop can occur in daily planning for several reasons. The most common causes are errors when defining input arrival times or dependencies. A chain of dependent operations, called a *network*, must have a beginning and an end. If there is no distinct beginning or end, a dependency loop is detected. Sometimes the loop can be small and easy to fix (for example if an operation is defined as both predecessor and successor). In other cases, the loop might involve thousands of operations.

You can detect a loop using a trial plan. To help you correct a dependency loop, the daily planning program analyzes the loop and reports only those operations

directly involved in the loop rather than all operations in the network. IBM Workload Scheduler for z/OS analyzes the loop and reports on operations that are most likely to cause the loop:

- The operation input arrival time is earlier than the predecessor operation input arrival time.
- The operation is an entry to the loop; it is not in the loop, but a successor operation is in the loop.
- Removal of a dependency has minimal impact on the network but removes the loop.

The criteria are weighted in the listed order. Any operation satisfying the first test is reported as a probable cause.

Complex loops that contain more than one looping path are reported as a single set of looping operation dependencies with more than one probable cause. Figure 144 shows examples of the messages issued by the daily planning programs to assist dependency loop resolution.

```
EQQ3150E LOOP FOUND IN AN APPLICATION NETWORK:
EQQ3150I - LOOP TYPE                   =SOME NODES COULD NOT BE CHECKED
EQQ3150I - NETWORK ID                  =000000000002
EQQ3150I - TOTAL OPERATIONS            =000000000009
EQQ3150I - TOTAL DEPENDENCIES          =000000000020
EQQ3150I - NO. OF FOPs                 =000000000003
EQQ3150I - NO. OF LOPs                 =000000000001
EQQ3150I - NO. OF UNCHECKED NODES      =000000000005
EQQ3150I - FIRST OCCURRENCE            =LOOPA      051027 1023
EQQ3151I LOOP REDUCTION ITERATION 00001 REDUCED LOOP TO 000000004 OPERATIONS
EQQ3152I                           ADID     IADATE   IATM    WSD   OPNO  JOBNM
EQQ3153I LOOP OPERATION:          (LOOPC  ) 051027   1023    CPU1   006  JOBX
EQQ3154I PREDECESSOR OF:          (LOOPD  ) 051027   1023           007
EQQ3155I SUCCESSOR OF:            (LOOPD  ) 051027   1023           008
EQQ3153I LOOP OPERATION:          (LOOPD  ) 051027   1023    CPU1   008  JOBY
EQQ3154I PREDECESSOR OF:          (LOOPC  ) 051027   1023           006
EQQ3154I PREDECESSOR OF:          (LOOPA  ) 051027   1023           002
EQQ3155I SUCCESSOR OF:            (LOOPD  ) 051027   1023           007
EQQ3153I LOOP OPERATION:          (LOOPD  ) 051027   1023    CPU1   007  JOBZ
EQQ3154I PREDECESSOR OF:          (LOOPD  ) 051027   1023           008
EQQ3155I SUCCESSOR OF:            (LOOPA  ) 051027   1023           002
EQQ3155I SUCCESSOR OF:            (LOOPC  ) 051027   1023           006
EQQ3153I LOOP OPERATION:          (LOOPA  ) 051027   1023    CPU1   002  JOBT
EQQ3154I PREDECESSOR OF:          (LOOPD  ) 051027   1023           007
EQQ3155I SUCCESSOR OF:            (LOOPD  ) 051027   1023           008
EQQ3156I REMOVED DEPENDENCY:      (LOOPD  CPU1 0008 JOBY  051027  1023)
EQQ3156I PREDECESSOR OF:          (LOOPA  CPU1 0002 JOBT  051027  1023)
EQQ3156I REASON FOR REMOVAL:      CLOSEST TO LOOP ENTRY
EQQ3151I LOOP REDUCTION ITERATION 00002 REDUCED LOOP TO 000000003 OPERATIONS
EQQ3156I REMOVED DEPENDENCY:      (LOOPC  CPU1 0006 JOBX  051027  1023)
EQQ3156I PREDECESSOR OF:          (LOOPD  CPU1 0007 JOBZ  051027  1023)
EQQ3156I REASON FOR REMOVAL:      CLOSEST TO LOOP ENTRY
EQQ3151I LOOP REDUCTION ITERATION 00003 REDUCED LOOP TO 000000000 OPERATIONS
EQQ3157I                          ADID   VALIDTO   LASTUPD        USER
EQQ3158I LOOP ADID:               LOOPD  991231     051104 0107    USER1
EQQ3158I LOOP ADID:               LOOPA  991231     051027 0644    USER2
EQQ3158I LOOP ADID:               LOOPC  991231     051027 0530    USER3
```

Figure 144. Example of messages issued in the EQQLOOP data set

For detailed information about how daily planning detects a loop condition and provides you with suggestions on how to resolve it, see Chapter 27, "Loop detection and analysis," on page 549.

For end-to-end scheduling with fault tolerance capabilities

If you are using the end-to-end scheduling with fault tolerance capabilities, the return code of a plan might not be 0. If the return code is 4, the current plan is created, but the Symphony file is not, as logged in EQQMLOG. To create a Symphony file, select the SYMPHONY RENEW option from the PRODUCING OPC DAILY PLANS panel.

Modifying the current plan

To construct a current plan, you must first set up the IBM Workload Scheduler for z/OS databases and then construct the long-term plan. Changes in the long-term plan are reflected in the current plan only after you perform a current plan EXTEND or REPLAN. If you want your changes to take effect immediately or if you want to add occurrences to the existing current plan, you must use the MCP (MODIFY CURRENT PLAN) panel.

```
EQQMTOPP ---------------- MODIFYING THE CURRENT PLAN --------------------
Option ===>

Select one of the following:

1 ADD             - Add a new occurrence to the current plan
2 LIST            - List existing occurrences for further processing

3 OPERATIONS      - List existing operations for further processing
4 ERROR HANDLING  - Handle operations in error
5 WORK STATIONS   - Change status and open interval of work stations

6 JOB SETUP       - Prepare JCL for jobs in the current plan

7 SPECRES         - Special resource monitor

9 DEFINE EL       - Define alternative error list layouts
```

Figure 145. EQQMTOPP - Modifying the current plan

You can reach the MODIFY CURRENT PLAN panel from the main menu.

Querying the current plan

The QCP (query current plan) option from the main menu presents you with a list of resources within the current plan that you can investigate. From here, you can obtain information on operations, workstations, and application occurrences. This information is taken directly from the current plan. The panel can also show a list of all operations that have ended in error.

```
EQQSTOPP -------------- CURRENT PLAN AND STATUS INQUIRY -----------------------
Option ===>

Select one of the following:

1 APPLICATIONS    - Query application occurrences
2 MOST CRITICAL   - Query most critical uncompleted application occurrences

3 OPERATIONS      - Query operations (jobs)
4 ENDED IN ERROR  - Query operations ended in error

5 WORK STATIONS   - Query work station activities

6 GENERAL         - Query general information about current plan

7 CRITICAL JOBS   - Query critical jobs and their critical paths
```

Figure 146. EQQSTOPP - Current plan and status inquiry

For more information about the functions available from the CURRENT PLAN AND STATUS INQUIRY panel, refer to "The QCP panel" on page 576.

Current plan reference information

The remainder of this chapter describes the daily planning process in more detail. Refer to this if you have a problem, or if you need to understand how IBM Workload Scheduler for z/OS builds the plan.

Organization and integrity of the current plan

IBM Workload Scheduler for z/OS is designed so that in most error situations, the current plan can be automatically recovered. If you need to recover the plan manually, refer to *Customization and Tuning*.

These data sets are used for current plan integrity:

EQQCKPT
: Checkpoint data set

EQQCP1DS
: Primary current-plan data set

EQQCP2DS
: Alternate current-plan data set

EQQCXDS
: Current plan extension data set

EQQDB*nn*
: Current and inactive extended-auditing data logs

EQQDBARC
: Extended-auditing data archive log

EQQDL*nn*
: Current and inactive dual job-tracking logs

EQQJT*nn*
: Current and inactive job-tracking logs

EQQJTARC
: Job-tracking archive log

EQQNCPDS
: New current-plan data set

EQQNCXDS
: New current plan extension data set

EQQSCPDS
: Current plan copy to produce the Symphony file

EQQSIDS
Side information data set

However, the explanation of the current plan process uses these logical terms to describe the current plan and its associated data sets:

Current plan
Used when describing the current plan in general. The current plan consists of the active current-plan data set, the extension (CX) data set, and the side data set (EQQSIDS). These data sets are described later.

Active current plan
Refers to the current-plan data set that is currently in use within IBM Workload Scheduler for z/OS. It might be either EQQCP1DS or EQQCP2DS. Every time a current plan backup is performed, IBM Workload Scheduler for z/OS switches the active current plan to the other data set. The current plan backup process is described in "The current-plan backup process" on page 316.

Backup current plan
Refers to the current-plan data set that is not currently in use. This data set contains a backup copy of the current plan. It might be either EQQCP1DS or EQQCP2DS.

Side information
Refers to a file (EQQSIDS) that contains frequently referenced database information, ETT criteria, and configuration information.

Current plan extensions
Refers to a file that contains current special resource information. The current file refers to EQQCXDS, and the daily planning process creates EQQNCXDS.

New current plan
Refers to a new version of the current plan, which is created by one of the daily planning batch jobs. It always refers to EQQNCPDS.

Current and inactive job-tracking log
Refers to the data sets used to log updates to the current plan and to record auditing information for the requested files. You must use at least two job-tracking logs, referenced by ddnames EQQJT01 and EQQJT02. You can use up to 99 job-tracking logs. The job-tracking logs are used in a cyclic manner, IBM Workload Scheduler for z/OS automatically switches to the next available job-tracking log after a current plan backup. The data from the inactive data set is copied to the archive log, and the data set is considered emptied in preparation for future use. You should use at least 5 job-tracking logs (this is the default number specified by the JTLOGS keyword of the JTOPTS statement).

Current and inactive extended-auditing data log
If you specified AMOUNT(EXTENDED) in the AUDIT statement, refers to the data sets used to log updates to the databases and to record auditing information for the requested files. You must use at least two extended auditing data logs, referenced by ddnames EQQDB01 and EQQDB02. You can use up to 99 extended-auditing data logs. The extended-auditing data logs are used in a cyclic manner, IBM Workload Scheduler for z/OS automatically switches to the next available log after a current plan backup. The data from the inactive data set is copied to the archive log, and the data set is considered emptied in preparation for future use. You

should use at least 5 extended-auditing data logs (this is the default number specified by the JTLOGS keyword of the JTOPTS).

Current and inactive dual job-tracking log
If the dual logging function has been requested, IBM Workload Scheduler for z/OS duplicates the job-tracking records in the corresponding dual job-tracking log. Dual logs are switched at the same time, and in the same sequence, as the job-tracking logs. So the number of dual job-tracking data sets is determined by the number of normal job-tracking data sets.

Job-tracking archive log
Represents the accumulated job-tracking data since the new current plan was created. When the job-tracking log is switched, the data from the inactive data set is appended to the archive log. The archive log is copied to the track-log data set referenced by the EQQTROUT ddname during the daily planning process. When IBM Workload Scheduler for z/OS takes over the NCP, the archive data set is emptied.

Extend-auditing data archive log
Represents the accumulated extended-auditing data since the new current plan was created. When the extended-auditing data log is switched, the data from the inactive data set is appended to the archive log. The archive log is copied to the extended-auditing data set referenced by the EQQDBOUT ddname during the daily planning process. When IBM Workload Scheduler for z/OS takes over the NCP, the archive data set is emptied.

Checkpoint
Refers to the EQQCKPT data set, which contains information about the current status of the IBM Workload Scheduler for z/OS system, including which current plan and job-tracking data sets are currently active.

Symphony file
Represents a local plan for a set of fault-tolerant workstations and is updated according to the changes in the local and current plan.

The basic principle of current plan recovery is that if the active current plan becomes unusable for any reason, IBM Workload Scheduler for z/OS must always be able to create an up-to-date current plan from the backup current plan and the job-tracking logs. For detailed information about how IBM Workload Scheduler for z/OS creates a current plan again, see *Customization and Tuning*.

Current plan during normal processing

Normal processing means that the IBM Workload Scheduler for z/OS subsystem is running, job tracking is active, and users have access to the IBM Workload Scheduler for z/OS subsystem. *Job tracking is active* means that an active current plan is updated as events occur in the operating system.

Figure 147 on page 315 shows the current plan with associated data sets and how they are used during normal processing.

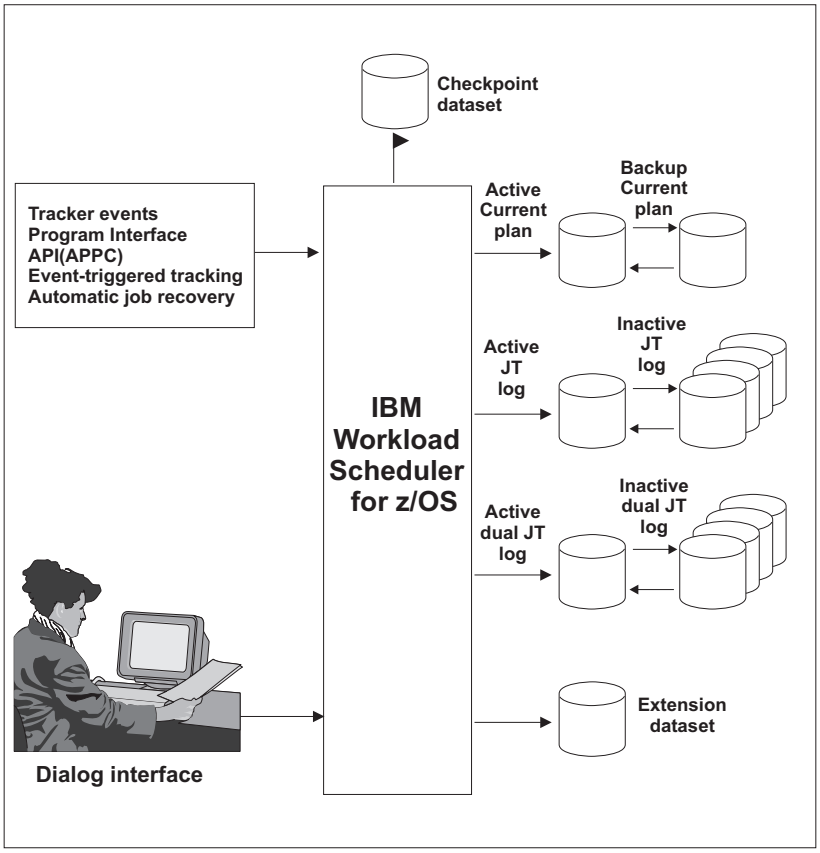


Figure 147. Updating the current plan during normal processing

IBM Workload Scheduler for z/OS can update the current plan:

- With event information from the event data sets, for example *job ABC started*, *job XYZ ended*
- With panel requests, for example from the MODIFY CURRENT PLAN panel
- With requests from the IBM Workload Scheduler for z/OS program interface
- As a result of a triggering event recognized by the event-triggered tracking function
- As a result of a request from IBM Workload Scheduler for z/OS automatic recovery statements

Every time the active current plan is updated, a record of the change is written to the active job-tracking log (JT log). The job-tracking record is also written to the dual job-tracking log if dual logging has been requested.

The remaining data sets are not used during normal processing:

- The checkpoint data set contains status information; for example, which physical data set is the active current plan.
- The backup current plan contains a copy of the current plan as it was at the last successful current plan backup. In recovery situations, this is used with the job-tracking log to create an up-to-date current plan again. The current plan backup process is described in "The current-plan backup process" on page 316.
- The new current plan (NCP) is used by the daily planning batch jobs when extend or replan is requested. These batch jobs create the new plan in this data set. The NCP is also used to re-create the current plan in conjunction with the

various job-tracking logs, if a usable current plan is not available or when you specifically request to start IBM Workload Scheduler for z/OS from the NCP.
- The inactive job-tracking logs and the inactive dual-logging data sets.

The current-plan backup process

IBM Workload Scheduler for z/OS automatically backs up the active current plan at certain stages in processing.

This is a step-by-step description of the current-plan backup process:

1. IBM Workload Scheduler for z/OS locks the current plan to prevent it from being updated during the backup process. During the backup, events are queued in storage. Panel users working with the current plan might experience a short delay.
2. The CX data space (EQQCXDS) is backed up to DASD.
3. The backup current plan is erased.
4. The active current plan is copied to the backup current plan. The contents of the two are now identical.
5. The data sets are switched. The backup current plan becomes the active and the active becomes the backup.
6. A current plan backup record is written to the job-tracking log, and the next available job-tracking log becomes active. The corresponding dual job-tracking log is also switched.
7. The current plan is unlocked. Normal processing continues. Events queued in storage start to update the active current plan. Panel users' requests are processed.
8. The data from the now inactive job-tracking log is appended to the job-tracking archive log. The inactive job-tracking log is emptied for future use.

   If you activated the extended auditing feature, the data from the now inactive extended-auditing data log is appended to the extended-auditing archive log. The inactive extended-auditing log is emptied for future use.

A current plan backup is performed at these times:

- During normal processing, according to the value of the BACKUP parameter of the JTOPTS initialization statement. This parameter specifies the number of current plan updates that must occur before a current plan backup is performed.
- When the BACKUP command is issued specifying the current plan resource. See "BACKUP" on page 730 for more information.
- Immediately before normal termination of the IBM Workload Scheduler for z/OS subsystem.
- When IBM Workload Scheduler for z/OS detects that a daily planning batch job has started.
- After a daily planning batch job has created a new current plan.
- After current plan recovery processing has successfully re-created an up-to-date current plan.

Creating and activating the new current plan

The creation of a new current plan is performed by the daily planning batch jobs. The two possible options are *extend* and *replan* the current plan. You also use the extend function when creating a current plan for the first time. Both the extend and replan functions cause the creation of a new current plan in the new current-plan (NCP) data set.

The steps below describe in detail how the new current plan is created and then brought into normal processing, including the use of the Symphony file:

A Daily Planning Job Starts and Is Recognized by IBM Workload Scheduler for z/OS.

1. A daily planning batch job starts, signals the IBM Workload Scheduler for z/OS subsystem using an ENQ, and then waits.

   The Active Current Plan Is Backed Up

2. IBM Workload Scheduler for z/OS detects the ENQ from the batch job and locks the current plan, thereby preventing more updates. All events related to job streams and jobs in IBM Workload Scheduler are queued for later processing.
3. The active current plan is updated with the latest information from in-storage control blocks representing workstations and active operations. The extension file (CX), which is held in a data space, is refreshed to DASD.
4. The inactive current plan is erased.
5. The active current plan is copied to the inactive current plan. They are now identical.
6. The inactive current plan becomes the active current plan, and the previously active becomes the inactive.
7. The job-tracking logs are switched.
8. The current plan is unlocked, and normal processing continues. The current plan is updated, processing the queued events: these updates are logged into the currently active job-tracking log.
9. The data from the inactive job-tracking log is appended to the job-tracking archive log.
10. IBM Workload Scheduler for z/OS signals to the batch job that backup processing is complete.
11. No more events for IBM Workload Scheduler are processed. These events are processed later in the new plan using the usual processing for IBM Workload Scheduler.

    The daily planning job builds a NCP

12. The batch job starts executing again. The inactive current plan is used (together with the long-term plan, application description, resource database, and workstation for a current plan extend) as input, and a new current plan is created in the NCP and new current plan extension (NCX) data sets. While the batch job is building the new current plan, IBM Workload Scheduler for z/OS continues normal processing except that a current plan backup is not permitted because the batch job is using the inactive current plan data set.
13. In the new current plan, the daily planning job flags the jobs and job streams that will be added to the Symphony file.
14. The daily planning batch job starts updating the Symphony file. Message EQQ3133I INITIALIZING NEW SYMPHONY FILE (RUN NUMBER = *nn*) is issued by the DP batch job at this time.
15. The contents of the job-tracking archive data set are copied to the data set in the daily planning job referenced by the EQQTROUT ddname.
16. When the new current plan is ready, the checkpoint data set is updated to show if the new current plan was successfully created. The normal mode manager (NMM) subtask is notified that the daily planning process has completed.

17. The subsystem examines the checkpoint data set to see if a new current plan was successfully created. In this case, the scheduler sets the OPCTUNCP flag to H in the EQQCKPT header record, indicating that **an NCP is being taken over**. If the end-to-end scheduling with fault tolerance capabilities feature is not active (no TPLGYPRM parameter in BATCHOPTS), skip to step 21.
18. The scheduler sends a command to stop the local fault-tolerant end-to-end scheduling and sets a timer to 5 minutes (300 seconds).
19. If a response arrives within 5 minutes, indicating that all the local fault-tolerant end-to-end scheduling stopped, processing continues with step 21.
20. If a response does not arrives within 5 minutes, the scheduler continues as if a daily planning did not run (steps 21-34 are skipped). This might leave the LTP header record updated as if the NCP was taken over while the current plan header shows the prior value for CP end date and time.
21. The current plan is locked, preventing it from being updated. All events related to job streams and jobs for IBM Workload Scheduler are queued for later processing.
22. The new current plan is copied to the active current plan, and the NCX is copied to the current plan extension (CX).
23. The job-tracking archive log is emptied.
24. The active job-tracking log now contains a record of the updates to the current plan that were made while the daily plan job was running. These are read, and the current plan is updated accordingly.
25. In-storage control blocks representing workstations and active operations are rebuilt from the active current plan, and a data space is created from the current-plan-extension data set.

    The Newly Created Active Current Plan Is Backed Up
26. A current plan backup is performed. The inactive current plan is erased.
27. The active current plan is copied to the inactive one, and EQQSCPDS is produced. This VSAM is a copy of the current plan and will be used by data processing to add job information to the Symphony file.
28. The next available job-tracking log becomes active.
29. The current plan is unlocked and normal processing continues. All changes to jobs in the Symphony file are sent to the distributed agents, when the Symphony file is available.
30. The data from the now inactive job-tracking log is copied into the job-tracking archive log.

    The Symphony File is Updated
31. Starting from EQQSCPDS that contains the updates for the job-tracking file, the job and job stream information is added to the new Symphony file. If a problem occurred during the building of the Symphony file, the Symphony file is not built. To create the Symphony file, you must perform a Symphony renew after correcting the errors.

    The Symphony File is Distributed.
32. IBM Workload Scheduler for z/OS sends the Symphony file to IBM Workload Scheduler.
33. Before distributing the new Symphony file, all the events of the old Symphony file that are still outstanding are applied to the new Symphony file.
34. In IBM Workload Scheduler, the new Symphony file is distributed.

Note:

1. Consider that all long-term plan and current plan batch planning jobs have to be excluded from SMARTBATCH DA (Data Accelerator) processing. When the SMARTBATCH DATA ACCELERATOR is used with the long-term plan and current plan batch planning jobs, the normal I/O to EQQCKPT is delayed until END OF JOB (or at least END OF JOBSTEP). This interferes with the normal exchange of data between the batch job and the controller started task so that when the batch job signals the controller to check the EQQCKPT to determine whether a new current plan has been created, the required updates to the CKPT have not yet been made. This causes the controller to conclude that no NCP has been created, and no turnover processing is done. As a result, even if the plan jobs run successfully, the NCP is not taken into production by the controller unless a CURRPLAN(NEW) restart is performed.
2. Batch optimizer utilities, such as BMC Batch Optimizer Data Optimizer and Mainview Batch Optimizer, prevent correct communication between the scheduler's controller and CP/LTP batch planning jobs. The scheduler's logic depends on an exchange of enqueues and real-time updates of several sequential data sets to pass information back and forth between the controller's STC and the CP/LTP batch planning jobs. These optimizers hold I/O from the batch jobs until END OF STEP or END OF JOB, then preventing the required communication from taking place. When such utilities are allowed to "manage" I/O for the scheduler's CP or LTP batch planning jobs, communication between the jobs and the controller is disrupted. This causes numerous problems that are hard to diagnose. Most commonly, the CURRENT PLAN EXTEND or REPLAN jobs will run to normal completion, and an NCP data set will be successfully created, but the controller will fail to automatically take the new plan into production until it is forced to do so via a CURRPLAN(NEW) restart of the CONTROLLER. Use of BATCHPIPES with these batch planning jobs will result in the same sorts of problems.

Problems with current plan batch jobs

About this task

The recovery actions you take are crucial any time a CP batch job ends unsuccessfully, for example:

- A DP batch job abnormally ends or is cancelled.
- A system outage occurs while a DP batch job is running.
- In an end-to-end with fault tolerance capabilities environment, a problem related to UNIX system services (HFS, zFS, OMVS) occurs during DP batch processing.

Before taking any recovery action, do the following:

1. Check if the NCP you have is valid for a restart, looking for message EQQN057I in the controller message log. If you do not find it, do NOT restart the controller with JTOPTS CURRPLAN(NEW). In fact the controller issues message EQQN057I when recognizing the NCP, created by the DP process, as new version of the CP.
2. If you must restart the controller after unexpected events, such as system crash or controller abend, before starting the controller temporarily set in the in JTOPTS statement:
   - JOBSUBMIT(NO)
   - If the end-to-end scheduling with fault tolerance capabilities is active, FTWJSUB(NO)

3. With controller running, compare the current plan end value reported in LTP (panel 2.4 EQQLSTAP) with the planning period end value reported in CP (panel 6.6 EQQGSCPP). If the EQQLSTAP value is more recent than EQQGSCPP value, it is a symptom of a synchronization problem during the Symphony file creation process.

Recovery actions

Take different actions depending on whether the batch job log shows message EQQ3105I, meaning that the batch job produced the NCP:

- If the batch job produced the NCP, check if the controller message log contains message EQQN057I with the *FROMDD* variable set to EQQNCPDS: if you find it, then the controller recognized the NCP. If the end-to-end scheduling with fault tolerance capabilities is active, message EQQN057I is issued after the synchronization phase ended, therefore check if a synchronization process is in progress and wait for its end to understand whether the controller recognized the NCP or not. The synchronization phase lasts approximately 5 minutes, starting with EQQN117I message and ending with EQQZ195I (successful synchronization) or EQQN064E (synchronization failed).
  - If the controller recognized the NCP then, if the end-to-end scheduling with fault tolerance capabilities is active, run a Symphony renew, otherwise no further action is needed.
  - If the controller did not recognize the NCP, take the following actions:
    - Run a DP extend, with the TPLGYPRM parameter commented out in the BATCHOPTS statement.
    - Run a Symphony renew, with the TPLGYPRM parameter uncommented in the BATCHOPTS statement.
- If the batch job did not produce the NCP, rerun the batch job.

Post-recovery actions

After completing the recovery actions, consider activating the job submission, by using option 9.2 of the ISPF dialog, and restoring the original values for the JOBSUBMIT and FTWJSUB controller parameters.

Chapter 13. Multiple matching criteria for the resolution of dependencies

The execution of an operation or occurrence in the plan may be specified to depend on the completion of another operation or occurrence. The operation/occurrence that depends on another is termed *successor*. A successor depends on a *predecessor*. After a dependency is defined in the database, the process by which it is resolved in the plan can be defined as finding the best match between the operations or, if this is not possible, the occurrences that they are part of. The process takes as its primary basis the input arrival times of the successor and of the predecessor: starting from the input arrival time of the successor, the dependency is resolved when a predecessor with the input arrival time that best matches the selection criteria defined in the database is found.

As described in "Specifying dependency resolution criteria" on page 178, there are several options for defining in the Application Description how a dependency between predecessor and successor operations is resolved. The criterion chosen to pick a matching predecessor that best resolves the dependency can be that the matching predecessor is the one with:

- The nearest preceding input arrival time.
- The nearest input arrival time within the same day of the successor.
- The closest input arrival time within a specified interval. The interval boundaries are calculated using an offset expressed in hours and minutes before or after the IA time of the successor. The interval can be timed entirely before, entirely after, or across the IA time of the successor.
- The closest input arrival time within a specified interval. The interval boundaries are specified by a time and a number of days before or after the IA time of the successor. The interval can be timed entirely before, entirely after, or across the IA time of the successor.

In addition, the resolution of a normal dependency may be defined mandatory at `plan` level where, if the predecessor is not in the plan, the plan (LTP and DP) fails directly, or at `control` level where, if the predecessor is missing, a `pending mandatory predecessor` entry is added and the occurrence remains in `waiting` status. If no predecessor matches the specified criteria, the successor operation will not start until it is manually unblocked by the operator. The mandatory dependency resolution mechanism does not apply to conditional or cross dependencies.

Dependencies are defined in the database and resolved in the plans (long-term, current, and daily). In the long-term and daily plans, they are resolved when the batches run. In the current plan, they are resolved when occurrences are added dynamically through PIF, ETT, ISPF, or the Dynamic Workload Console. The next sections detail the mechanisms used for resolving dependencies at the different plan stages.

The resolution of dependencies in the long-term plan

The batch long-term planning functions represent the resolution criterion specified in the database for a dependency (C/S/R/A) as an interval defined by start and end dates and times:

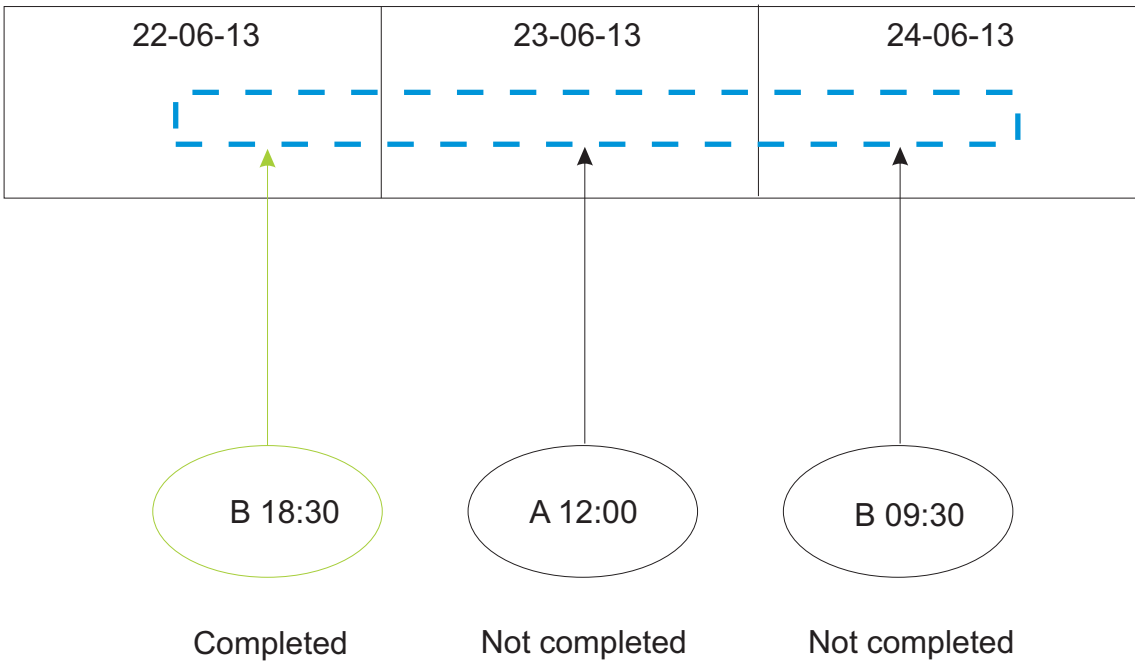
- For Closest Preceding (C), the interval goes from infinity to the IA time of the successor.
- For Same scheduled date (S), the interval starts on the same day of the IA time of the successor if the IA time is after the start of day defined in the calendar. If the IA time of the successor is earlier or equal to the start of day, then the interval starts the day before. The end is 24 hours later.
- For a relative interval (R), the start and end are offsets specified in terms of hours and minutes with respect to the IA time of the successor.
- For an absolute interval (A), the start and end are specific time boundaries specified for up to seven days before, after, or around the IA time of the successor.

With the exception of C, the other criteria allow for the IA time of a matching predecessor to be searched before, after, or across (where the interval starts before and ends after) the IA time of the successor. When the interval ranges from before to after the IA time of the successor (this is true also for S), the matching predecessor is searched, starting from the IA time of the successor, first by scanning the plan backwards to the start of the interval; if no match is found, the scheduler scans forward from the IA time to the end of the interval.

In situations were a possible match can be found also after the IA time of the successor, the scheduler first checks if there is a match with a completed predecessor before the IA time. If it finds it, it considers the dependency as resolved and does not add it in the plan. For example, operation A with a IA time at noon of 23-06-2013 is defined in the database with B as external predecessor. The match is to be looked for within an absolute interval spanning from 18:00 of the day before to 20:00 of the day after the IA time of A.

There are two possible matches of B to resolve this dependency:

- B with IA time equal to 18:30 of 22-06-2013 that has completed.
- B with IA time equal to 09:30 of 24-06-2013 that has not yet completed.



A match is found with the instance of B that completed on 22-06-2013: the dependency is considered solved and is not added to the long-term plan.

At each extension, the long-term plan normally removes all the completed occurrences that precede the first not completed occurrence (FNONC) of an application. For more flexibility in the management of dependencies, you can configure the `BATCHOPTS LTPREMSHIFT(n)` parameter to save in the plan the occurrences that completed within a number of *n* days, from 0 to 7, before the FNONC. See *Customization and Tuning* for reference on this parameter.

If a dependency was defined in the database as mandatory at plan level (P) and the scheduler does not find a match, the dependency is not resolved and an error is returned. If it was defined mandatory at control level (C), under similar circumstances a *mandatory pending predecessor* is added to the plan and an informational message is issued. Mandatory pending predecessors can be viewed in both the LIST and detailed panels of the LTP ISPF dialogues (with status equal to M). You can browse and delete a pending mandatory predecessor but cannot create it from an LTP ISPF dialog.

After changing the definition of a dependency from mandatory to non mandatory or vice-versa in the Application Description, be sure to run the Modify the long term plan for all applications batch job to be sure that the change in the database is reflected in the LTP.

The resolution of dependencies in the current plan

In the current plan a dependency is resolved as the occurrence is added by dialogue, programming interfaces (PIF), event-triggered tracking (ETT), or automatic recovery (AR).

When in the AD the end of an interval is defined to be after (A) the IA of the successor, the match with a predecessor can lead to linking to an occurrence with IA that is later than that of an added occurrence. When this happens, an extra check can be run for archived completed occurrences in order to avoid unwanted forward links. To this effect, you can configure the BATCHOPTS LTPREMSHIFT parameter so that the occurrences that completed within up to seven days before the first uncompleted occurrence - which are normally deleted at the first extend/replan of the plan - are instead kept in the new plan. To find a matching predecessor, the dependency resolution mechanism starts first from the IA of the successor and moves back in time; if no match is found, the mechanism then searches forward (starting again from the IA of the successor). Use LTPREMSHIFT to favor the resolution with a preceding occurrence.

Note that archived completed occurrences do not show operation details, even when they provide the best match.

When a predecessor dependency is of type mandatory control (C) and the predecessor is not found, a mandatory dependency is created and the IA visible from the dialogue is the right side of the interval defined for resolution.

When a predecessor dependency is of type mandatory Plan (P) and the predecessor is not found, the occurrence is not added (the process is stopped) even if the `solve required` option is set to NO in the dialogue.

When a *mandatory pending* predecessor is created, it is flagged in the dialogue with the **MANDATORY PRED or **MANDATORY PEND PRED text. When the

dependency is resolved for an operation waiting for its mandatory pending predecessors, it is flagged in the dialogue with the **MANDATORY SUCC text.

In the case of mandatory dependencies with successors - in opposition to the resolution mechanism used for non mandatory dependencies, which is satisfied by the best match - the approach is to seek and resolve not only the best matching successor, but also all those operations in the plan that are waiting for a predecessor occurring in the time interval being added.

Like for any other modifications made on the Application Description, any changes made on the matching criteria of a dependency in the database must be followed by:

1. Running the Modify the long term plan for all applications batch job
2. Extending the current plan

to make the changes effective in the plan.

For a smooth dependency resolution process, if you use multiple calendars - defined in the AD, in the dialog, in BATCHOPT, or also the DEFAULT calendar - keep a consistent work day end time in all of them. In the specific scenario of a dynamically added mandatory predecessor defined for the same scheduled date at control (C) level where the input arrival time of the successor falls on the work day end time, the dependency could be resolved with an unexpected predecessor if the work day end time is not the same throughout the calendars.

In the normal processing of the daily plan, dependencies involving *mandatory pending* predecessors are resolved first and normal dependencies next. And while dependencies with *mandatory pending* predecessors are resolved based on operation IA times, normal dependencies are resolved based on occurrence IA times. This can lead to unexpected situations. For example:

```
The predecessor application is APPLRELPRED1 (1 operation).

The successor application is APPLRELSUCC1 (3 operations). The operations are:

001-has external predecessor APPLRELPRED1-001 with with Relative interval (30 mins before IA and
 30 mins after IA)
002-has external predecessor APPLRELPRED1-001 with with Relative interval (30 mins before IA and
 30 mins after IA)
003-has external predecessor APPLRELPRED1-001 with with Relative interval (30 mins before IA and
 30 mins after IA)

Operation 002 has time defined: same day, 15.00

All dependencies have Mandatory resolution set to C.

Dynamically add successor APPLRELSUCC1 with IA: 13/05/09 - 11.31. You then find the following
mandatory pending dependencies:

------------------------------------------------------------------------------
EQQMARXL - RESOLVING EXTERNAL AND CONDITIONAL DEPENDENCIES IN  Row 1 to 3 o
Command ===>                                                  Scroll ===> P

Enter CREATE in the command line to create new dependencies
for this occurrence.
Enter the row command D to delete unwanted dependencies.
(Delete is not allowed for conditional dependencies).

Application         : APPLRELSUCC1
Input arrival       : 13/05/09 11.31
Deadline            : 13/05/09 23.59

Row Operation in application   Dependency
cmd ws   no.  text             Application id   Input arrival         WS   No. T
```

```
 '  CPU1 001 **MANDATORY PEND. APPLRELPRED1     13/05/09 12.01             001 P
 '  CPU1 002 **MANDATORY PEND. APPLRELPRED1     13/05/09 15.30             001 P
 '  CPU1 003 **MANDATORY PEND. APPLRELPRED1     13/05/09 12.01             001 P
--------------------------------------------------------------------------------

If you dynamically add predecessor APPLRELPRED1 with IA: 13/05/09 - 12.01 and
again look at the dependencies for APPLRELSUCC1, you see:

--------------------------------------------------------------------------------
EQQMARXL - RESOLVING EXTERNAL AND CONDITIONAL DEPENDENCIES IN  Row 1 to 4 o
Command ===>                                                  Scroll ===> P

Enter CREATE in the command line to create new dependencies
for this occurrence.
Enter the row command D to delete unwanted dependencies.
(Delete is not allowed for conditional dependencies).

Application           : APPLRELSUCC1
Input arrival         : 13/05/09 11.31
Deadline              : 13/05/09 23.59

Row Operation in application   Dependency
cmd ws   no. text              Application id   Input arrival   WS     No. T
 '  CPU1 001                   APPLRELPRED1     13/05/09 12.01 CPU1 001 P
 '  CPU1 002                   APPLRELPRED1     13/05/09 12.01 CPU1 001 P
 '  CPU1 002 **MANDATORY PEND. APPLRELPRED1     13/05/09 15.30      001 P
 '  CPU1 003                   APPLRELPRED1     13/05/09 12.01 CPU1 001 P
--------------------------------------------------------------------------------
```

Apparently, occurrence APPLRELPRED1 with IA: 13/05/09 - 12.01 is outside the relative interval specified for operation APPLRELSUCC1-002, which has IA: 13/05/09 - 15.00 and the dependency should not be resolved. In reality the process works correctly, because the chain to operation 002 with IA 15.00 is added by the normal successor resolution process and not by the mandatory pending resolution process (and in fact APPLRELPRED1 with IA: 13/05/09 - 15.30 still shows as *mandatory pending*). This is because the two processes use different IA times, one based on occurrence and the other on operation. Moreover, the resolution of mandatory pending predecessors is an additional process that is run before the normal successor resolution process.

On ISPF and on the Dynamic Workload Console you can browse and modify operations in the current plan that are in waiting status for pending and mandatory pending predecessors. When you enter the 5.3 menu fast path on ISPF and display the SELECTING OPERATIONS (EQQSOPFP) panel, you can request lists of operations that are waiting for pending predecessors, for mandatory pending predecessors, or for either or both. From the ensuing list, you can then browse operation details or run any of the possible actions.

Chapter 14. Using service and optional functions

This chapter describes the service and optional functions, which let you do the following:

- Activate or deactivate job submission
- Activate or deactivate automatic job and started-task recovery
- Refresh the long-term plan
- Refresh the RACF resource profiles
- Activate or deactivate event-triggered tracking
- Produce an authorized program analysis report (APAR) tape
- Produce report of track log events

Select option 9 on the main menu to see the SERVICE FUNCTIONS menu (Figure 148). Select option 10 on the main menu to see the OPTIONAL FUNCTIONS menu for track logs.

```
EQQUTOPP --------------------- SERVICE FUNCTIONS ------------------------
Option ===>

Select one of the following:

Job submission:     Current Status: Inactive
1 DEACTIVATE      - Deactivate job submission
2 ACTIVATE        - Activate job submission

Automatic recovery: Current Status: Active
3 DEACTIVATE      - Deactivate automatic recovery
4 ACTIVATE        - Activate automatic recovery

5 REFRESH         - Delete current plan and reset long term plan

6 RACF RESOURCES  - Activate subresources defined after EIDA started

ETT:                Current Status: Active
7 DEACTIVATE      - Deactivate event triggered tracking
8 ACTIVATE        - Activate event triggered tracking

9 APAR TAPE       - Produce APAR tape
```

Figure 148. EQQUTOPP - Service functions

Activating and deactivating job submission

When you deactivate job submission, operations are not started on automatic reporting computer workstations and remote engine workstations. Therefore, no jobs or started tasks are submitted. Also, WTO operation messages are not issued. When you activate job submission again, the operations that were scheduled to start are started.

After a failure, when you need to check the status of jobs in the plan before anything is submitted, you can:

1. Specify JOBSUBMIT(NO) in the JTOPTS initialization statement on host systems. If you are scheduling end-to-end with fault tolerance capabilities, also specify FTWJSUB(NO) in the JTOPTS initialization statement for fault-tolerant workstations.
2. Bring up IBM Workload Scheduler for z/OS to recover the current plan.
3. Check that operations have the correct status.

4. Activate job submission when you are satisfied.

Activating and deactivating automatic job and started-task recovery

Automatic job recovery is normally started when IBM Workload Scheduler for z/OS is started. However, there are situations in which you might not want automatic job recovery, for example, when a recovery action might occupy resources required for other purposes.

You can inhibit automatic recovery in several ways. For example, you can specify this in the time parameter of the RECOVER statement and in the start-time and end-time parameters of the AROPTS (automatic job recovery options) statement. Another way is to deactivate automatic job recovery. When automatic job recovery is deactivated, ended-in-error jobs remain on the ended-in-error list, regardless of the presence of RECOVER statements.

When jobs that ended in error while automatic job recovery was deactivated are activated, they are first tested for RECOVER statements, and any necessary recovery actions are performed.

Note: On the HANDLING OPERATIONS ENDED IN ERROR panel in the MCP panel, you can request (with the ARC row command) automatic job recovery for jobs ending in error, even if you have deactivated automatic recovery. But you cannot activate automatic recovery here unless RECOVERY(YES) is specified on the OPCOPTS initialization statement.

For information on using automatic recovery, see Chapter 21, "Automatic recovery of jobs and started tasks," on page 395 and "What you need for automatic recovery" on page 346.

Refreshing the long-term plan

IBM Workload Scheduler for z/OS has a safeguard against changing plans after they are used. After an occurrence in the long-term plan has been scheduled in a current plan (CP), you cannot change it in the long-term plan, nor can you schedule it a second time in a current plan. There might be times, however, when you need to bypass this safeguard. The *refresh* function is provided for this purpose.

Note: Use the refresh function only when you have no other alternative because your current plan will be deleted.

You might have a situation in which you want to delete the current plan and produce a new current plan for the current period, using a new version of the long-term plan. To do this, you must go through a complete replanning cycle, including producing a new long-term plan and current plan. To do this, first run a refresh, which:

- Makes already scheduled occurrences available to both long-term and daily planning.
- Deletes the current plan so that you can make a new current plan.

If you want completely new plans, follow the refresh function with a CREATE of the long-term plan and then a daily planning EXTEND. The create long-term plan function is necessary only if the old long-term plan is no longer valid.

If an LTP re-creation is needed (to re-create a long-term plan) after scratching the current plan, the user must also keep the LTP related data set (LB, LD) content in synch with LT. A plan that runs processing normally scheduled for a future or past day of processing can be created. This procedure effectively re-creates any specified day of processing. The following procedure can be used if a day of processing was lost due to an emergency:

1. CP refresh (dialog option 9.5)
2. Create LTP with the date you want
3. CP extend for the date you want
4. Run jobs needed on the date you want
5. CP refresh
6. Create LTP for normal date
7. CP extend for normal date

Use this procedure carefully and only in exceptional situations.

Refreshing RACF resource profiles

In-storage resource profiles are built for RACF-defined resources at IBM Workload Scheduler for z/OS start time. This is done for resources of the class that you defined in the AUTHDEF initialization statement. When you define new RACF resources after the IBM Workload Scheduler for z/OS start time, they are not immediately available to IBM Workload Scheduler for z/OS. Select the RACF RESOURCES option on the SERVICE FUNCTIONS panel to refresh the in-storage profiles and make them available to all panel users.

Activating and deactivating ETT

When IBM Workload Scheduler for z/OS is started, the initial status of the ETT is decided by the value of the ETT keyword on the JTOPTS initialization statement. You can change this status, while IBM Workload Scheduler for z/OS is active, using the Activate and Deactivate ETT functions. See "Adding occurrences by event-triggered tracking" on page 478 for more information.

Producing an APAR tape

You can use the authorized program analysis report (APAR) tape function when you are reporting a problem to Customer Support. The APAR tape function generates a batch job that collects data sets that are useful for problem determination and writes them to a tape. You might need to modify the JCL that is generated so that all your event data sets are collected.

For a detailed description of the procedure for documenting and reporting problems, see *Diagnosis Guide and Reference*.

Producing a report of track log events

In addition to the service functions, there are also additional optional functions you can use. You can create a report of track log events. To produce the report, you have the following options:

- Audit, debug, or both
- Audit created through job batch submission

When creating the report, the only required value is for the type of input for the report. If you do not provide data for the remaining fields, all the records in the input files are selected. Also, the output of the report is written to the file specified during installation.

Follow these steps to produce a report of track log events:

1. Select option 10 from the main menu. The OPTIONAL FUNCTIONS menu is displayed.
2. Select option 1 (AUDIT/DEBUG). The EXTRACT/FORMAT LOG RECORDS SPECIFY SELECTION CRITERIA panel is displayed.
3. On this panel, select the option for either real-time data (JTX) or previous period data (TRL) to be on the report.
4. Optionally, specify a string in the Search-string field to be searched for in the input records.
5. Optionally in the time and date fields, specify filters that limit the size and time period of the report.
6. Optionally, specify a dsname to replace the value defined at the time of installation.

For additional information, see *Planning and Installation* and *Customization and Tuning*.

Chapter 15. How work is selected for automatic submission

This chapter describes how IBM Workload Scheduler for z/OS decides the run order of operations on computer, nonreporting, and WTO workstations.

IBM Workload Scheduler for z/OS builds the current plan from information in the long-term plan, calendar database, application description database, workstation database, and resource database. When the current plan is created, IBM Workload Scheduler for z/OS assigns start times to each operation. These start times are IBM Workload Scheduler for z/OS's estimates of when the operations should start. They are not the actual times when IBM Workload Scheduler for z/OS will start the operations, unless the operation has been designated as a time-dependent operation. Here, the start time is the time when IBM Workload Scheduler for z/OS will attempt to start the operation. (See "Creating time-dependent operations" on page 184.) This is because IBM Workload Scheduler for z/OS attempts to maximize throughput in your system by starting as many operations as soon as possible.

Identifying the order of submission

To meet occurrence deadlines, IBM Workload Scheduler for z/OS must assess which operations, of those that are eligible, should be processed first. IBM Workload Scheduler for z/OS does this in two stages:

1. It constructs a list of work that is ready to be started on each computer workstation and nonreporting workstation. This list, called a *ready list*, shows all operations with ready status, in the order that they should be started.
2. From each of the ready lists, it selects the most urgent operation for which resources are available. It then compares these operations and selects the single most urgent operation to be started.

Before deciding which operation to start, the daily planning function first builds queues of work that is ready to be processed at each workstation. These queues are lists of operations that are ready to be run, that is, operations with no outstanding predecessors. The operations are placed on the workstation ready list in the order that IBM Workload Scheduler for z/OS thinks they should be run. They are sorted in this order:

1. Operations that have the urgent flag set on.

   The urgent flag is automatically turned on by IBM Workload Scheduler for z/OS when an operation has been defined with priority 9, or when an operation has missed its deadline.
2. Earliest *latest start time*.

   The latest start time is the latest time that the operation can start in order to meet the deadline. This calculation considers the operation deadline, estimated duration, resource requirements, and successor processing. When IBM Workload Scheduler for z/OS creates the current plan, it calculates the latest start time for all the operations in a chain of dependencies, starting at the last one.
3. Operation priority (other than 9).

   Each operation takes the priority assigned to its owning application, as defined in the AD database. When in a dependency chain an operation with priority *x* has predecessors with a priority *y* lower than *x*, those predecessors automatically take the priority *x* when they are included in the current plan. In

this way, the submission of the operations defined as urgent in the dependency chain is not delayed. The priority promotion of the predecessors occurs at operation level, *not* at application level, because only some operations within an application might have an urgent operation as a successor.

4. Shortest estimated duration.

IBM Workload Scheduler for z/OS builds these queues when there is more than one operation that is ready to be started. Operations that are time dependent, or waiting for resources to become available, are not included.

For example, if IBM Workload Scheduler for z/OS finds two operations in ready status, it checks if either operation is marked as urgent. If neither is urgent, the latest-start times are compared. In the unlikely event that the latest-start times are equal, IBM Workload Scheduler for z/OS examines the priority. If the priority is also equal, IBM Workload Scheduler for z/OS first starts the operation that has the shortest estimated duration.

The submission process can deal with many candidates for submission per second. It is unlikely you will ever see a significant backlog of operations to be started.

The ready list is the order that the operations should be started in. If a workstation is closed, the operations on that workstation's ready list are not eligible for processing. To decide which operation to start, IBM Workload Scheduler for z/OS scans the ready lists of each computer, nonreporting, and WTO workstation that is open for operations that are eligible to start. To be eligible to start, the resources that the operation requires must be available, according to the information recorded in the IBM Workload Scheduler for z/OS database.

Operations that have been placed in HOLD status by a dialog user are not eligible candidates for submission until they have been set to RELEASE. For more information on holding and releasing operations in the current plan, refer to “Delaying an operation, and releasing it” on page 572.

If sufficient resources are not available, or the operation is waiting for a particular time, IBM Workload Scheduler for z/OS assigns an appropriate extended status. The extended status identifies which type of resource the operation is waiting for.

Operations that have been placed in waiting for Scheduling Environment (status READY, extended status W) are not eligible candidates for submission: they become eligible again after the event stating that the Scheduling Environment is again available has been received by the controller and the extended status has been reset.

If no sufficient resources are available, or if the operation is waiting for a particular one that is unavailable at the time, IBM Workload Scheduler for z/OS assigns an appropriate extended status. The extended status identifies which type of resource the operation is waiting for.

The submission process

For IBM Workload Scheduler for z/OS to start an operation, job submission must be activated for all operations. The job options of the particular operation must also have automatic submit set to yes. If this is not the case, the operation remains on the ready list in R, *, or A status. All of these rules are bypassed, however, if an operator uses the EXECUTE command , which starts the operation regardless of all normal scheduling criteria.

The status of an operation on a nonreporting workstation is automatically set to C (complete) when the operation is ready to be started. Operations that have been stopped with the NOP command by an operator are also automatically set to complete when the operation is ready to be started. Refer to "Running an operation immediately with EXECUTE" on page 574 for information on NOP and EXECUTE.

Operations on computer workstations are given status S (started) once the operation, in this case a job or started task, has been submitted. The operation remains in S status until IBM Workload Scheduler for z/OS learns, by way of JES and SMF events, how the operation ended. The status of the operation will then either be set to C (complete) or E (ended-in-error).

Because an operation can remain in S status for a long time, IBM Workload Scheduler for z/OS assigns appropriate extended status codes to help you identify exactly what stage of processing the operation has reached.

For end-to-end scheduling with fault tolerance capabilities

When an operation on a fault-tolerant workstation has resolved all dependencies and is ready to start, and has Automatic Submit set to YES, the controller changes the status to S with an extended status of Waiting for Submission. When the Controller is notified that the operation has started, the status remains simply as S.

On non-centralized operations, if the Automatic Submit is set to NO, the priority of the corresponding job in the Symphony file is set to 0. When the Automatic Submit is set to YES, or an EXECUTE command is issued, the Occurrence priority is reset to its real value, calculated by multiplying the Application priority by 10.

If the NOP command is issued for non-centralized operations, it results in setting a CANCEL PENDING option and the operations are immediately set to the status Complete when the conditions for them to run occur. If the NOP command is issued for completed non-centralized operations, it does not determine a CANCEL PENDING option and the operations effectively run when the conditions occur, regardless of the NOP status.

Submitting work on nonreporting workstations

The submission process is initiated when IBM Workload Scheduler for z/OS finds an operation on a ready list in A, R, or * status and all requested resources are available. Operations that have been manually set to HOLD by dialog users will not be considered candidates for submission until the operation is set to RELEASE or a dialog user requests EXECUTE.

This is how IBM Workload Scheduler for z/OS submits operations on nonreporting workstations:

- The current plan (CP) is locked to prevent other tasks or users from updating the operations.
- The best candidate for submission is chosen as described in "Identifying the order of submission" on page 331.
- IBM Workload Scheduler for z/OS sets the operation status to complete.
- If there are more operations eligible to start, IBM Workload Scheduler for z/OS will move on to the next best candidate. Up to 5 operations can be started.
- The current plan lock is released.

If the JTOPTS keyword QUEUELEN is specified, IBM Workload Scheduler for z/OS starts up to the number of operations defined by QUEUELEN. For more information about the QUEUELEN parameter, see the JTOPTS statement in *Customization and Tuning*.

Submitting work on WTO workstations

This is how IBM Workload Scheduler for z/OS submits operations on WTO workstations:

- The current plan is locked to prevent other tasks or users from updating the operations.
- The best candidate for submission is chosen as described in "Identifying the order of submission" on page 331.
- If the operation has been marked with a NOP, IBM Workload Scheduler for z/OS immediately sets the operation to complete.
- IBM Workload Scheduler for z/OS gathers the operation text and builds the required WTO message.
- A submit request is queued, which includes the WTO and the workstation destination.
- If there are more operations eligible to start, IBM Workload Scheduler for z/OS will move on to the next best candidate. Up to 5 operations can be started.
- The current plan lock is released.
- IBM Workload Scheduler for z/OS determines the destination, which can be a submit/release data set, an XCF link, an NCF link, a TCP/IP link, or blank. If the destination is blank, the WTO is issued on the system that the controller in started on.
- The workstation reporting attribute for the WTO workstation will determine what status the operation will be set to. Operations defined on workstations with automatic, or manual start and complete reporting will be set to S status. Operations on workstations defined with manual-complete-only reporting are immediately set to C status.

If the JTOPTS keyword QUEUELEN is specified, IBM Workload Scheduler for z/OS starts up to the number of operations defined by QUEUELEN. For information about the QUEUELEN parameter, see the JTOPTS statement in *Customization and Tuning*

Submitting started tasks

This is how IBM Workload Scheduler for z/OS submits operations on computer workstations with the STC attribute:

- The current plan is locked to prevent other tasks or users from updating the operations.
- The best candidate for submission is chosen as described in "Identifying the order of submission" on page 331.
- If the operation has been marked with a NOP, IBM Workload Scheduler for z/OS immediately sets the operation to complete.
- IBM Workload Scheduler for z/OS attempts to find the STC procedure JCL in the JS file. The JCL will be found here only if a dialog user has updated the JCL or if this operation occurrence has been previously submitted.

- If the JCL is not found on the JS file, IBM Workload Scheduler for z/OS attempts to find it (the member name must be the operation name) in the EQQJBLIB partitioned data set concatenation, first calling the EQQUX002 exit if it is loaded.
- If no JCL can be found, the operation is given an extended status E to indicate the error; and a message is written to the IBM Workload Scheduler for z/OS message log.
- If the JCL is found, either in the JS or in EQQJBLIB or returned by EQQUX002 exit, JCL substitution is performed, if required, and the job submit user exit is called.
- A copy of the JCL is written to the JS file. The JCL and workstation destination are queued. The operation status is set to S and extended status U is assigned to indicate that submission is in progress.
- If there are more operations eligible to start, IBM Workload Scheduler for z/OS will move on to the next best candidate, up to 5 operations can be started.
- The current plan lock is released.
- The destination is resolved, it can be either a submit/release data set, an XCF link, an NCF link, a TCP/IP link, or blank. If the destination is blank, the JCL is directed to the system the controller is started on.
- When the JCL arrives at the destination, the procedure JCL is written into the partitioned data set referenced by ddname EQQSTC.
- IBM Workload Scheduler for z/OS then builds and issues the z/OS START command. Once the command is issued and processed by JES, the procedure JCL is deleted from the EQQSTC data set.
- The extended status of the operation is set to blank.
- When IBM Workload Scheduler for z/OS learns from JES that the started-task is executing, the extended status is set to S.

If the JTOPTS keyword QUEUELEN is specified, IBM Workload Scheduler for z/OS starts up to the number of operations defined by QUEUELEN. For information about the QUEUELEN parameter, see the JTOPTS statement in *Customization and Tuning*

Submitting jobs

This is how IBM Workload Scheduler for z/OS submits operations on computer workstations:

- The current plan is locked to prevent other tasks or users from updating the operations.
- The best candidate for submission is chosen as described in "Identifying the order of submission" on page 331.
- If the operation has been marked with a NOP, IBM Workload Scheduler for z/OS immediately sets the operation to complete.
- IBM Workload Scheduler for z/OS attempts to find the job in the JS file. The job is found here only if a dialog user has updated the job statements, or if this operation occurrence has been previously submitted.

  Note: To prevent the JS file from becoming full, IBM Workload Scheduler for z/OS maintains the JCL records on the JS data set until the next occurrence of the same application is set to Complete. For details, see the *Diagnosis Guide and Reference*.

- If the job is not found on the JS file, IBM Workload Scheduler for z/OS attempts to find it (the member name must be the operation name) in the EQQJBLIB partitioned data set concatenation, first calling the EQQUX002 exit if it is loaded.
- If no job can be found, the operation is given an extended status E to indicate the error, and a message is written to the IBM Workload Scheduler for z/OS message log.
- If the job is found, either in the JS file or in EQQJBLIB or returned by the EQQUX002 exit, variable substitution is performed, if required, and the job submit user exit (EQQUX001) is called.
- A copy of the job is written to the JS file. The job and workstation destination are queued to the data router. The operation status is set to S and extended status U is assigned to indicate that submission is in progress.
- If there are more operations eligible to start, IBM Workload Scheduler for z/OS will move on to the next best candidate. Up to 5 operations can be started.
- The current plan lock is released.
- The destination is resolved. It can be a submit/release data set, an XCF link, an NCF link, a TCP/IP link, or blank. If the destination is blank, the job is directed to the system the controller is started on.
- (z/OS only.) When the JCL arrives at the destination, the job is submitted to JES via the EQQBRDS ddname. The EQQBRDS ddname is used to allocate a JES internal reader.
- The extended status of the operation is set to blank.
- (z/OS only.) When IBM Workload Scheduler for z/OS learns from JES that the job has been successfully loaded onto the internal reader, the extended status is set to Q.
- Once the job actually starts to execute, the extended status is set to S. For z/OS jobs, this happens when the initiator is available.
- If a job is routed to another NJE node for execution and in this process the related JES reader time changes by more than one minute, the job is not tracked correctly. In fact, if a job has a ROUTE EXEC statement to a specific NJE node, it is sent to the JES PLEX and can be run on any member of the JES MAS complex. To allow IBM Workload Scheduler for z/OS to track the job, define a tracker on every member of the JES multi-access spool complex at the destination NJE node. Instead of using ROUTE EXEC, define a CPU workstation whose destination is one of the trackers on the destination NJE node, and schedule the work on that workstation. In this way, IBM Workload Scheduler for z/OS, not NJE, sends the job directly to the node where it is to be run. The results is that the job goes through JES input/conversion processing only once, and the JES reader timestamp does not change.

If the JTOPTS keyword QUEUELEN is specified, IBM Workload Scheduler for z/OS starts up to the number of operations defined by QUEUELEN. For information about the QUEUELEN parameter, see the JTOPTS statement in *Customization and Tuning*

Submitting jobs or started task on a virtual workstation

The process is the same as that described in the previous sections for jobs and started task, with the difference that the scheduler selects the submission destination among the virtual workstation destinations, according to a round-robin scheduling logic.

The availability checks related to open intervals, parallel servers, and fixed resources are done at virtual destination level.

The alternate workstation concept is not applicable to virtual workstations.

Chapter 16. Overview of job tracking on z/OS

This chapter describes briefly how IBM Workload Scheduler for z/OS tracks work on the host. If an operation is not tracked, there is normally a problem with the IBM Workload Scheduler for z/OS configuration or the initialization statements.

IBM Workload Scheduler for z/OS uses *event records* to track the workload. Most event records are generated automatically as a job progresses through the system, but they can also be generated manually. You can use IBM Workload Scheduler for z/OS TSO commands and IBM Workload Scheduler for z/OS subroutines to report event information to IBM Workload Scheduler for z/OS, both manually and automatically. You can:

- Request a backup of the current plan or JCL repository using the BACKUP TSO command or EQQUSINB subroutine.
- Make a special resource available or unavailable using the SRSTAT TSO command or EQQUSINS subroutine.
- Change the status of an operation using the OPSTAT TSO command or EQQUSINT subroutine.
- Update the user data field of an operation in the current plan using the OPINFO TSO command or EQQUSINO subroutine.
- Change the status of a workstation in the current plan using the WSSTAT TSO command or EQQUSINW subroutine.
- Request any of these changes using the EQQUSIN subroutine or the application programming interface (API) for IBM Workload Scheduler for z/OS.

This is how the event information is passed to IBM Workload Scheduler for z/OS:

- For z/OS jobs and started tasks, z/OS calls the SMF and JES exits at certain stages in the life of a job. For example, the job initiation exit IEFUJI is called whenever a job starts. IBM Workload Scheduler for z/OS code in the exit collects information about the event and passes it to the event-creation module, EQQSSCM*x*, through the z/OS subsystem interface. Relevant information for a job that has started would include the job name and number, and its starting date and time.
- All IBM Workload Scheduler for z/OS address spaces start a submit task, which initiates work for the workstation destination that represents the system that the controller or tracker is started on. When the submit task starts work, it uses EQQSSCM*x* to create initialization events, depending on the type of work to be started. Different initialization events are created for batch jobs, started tasks, write-to-operator (WTO) operations. Submit-checkpointing events are created for all work that IBM Workload Scheduler for z/OS submits, except operations that are routed to a user-defined destination.
- If you generate an event using the BACKUP, OPINFO, OPSTAT, WSSTAT, or SRSTAT commands from the TSO environment or from the EQQEVPGM batch program, the parameters are checked and then passed to the event-generation module, EQQSSCM*x*, through the z/OS subsystem interface.
- You can generate an event if you write a program that passes parameters to the EQQUSIN, EQQUSINB, EQQUSINS, EQQUSINO, EQQUSINW, or EQQUSINT subroutines. The subroutine checks the parameters and passes them to the event-generation module, EQQSSCM*x*, through the z/OS subsystem interface.

When the events have been created, this is how they are passed to the controller:

1. EQQSSCM*x* uses the information to build an event record and places the record into the event writer queue in ECSA.

   This processing can take place as soon as the z/OS subsystem interface is started. It is not necessary for IBM Workload Scheduler for z/OS itself to be active. If IBM Workload Scheduler for z/OS is not active (in particular, if the event writer subtask is not active), event records stay in the event writer queue until the event writer starts and processes them.

   Event records are generated for all z/OS jobs and started tasks, even though they might not be relevant to a particular IBM Workload Scheduler for z/OS address space. It is not possible for the programs creating the event records to determine if a particular job is relevant to a particular IBM Workload Scheduler for z/OS address space. The event creation programs reside in z/OS common storage and do not belong to, or have access to, the data or resources of any IBM Workload Scheduler for z/OS address space that might be running on the same system or some other system.
2. The event-writer subtask of the tracker reads event records from the event writer queue and writes them to an event data set. They can be filtered at this stage by the EQQUX004 exit, if this is required for performance reasons.
3. Events are transmitted to the controller by an event reader function, which is either a function of the event writer, or is a separate event reader task. An event writer can use an XCF, NCF or TCP/IP connection to transmit events to the controller. Where a separate event reader is used, the event reader can be active at the controller, or at a tracker that is connected to the controller through XCF or NCF. If the event writer is active but there is no connection to the controller, or if the event reader is not active, events stay in the event data set until the required function is available.
4. The event manager subtask that is started at the controller processes the events, and IBM Workload Scheduler for z/OS takes the relevant action.

Events are never lost, if these conditions are satisfied:

- The event writer queue in ECSA is large enough to hold all the event records that might be created while the event writer is not active.
- The event data set is large enough to hold all the event records that might be created while a connection to the controller is lost, or an event reader is not active.

How to make sure that events are not lost

About this task

Use one of these methods to ensure that events are not missed between the time IBM Workload Scheduler for z/OS is taken down and JES (JES2 commands are given in the example) is taken down:

Method 1

1. Remove the system being stopped from the JES2 MAS by placing it into independent mode (issue `$T MEMB,IND=Y`).
2. Allow the jobs currently running on this system to complete.
3. Stop the tracker (`P OPCx`).
4. Stop JES.
5. Re-IPL.
6. Restart JES.

7. Restart the tracker.
8. Resume normal work (issue `$T MEMB,IND=N`).

Method 2

1. Abend JES2 (`$PJES2,ABEND`).
2. Stop the tracker (`P OPCx`).
3. Re-IPL.
4. Restart JES. This will be a hot start.
5. Restart the tracker.

Method 3

1. Take the tracker down (`P OPCx`).
2. Bring it up again under the master scheduler (`S OPCx,SUB=MSTR`). Remember that a tracker cannot use JES services (SYSOUT data sets, JCC) if it runs under the master scheduler.
3. Bring down JES.
4. Take the tracker down (`P OPCx`).

Time zones

IBM Workload Scheduler for z/OS can support several z/OS systems. The tracker collects information about activity on the z/OS system it supports, such as when a job has started, or when a print has been processed. This information is recorded in an event record and sent to the controlling system. Each event contains a time stamp, which records the date and time that the event record was created.

The systems that IBM Workload Scheduler for z/OS supports might be in different time zones. The event record contains a field that specifies the difference between the local time of the system that collected the record and Greenwich mean time (GMT). This time difference is automatically calculated and placed in event records. If you intend to change the local clock GMT offset by using the z/OS `SET CLOCK` command, all IBM Workload Scheduler for z/OS systems running on the affected z/OS should be shut down and then restarted after the `SET CLOCK` command has been issued. The GMT offset is stored when the subsystem is started.

To avoid shutting down and restarting the IBM Workload Scheduler for z/OS systems for daylight savings time, set record 90 in member SMFPRM*xx* of the SYS1.PARMLIB. At daylight savings time, the time is updated automatically. For more information, see how to update SMF parameters in *IBM Workload Scheduler for z/OS: Planning and Installation*.

The controller processes event records from all the systems in your IBM Workload Scheduler for z/OS complex. Because all event records contain a local time difference field, the controller can convert time stamps to the local time of the controlling system. This is necessary because all time values stored in IBM Workload Scheduler for z/OS databases and data sets are expressed in the local time of the controlling system.

Time values appearing printed reports are also expressed in the local time of the IBM Workload Scheduler for z/OS controlling processor.

Chapter 17. Planning for recovery and restart

This chapter describes how to plan for a job that fails. You can restart it automatically, or examine the job log first and then restart the job from the MCP dialog.

The job log is the system data written to the SYSOUT class defined by the job message class. It is used to build information needed for restart and cleanup.

IBM Workload Scheduler for z/OS has a number of tools to help you restart jobs:

Job completion checker (JCC)
This function reads job output and can set an error code. This is useful if you cannot tell from return or abend codes alone whether or how a job must be restarted: you sometimes need to check for specific messages.

Tracker platforms supported: z/OS

Job log retrieval
This function can fetch the job log for a job (even one that has not failed) so that you can browse it.

Tracker platforms supported: All

Restart and cleanup
This function checks whether a job is restartable, and tailors the JCL, if required, to run again from one named step to another, or to the end of the job. Also, this function can back out changes to catalogs and can delete data sets that are created by the failed job. The following example describes a JCL for jobs failing on reruns:

```
//OUTDS   DD   DSN=NEW.DATA.SET,DISP=(NEW,CATLG,CATLG),...
```

Tracker platforms supported: z/OS

Automatic recovery
The `//*%OPC RECOVER` job statement controls automatic recovery. Parameters on this statement specify whether IBM Workload Scheduler for z/OS should start other occurrences, delete steps, and so on. If the data set cleanup is required, this is invoked before the rerun when immediate cleanup is specified. Otherwise, automatic recovery is not done.

Tracker platforms supported: All (restart and cleanup functions are available only on z/OS systems)

History function
This optional function lets you rerun operations that have completed and been deleted from the current plan. If this function is active, completed operations are copied to the DB2 database when the current plan is extended, and the details (including job log and job statements if available) are kept there for a period of time that you specify in initialization statements.

RECOVERY statement
This statement in the SCRPTLIB defines the options to run the IBM Workload Scheduler recovery for jobs on distributed agents. The recovery actions can be followed by one of the recovery options (the OPTION

parameter), stop, continue, or rerun. The RECOVERY statement is ignored if it is used with a job that runs a centralized script.

What you need to run the functions

Some of the functions need to be turned on before you can use them. This section describes the parameters that you need, and where to find more information.

What you need for the job completion checker

About this task

Procedure

1. Specify JCCTASK(YES) on the OPCOPTS statement for the tracker where the job will run.
2. Code and assemble message tables that direct the job completion checker, as described in *Customization and Tuning*.
3. Specify options on the JCCOPTS initialization statement.

Results

Where to find more information

On setting error codes
See "Setting error codes using completion codes" on page 359.

On the JCCOPTS and OPCOPTS statements
See *Customization and Tuning*.

On coding message tables
See *Customization and Tuning*.

What you need for job log retrieval

Job log retrieval for trackers on z/OS is different than retrieval for trackers on other systems. The IBM Workload Scheduler for z/OS data store keeps the job logs for z/OS. For distributed agents, the job log retrieval is available by request from the controller. The following subsections describe the considerations for both z/OS and non-z/OS trackers.

z/OS job logs

For z/OS job logs, the retrieval can either occur on demand or on error. That is, the job log can be requested from the panels manually, or it can be automatically retrieved when a job ends in error. Refer to the RCLOPTS and HTTPOPTS initialization statements in Customization and Tuning.

Install and customize the data store with the STOUNSD parameter set to YES. Also, specify restart and cleanup on the controller with the RCLEANUP parameter. All data stores must have the same destination (set by the SYSDEST parameter), and this must be equal to the controller RCLOPTS DSTDEST parameter.

Note: If you are running on z/OS system Version 1 Release 2 or higher, JOBLOG retrieval does not function properly when the SPIN option for the JES job output is used. Therefore, use the SPIN parameter to prevent MVS JOBLOG SPIN. For details, see *Customization and Tuning*

Job logs on systems running distributed agents

For job logs on systems running distributed agents, job log retrieval is as follows:

- The retrieval is always delayed.
- You can manually request the job log.

Where to find more information

About browsing the job log

See "Selecting a history operation" on page 622.

About automatic job log retrieval and customizing the HTTPOPTS and RCLOPTS statements

See *Customization and Tuning*. For z-centric and dynamic workstations, see the JOBLOGRETRIEVAL keyword in the HTTPOPTS statement. For MVS jobs, see the JOBLOGRETRIEVAL and RESTARTINFORETRIEVAL keywordS in the RCLOPTS statement.

About browsing the job log

See "Selecting a history operation" on page 622.

About customizing the data store with RCLOPTS

See *Customization and Tuning*.

What you need for restart and cleanup

About this task

This function is a combination of restart and data set cleanup functions. They can be completed together or separately depending on the operation definition and the use of the panels. To set up restart and data set cleanup, perform the following steps:

1. Install and customize the data store on each z/OS image where jobs will run. Specify the FLOPTS parameter values for the controller.
2. Specify RCLEANUP (YES) on both the OPCOPTS controller statement and the BATCHOPT daily plan batch statement.
3. Specify the RCLOPTS DSTDEST value equal to the data store SYSDEST parameter on the DSTOPTS statement.
4. Specify the MSGLEVEL (1,1), if this is not the default for the jobs.
5. If you need data set cleanup before a job rerun, specify the cleanup type to any type but NONE for the operation.
6. Make the EQQCLEAN procedure available in all systems where the jobs can run.

   Note: If you are running on z/OS system Version 1 Release 2 or later, restart and cleanup does not function properly when the SPIN option for the JES job output is used. Therefore, use the SPIN parameter to prevent MVS JOBLOG SPIN. For details, see *Customization and Tuning*.
7. Customize the job-submit exit (EQQUX001) as suggested in the provided sample, if you want the same user to own both the stand alone cleanup job and the original job.

   For details about the stand alone cleanup job, see "Selecting cleanup options" on page 380, Immediate option. For details about the job-submit exit, see *Customization and Tuning*.

Where to find more information

About the DSTOPTS, OPCOPTS, and RCLOPTS statements
See *Customization and Tuning*.

About step restart and cleanup
See Chapter 20, "Restart and cleanup," on page 363.

About specifying cleanup for an operation
See "Options that apply to jobs and started tasks" on page 161.

About using the Modify Current Plan panel
See Chapter 29, "Updating the current plan," on page 587.

What you need for automatic recovery

About this task

Procedure

1. Make sure that automatic recovery is turned on (use the Service Functions menu, which is option 9 from the main menu).
2. Check the parameters on the controller AROPTS statement.
3. Specify RECOVERY(YES) on the controller OPCOPTS statement.
4. If you want automatic recovery to invoke the cleanup function before rerunning a job, see also "What you need for restart and cleanup" on page 345

   Note: When cleanup is required, you must set the cleanup type to IMMEDIATE for automatic recovery to run.
5. To use automatic recovery for a job running on a fault-tolerant agent, you must define it to use a centralized script. For information about defining a centralized script and about the RECOVERY statement, see the *Scheduling End-to-end with Fault Tolerance Capabilities* manual.

Results

Where to find more information

On the OPCOPTS and AROPTS statements
See *Customization and Tuning*.

On the automatic recovery function, and more examples
See Chapter 21, "Automatic recovery of jobs and started tasks," on page 395.

On the syntax of the `//*%OPC RECOVER` statement
See "The automatic-recovery-control statement" on page 399.

On the Service Functions menu.
See Chapter 14, "Using service and optional functions," on page 327.

What you need for the history function

Specify OPERHISTORY(YES) and the DB2SYSTEM keyword on the controller BATCHOPT and OPCOPTS statements.

Where to find more information

About creating or migrating a DB2 database
See *Planning and Installation Guide*.

About the BATCHOPT and OPCOPTS statements
See *Customization and Tuning*.

About using the history function
See "Rerunning operations in the history database" on page 620.

What you need for recovery on distributed agents

About this task

This function applies only to operations on distributed agents using non-centralized scripts. Perform the following tasks for job recovery on distributed agents:

1. Activate the end-to-end scheduling with fault tolerance capabilities feature.
2. Use the RECOVERY statement when you define the operation in the SCRPTLIB.
3. View data about recovery, respond to the prompt, and browse the JOB log of the recovery job in one of the following ways:
   - Use the command line on the fault-tolerant workstation.
   - Use the RI row command on the List Operations panel (EQQMOPRL) to access the EQQREINP panel.

Where to find more information

About activating the end-to-end scheduling with fault tolerance capabilities feature
See *Planning and Installation*.

See *Customization and Tuning*.

About the RECOVERY statement
See *Customization and Tuning*.

Chapter 18. Configuring a backup controller for disaster recovery

IBM Workload Scheduler for z/OS supports the recovery of a system failure between two remote sites. A disaster recovery process ensures that the business supported by the data center is always kept viable by switching from a local site where the failure occurs, to a remote site.

The controller in charge of planning, controlling, and monitoring the workload sends all the data and plan updates to a *backup* controller running in a different sysplex. In this way, the backup controller (also known as a *remote hot standby controller)* is kept up-to-date and can act as the *primary* controller when a planned or unplanned switch occurs.

You can configure a backup controller to replace the primary controller in the event of a system or connection failure. Both controllers must have the same configuration. The backup controller is continuously connected with the primary controller through TCP/IP and kept updated with all the required data. When the backup controller takes over from the primary controller, the tracker, if running, switches its connection from the primary to the backup controller.

To configure a backup controller and set its communication with the primary controller, define the following initialization statements. For detailed information about these statements, see *Customization and Tuning*.

BKPTOPTS
To define the local attributes for the TCP/IP communication between the primary and backup controller. Define this statement on both controllers.

OPCOPTS
To set the OPCHOST parameter, which defines the role of the subsystem. Define this statement on both controllers.

TRROPTS
To define the routing options from a z/OS tracker that is connected to a primary controller, and possibly also to a backup controller.

Note: To connect to a backup controller, a tracker can use only TCP/IP. In this case, to connect to a primary controller the same tracker can use only XCF or TCP/IP connection protocol.

The configuration to include a backup controller supports the following features:

- z/OS trackers
- IBM Workload Scheduler for z/OS agents (also known as z-centric agents)
- Dynamic domain managers
- Cross dependencies

Figure 149 on page 350 shows two remote sites, with two images each.

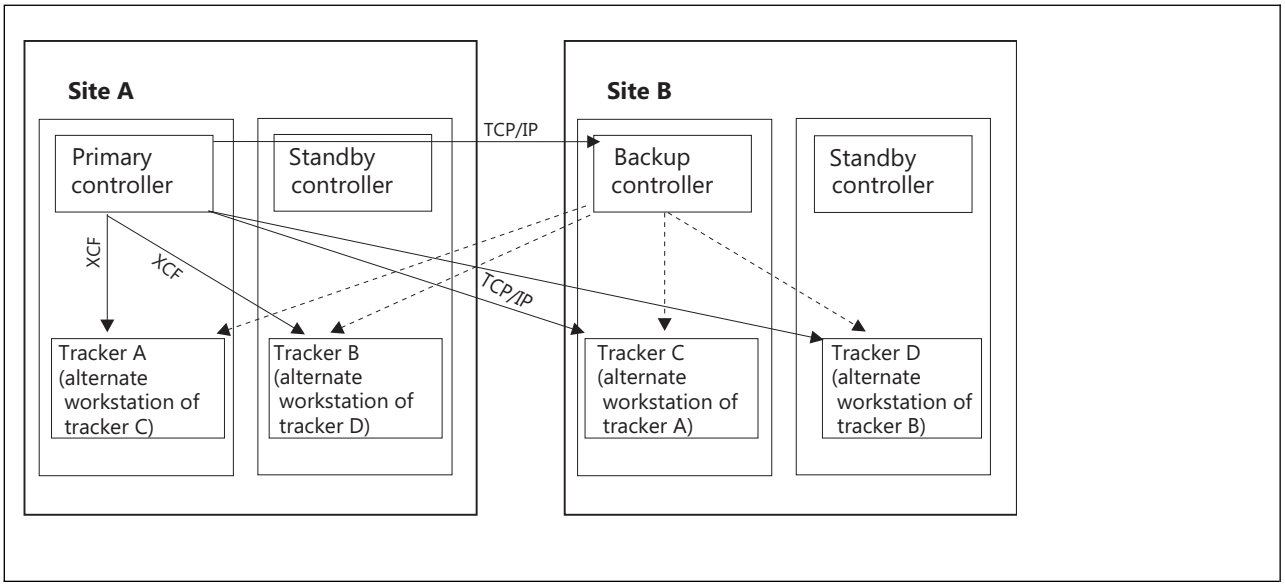


Figure 149. Configuring trackers, primary controller, and backup controller

In this configuration:

- The primary controller is connected to trackers A and B through XCF links. It is connected to the backup controller, trackers C and D through TCP/IP.
- The backup controller connects to trackers A, B, C, and D through TCP/IP links when you issue the modify command `/F procname,BKTAKEOVER` and the backup controller becomes the controlling system.
- On the primary controller you set the following statements:

```
OPCOPTS  OPCHOST(YES)
BKPTOPTS TCPIPJOBNAME('TCPIP')
         HOSTNAME('1.11.111.111')
         LOCPORTNUMBER(7543)
         PEERHOSTNAME('2.22.222.222')
         PEERPORTNUMBER(6456)
ROUTOPTS XCF(TWS2)                          1
```

- On the backup controller you set the following statements:

```
OPCOPTS  OPCHOST(BACKUP)
BKPTOPTS TCPIPJOBNAME('TCPIP')
         HOSTNAME('2.22.222.222')
         LOCPORTNUMBER(6456)
         PEERHOSTNAME('1.11.111.111')
         PEERPORTNUMBER(7543)
ROUTOPTS TCPIP(TWS2:'3.33.333.333'/4348) 1
```

- On trackers A and B you set the following statements:

```
TRROPTS  HOSTCON(XCF)
         BKPHOSTNAME('2.22.222.222')
         BKPPORTNUMBER(924)
XCFOPTS GROUP(GRUXCFX)
        MEMBER(TWS2)
TCPOPTS  HOSTNAME('3.33.333.333')
         TRKPORTNUMBER(4348)
```

- On trackers C and D you have set the following statements:

```
TRROPTS  HOSTCON(TCP)
         TCPHOSTNAME('1.11.111.111')
         TCPPORTNUMBER(424)
```

```
          BKPHOSTNAME('2.22.222.222')
          BKPPORTNUMBER(924)
TCPOPTS   HOSTNAME('3.33.333.333')
          TRKPORTNUMBER(4348)
```

1 On the primary and backup controller, the destination name in the ROUTOPTS statement must be the same (TWS2, in this example).

Starting a backup controller

Before you begin

Before starting the backup controller for the first time, ensure that you have:

1. Set the same name for the primary and backup subsystems, and that the VSAM data set names are the same on both controllers.
2. Allocated the required GDG root (sample EQQPCS13) on both the primary and backup controllers. For detailed information about how to allocate the GDG root, see the *Planning and Installation Guide*.
3. Customized the required transfer and restore procedures on both controllers. For detailed information about how to customize procedures, see the *Planning and Installation Guide*.
4. Sent all the databases from the primary controller to the remote site where the backup controller is located, by running the following procedures:
   - EQQSJS1
   - EQQSJS2
   - EQQSENDB

   You must send also the JOBLIB and, on the remote site, make any changes required to run the jobs on the remote destination environment.
5. Restored the databases on the backup controller, by running the following procedures:
   - EQQRJS1
   - EQQRJS2
   - EQQRESDB

About this task

To start the backup controller for the first time, complete the following steps:

1. Start the backup controller.

   The backup controller establishes a connection with the primary controller and sends a synchronization request. The EQQMLOG of the backup controller shows the following messages:

```
EQQN135I SYNCHRONIZATION CHECK REQUEST SENT TO PRIMARY CONTROLLER
EQQN135I BACKUP CONTROLLER
EQQN135I CP RUN NUMBER     : 00000000         TOD:
EQQN135I LTP RUN NUMBER    : 00000000         TOD:
EQQN135I LAST JT SEQNO     : 00000000
```

   The primary controller starts a synchronization process to send the required plans. The EQQMLOG of the backup controller shows the following messages:

```
EQQN136I SYNCHRONIZATION ANSWER RECEIVED FROM PRIMARY CONTROLLER:
EQQN136I PRIMARY CONTROLLER
EQQN136I CP RUN NUMBER     : 00000010         TOD: CD875679A8CF7B20
EQQN136I LTP RUN NUMBER    : 00000025         TOD: CD87833C781C1FA1
EQQN136I LAST JT SEQNO     : 000001AC
EQQN136I CP WILL BE SENT   : Y
EQQN136I LTP WILL BE SENT  : Y
EQQN136I JT WILL BE RESENT : N
```

The primary controller starts sending plans, and the corresponding restore is performed on the backup controller:

```
EQQN164I LTP  TRANSFER COMPLETED SUCCESSFULLY (EQQSENLT  STC00622)
EQQN168I LTP  RESTORE STARTED (EQQRESLT)
EQQN164I CP1  TRANSFER COMPLETED SUCCESSFULLY (EQQSECP1  STC00620)
EQQN168I CP1  RESTORE STARTED (EQQRECP1)
EQQN164I NCP  TRANSFER COMPLETED SUCCESSFULLY (EQQSENCP  STC00621)
EQQN168I NCP  RESTORE STARTED (EQQRENCP)
EQQN165I LTP  RESTORE COMPLETED SUCCESSFULLY (EQQRESLT  STC00623)
EQQN165I NCP  RESTORE COMPLETED SUCCESSFULLY (EQQRENCP  STC00625)
EQQN165I CP1  RESTORE COMPLETED SUCCESSFULLY (EQQRECP1  STC00624)
```

2. To check that the restore process for all the plans has completed, look for the following message in EQQMLOG:

   ```
   EQQN134I RE-SYNCHRONIZATION PLANS RESTORE COMPLETED
   ```

3. On the primary controller, to check that all data was sent successfully, look for the following messages in EQQMLOG:

   ```
   EQQN164I LTP  TRANSFER COMPLETED SUCCESSFULLY (EQQSENLT STC00622)
   EQQN164I CP1  TRANSFER COMPLETED SUCCESSFULLY (EQQSECP1 STC00620)
   EQQN164I NCP  TRANSFER COMPLETED SUCCESSFULLY (EQQSENCP STC00621)
   ```

Recovering from a system failure on the local site

You might want to replicate the configuration that you set on your local site system also on the remote site. Then, if a system failure occurs on your local site, your workload schedule can continue to run on the remote site.

To replicate your local site system configuration on the remote site, specify a remote alternate workstation for each workstation that exists locally. Figure 150 shows a local site system whose configuration is replicated on the remote site.

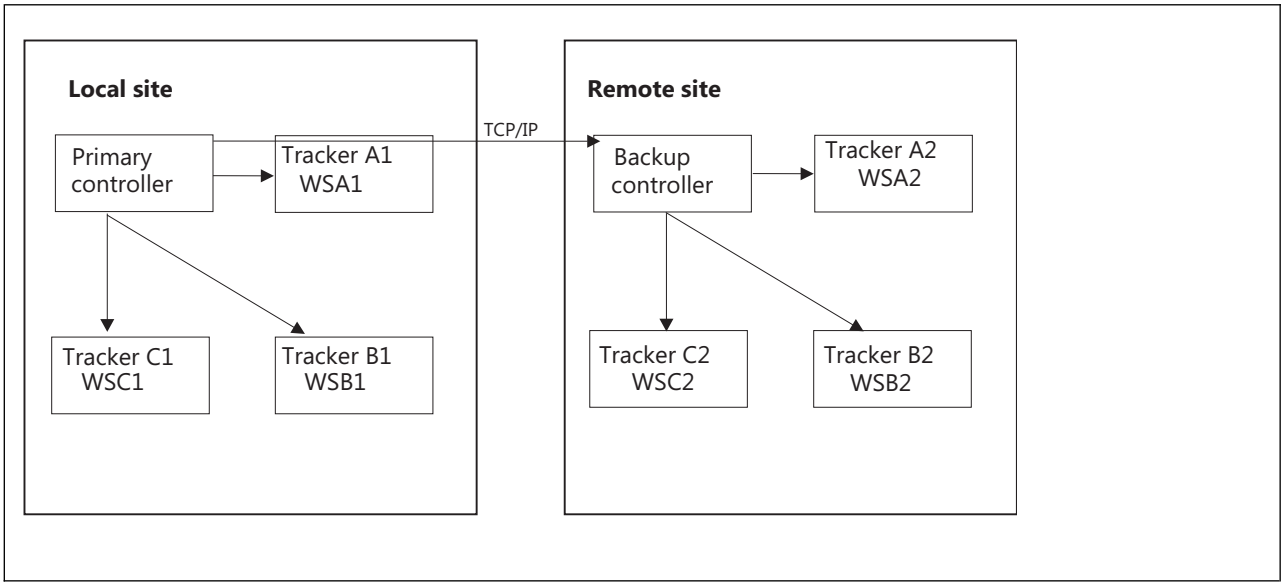


Figure 150. Configuring the local site and remote site in the same way

In this configuration:

- You defined the alternate workstations as follows:
  - On WSA1 you defined WSA2 as the alternate workstation, on WSA2 you defined WSB1 as the alternate workstation.

– On WSB1 you defined WSB2 as the alternate workstation, on WSB2 you defined WSC1 as the alternate workstation.
– On WSC1 you defined WSC2 as the alternate workstation, on WSC2 you defined WSA1 as the alternate workstation.

Therefore:

When the system on the local site is up and running

– If WSA1 is down, the work is redirected to WSB1.
– If WSB1 is down, the work is redirected to WSC1.
– If WSC1 is down, the work is redirected to WSA1.

If the system on the local site fails and the backup controller takes over from the primary controller

– The work that was scheduled to run on WSA1 is redirected to WSA2.
– The work that was scheduled to run on WSB1 is redirected to WSB2.
– The work that was scheduled to run on WSC1 is redirected to WSC2.

Running the primary and backup controllers

During normal processing, the primary controller sends all the data and plan updates to the backup controller, which in turn applies them to its databases.

For every event received from the primary controller, the backup controller checks that the information is aligned by browsing the following information:

- Run number and TOD ID of the CP (panel 6.6 EQQGSCPP) and run number and latest update of the LTP (panel 2.4 EQQLSTAP).
- Sequence number of the event that was received.
- Backup checkpoint data set information.

If changes to databases occur while the connection between the primary and backup controllers is lost, warning messages are logged in the EQQMLOG of the primary controller. Because the sending of databases to the backup controller is not automatic, you must manually start the following transfer procedures after replacing `EQQ` with your controller subsystem name:

- EQQSAD
- EQQSOI
- EQQSRD
- EQQSSI
- EQQSWS

At the end of the process, the backup controller is notified of the result and the database restore procedures are automatically started.

Note:

- Before you transfer the EQQSIDS data set, run a current plan backup (for details about a current-plan backup process, see “The current-plan backup process” on page 316). Do not transfer the EQQSIDS data set during the daily plan activities, because any updates might be lost.
- The mass update and batch-loader utilities are not propagated to the backup controller through events, because they directly update the AD VSAM file without logging each single update. For this reason, after you run the mass update or batch loader program you are required to submit the job that sends the AD file to the backup controller.

If the primary controller and backup controller run in different time zones, to ensure that the backup controller scheduling respects the time dependencies by applying the same time of the primary controller, customize the time-dependent-operation exit (EQQUX014) appropriately. For details about the exit EQQUX014, see *Customization and Tuning*.

If the connection between the controllers is lost at any time, a re-synchronization process is performed as soon as the connection is established again. The backup controller sends a re-synchronization request to the primary controller, and the primary controller sends all the events that were lost or, if the lost events no longer belong to the active JT, sends the current plans.

Because the MODIFY command is not supported on the backup controller, to update any initialization statement on the primary controller, complete the following procedure. For detailed information about the modify commands, see "Modifying the scheduler" on page 824.

1. On the backup controller change the initialization statements that you want to modify on the primary controller.
2. Stop and restart the backup controller.
3. Modify the required initialization statements on the primary controller.
4. Stop and restart the primary controller.

Applying maintenance to your environment

To apply maintenance to both the primary and backup controllers, complete the following steps.

About this task

1. Stop the primary controller.
2. On the backup controller, ensure that the connection with the primary controller closed (the EQQMLOG file shows the message `EQQBT17W CONNECTION RESET BY PEER`) and stop it.
3. Apply the required maintenance on both controllers.
4. Start the backup controller and check that EQQMLOG shows the following message:

   ```
   EQQN135I SYNCHRONIZATION CHECK REQUEST SENT TO PRIMARY CONTROLLER
   ```

5. Start the primary controller.

Creating or extending a long-term plan or current plan on the primary controller

When you create or extend a long-term plan, the primary controller sends a copy of it to the backup controller. When you create or extend a current plan, the primary controller sends a copy of the CP, NCP, and LTP files to the backup controller.

The backup controller restores the files that it receives, and the following messages are logged in the EQQMLOG (the following example applies to the extension of a long-term plan):

```
EQQN170I A NEW LTP HAS BEEN CREATED ON PRIMARY CONTROLLER
EQQN164I LTP  TRANSFER COMPLETED SUCCESSFULLY (EQQSENLT STC00319)
EQQN168I LTP  RESTORE STARTED (EQQRESLT)
EQQN165I LTP  RESTORE COMPLETED SUCCESSFULLY (EQQRESLT STC00156)
```

During the phase of restoring plans, any events that are received from the primary controller are suspended. They are reapplied immediately after the restore process completes.

Switching from primary controller to backup controller

You can plan to switch processing from a primary controller to its backup (for example, for maintenance reasons) or command the backup controller to take over from the primary controller for an unexpected event, such as a system crash or controller abend.

Note: After issuing a `BKTAKEOVER` command, the processing of critical paths is not automatically performed. You must replan the current plan.

Switching controller as a planned event

To switch from the primary controller to the backup controller as a planned event:

1. From the primary controller, send the JS1 and JS2 files to the backup controller by using the following procedures after replacing `EQQ` with your controller subsystem name:
   - EQQSJS1
   - EQQSJS2

   Note: This transfer is particularly important if you use the automatic recovery function.
2. Stop the primary controller.

   The controller stops when all events have been sent to the backup controller. On the backup controller, the following message is stored in EQQMLOG:

   ```
   EQQBT17W CONNECTION RESET BY PEER
   ```
3. On the backup controller, enter the modify command `/F procname,BKTAKEOVER`

   The available partners establish a connection with the backup controller and synchronize with it.

   Note: The `BKTAKEOVER` command is run only if the primary controller is completely stopped.

Switching controller for an unplanned event

If the primary controller ends processing unexpectedly, to switch to the backup controller, complete the following steps:

1. On the backup controller, enter the modify command `/F procname,BKTAKEOVER`

   The backup controller applies all the events in queue and switches from normal backup mode to active mode. The connection with the partners is established and a synchronization process occurs.
2. Check the jobs that were in started status on the primary controller when the connection failed, and manually correct the status on the backup controller.

Browsing the list of job steps

When a controller switch occurs, you might want to browse the list of steps that were run for the jobs in started status before the switch occurred.

Before you begin

To generate a list of the step events related to the jobs that were run, enable the step awareness function. In this way, the tracker creates the list of step events and sends it to the primary controller. The primary controller logs the step list and sends it to the backup controller, if any.

Enable the step awareness function on the backup controller to ensure that when the backup controller takes over from the primary controller, you can browse the list of steps for all the jobs that are in plan.

To enable the step awareness function from the ISPF panels, see *IBM Workload Scheduler for z/OS: Planning and Installation*. To enable the step awareness function by setting the `STEPINFO` parameter of the EWTROPTS and JTOPS statements, see *IBM Workload Scheduler for z/OS: Customization and Tuning*.

Note: You can also generate a list of the operations that were in Started status on the primary controller when the backup controller took over its functions. To do so, set the `Started at Startup` field to Y in the SELECTING OPERATIONS (EQQSOPFP) panel. For details about the SELECTING OPERATIONS panel, see "Specifying list criteria" on page 39.

About this task

To browse the list of step events:

1. From the SELECTING APPLICATION OCCURRENCE AND OPERATION INFORMATION (EQQSOPSP) panel, select option `15 STEP LIST` or from the OPERATIONS IN THE CURRENT PLAN (EQQMOPRV and EQQSOPRV) panels, enter the `Browse STEP LIST (BSL)` command.

   The Step List (EQQSSTEL) panel is displayed:

```
EQQSSTEL --------------------------- STEP LIST ----------------------Row 1 to 3 of 3
Command  ===>  _____________________________________________________Scroll ===> PAGE

Application                    : PAYRUN2        14/9/23  00.00
Operation                      : CPU1 1
Jobname and Jobid              : JOB1           JOB01217
Reader date and time           : 14/09/24 15.08

Step   StepName   ProcStep    Compl. Flushed  Abended     Start          End
No                             Code                        Time           Time
0001               STEP1       0000   No       No          14/09/24 15.08 14/09/24 15.08
0002               STEP5       S806   No       Yes         14/09/24 15.08 14/09/24 15.08
0003               STEP9       0000   Yes      No          14/09/24 15.08 14/09/24 15.08
****************************** Bottom of data ******************************
```

Figure 151. EQQSSTEL - Step List

2. According to the results shown, perform the actions that are appropriate to the job that you are browsing.

Note: If after reestablishing the connection between the primary controller and backup controller the system needs to resend the plans to recover the lost data, some information about the step events might be lost on the backup controller.

Restoring the primary controller

About this task

To switch back from the backup controller to the primary controller:

1. On the controller that you want to restore as the primary controller, set `OPCOPTS OPCHOST=BACKUP` and start it as the backup controller.

   The current backup controller and primary controller start the synchronization phase.
2. Stop the current primary controller.
3. On the backup controller, issue the modify command `/F procname,BKTAKEOVER`

   In this way, the backup controller takes over the functions of the controlling system.
4. Start the controller that you stopped in step 2 as the backup controller.

Chapter 19. Setting error codes

This chapter describes how IBM Workload Scheduler for z/OS sets error codes to describe the outcome of running a computer workstation operation. You can also set error codes manually from the Ready List or from the MCP panel.

When a computer workstation operation (either a job or started task) ends, IBM Workload Scheduler for z/OS determines the conditions under which it ended by inspecting the *error code* of the operation. Depending on the value you specified for the RETCODE parameter of the EWTROPTS statement, IBM Workload Scheduler for z/OS either uses the return code from the last executed step of the job or the highest return code from any step. For more information about EWTROPTS, see *Customization and Tuning*.

You can specify whether you want certain errors for all jobs to be considered acceptable. You can also specify that particular errors for specific jobs are to be considered acceptable. Unless informed otherwise, IBM Workload Scheduler for z/OS will, upon identifying an error, set the operation status to E (ended-in-error).

Note: With PQ87904 APAR, when the error in a job is determined by the EQQCLEAN step, that is a step inserted into the job by the Restart and Cleanup function, IBM Workload Scheduler for z/OS sets the operation status to E, overriding any other specification

How error codes are set for jobs on z/OS

Error codes can be set in these ways:

- Automatically, based either on the completion codes of the job or started-task step or on internal error detection.
- By the job completion checker. See "Setting error codes using the job completion checker" on page 360.
- Manually from the Ready List panel or from the MCP panel.
- Using the EQQUSIN subroutine. Refer to *Customization and Tuning*.
- Using the program interface. Refer to *Programming Interfaces*.
- Using the OPSTAT command in batch or TSO. See Appendix A, "TSO commands," on page 729.

In most cases, IBM Workload Scheduler for z/OS sets error codes using the z/OS user and system completion codes. In some special cases (for example, when there has been a JCL error), IBM Workload Scheduler for z/OS sets a special error code to enable it to react correctly to the situation.

Setting error codes using completion codes

IBM Workload Scheduler for z/OS sets error codes using completion codes when they are available. This is how IBM Workload Scheduler for z/OS derives the error code from the completion code:

- If the job or started task did not abend, the completion code is converted to a 4-digit number. The z/OS completion code 8, for example, is converted to the IBM Workload Scheduler for z/OS error code 0008. This also depends on the values specified on EWTROPTS.

- If the job or started task failed with a system completion code, the abend code (from the step-end SMF record) is set as the error code. System completion code 0C4, for example, becomes error code S0C4.
- If the job or started task failed with a user abend code, the code (from the step-end SMF record) is converted to a character string of the format U*xxx*, where *xxx* is three hexadecimal digits. User abend 2750, for example, is converted to error code UABE. That is, the decimal value of the abend code, as displayed in the job log, is converted to hexadecimal representation.
- In certain cases, IBM Workload Scheduler for z/OS does not use the completion code of a job or started task to set the error code. Instead, it sets one of its own error codes. Refer to Appendix E, "Status, error, and reason codes," on page 837 for a list of error codes.

Note:

1. If more than one step in a job or started task has abended, the operation error code is created from the abend code of the first step that failed.

   An exception to this rule is when you set RETCODE(LAST). In this case:
   - If all the steps fail, the operation error code is created from the abend code of the last step that failed.
   - If all the steps fail, except for the last one, which flushed, the operation error code is created from the abend code of the first step that failed.
2. IBM Workload Scheduler for z/OS converts only the three right-most hexadecimal digits. Therefore, the highest possible return code is 4095 (X'FFF'). If you pass a return code that is greater than 4095, an invalid return code could be set or invalid return code testing performed.

Setting error codes using the job completion checker

Sometimes the success or failure of a job or started-task operation cannot be determined from step completion codes alone. For example, a job might fail because a certain data set is not available, but this particular failure might be acceptable for this operation. That is, you would not want the operation representing the job to be marked as ended-in-error. However, if the job fails because it ran out of processor time, this failure might not be acceptable. In this case, you would want the operation representing the job to be marked as ended-in error. The job completion checker (JCC) function can be used to distinguish between operation failures of this type.

Just as you might look at the SYSOUT output of a job to find out whether a program issued a certain message, the JCC can do this automatically for you. The JCC scans the SYSOUT data set of a job or started task and set an error code for the operation, depending on the results of the scan.

The JCC can set an error code for the operation. But the step completion or abend code is still available and can be used in RECOVER statements; the JCC sets only the job error code.

The JCC is a tracker function, therefore is independent of the contents of the current plan. The JCC processes all jobs and started tasks for which a termination event (type 3P) was created in the event data set, regardless of whether the jobs or started tasks are defined in the current plan.

Note: Define acceptable nonzero return codes either by using the operation's HIGHRC job option or by defining statements on the NOERROR initialization

statement. Do not use the JCC to reset nonzero return codes that you consider acceptable. For more information about the job completion checker and NOERROR statement, see *Customization and Tuning*.

How error codes are set for jobs on distributed agents

Error codes can be set automatically, based on the completion codes. Because IBM Workload Scheduler return codes, with a completion code of ABND, vary from -2147483647 to 2147483647 and IBM Workload Scheduler for z/OS return codes vary from –999 to 9999, return codes from the distributed environment that exceed four digits are truncated. For example, a return code of 123456785 becomes 1234 for IBM Workload Scheduler for z/OS.

Using error codes to set operations to ended-in-error

Depending on the application, you might consider that not all error codes represent true operation errors. That is, you do not want the operation representing the job or started task to be marked as ended-in-error for certain error codes. You can tell IBM Workload Scheduler for z/OS to ignore certain error codes, using the NOERROR statement. You specify a list of error codes that must not cause the operation to be marked as ended-in-error. If the operation ends with an error code that matches a NOERROR condition, the operation is treated as having ended normally.

A specific extended status code shows if an operation, with completed (C) as current status, ended with an error code matching a NOERROR entry.

An error code specified by the NOERROR initialization statement can apply to all computer workstation operations, or it can be specified to apply to only a subset of such operations or steps within those operations. If the completion code of the last step in the operation is used to set the error code, this is regarded as a job error code. This means that the *stepname* and *procstepname* parameters of the NOERROR statement cannot be used to establish a match with the specified code because IBM Workload Scheduler for z/OS does not have the relevant step information.

If the error code is numeric, after checking the NOERROR list, IBM Workload Scheduler for z/OS checks the error code against the HIGHRC keyword of the JTOPTS initialization statement. If HIGHRC has been specified at operation level, IBM Workload Scheduler for z/OS uses this value instead of the installation-defined HIGHRC. The operation is considered to have ended-in-error if the error code has a higher numeric value than the HIGHRC value specified. If the error code is numerically lower than or equal to the HIGHRC value, the operation is considered to have ended normally. In this case, the operation is marked as C, complete.

To use the NOERROR keyword for specific job or started-task steps, the event writer options, as specified in the EWTROPTS initialization statement, must be set as follows:

- The STEPEVENTS keyword must specify either ALL or NZERO.
- The RETCODE keyword must specify HIGHEST.

For more information about the NOERROR statement, see *Customization and Tuning*; for more information about the NOERROR modify command, see "Modifying the scheduler" on page 824.

Resetting operations based on error codes

IBM Workload Scheduler for z/OS supports an error-reset error code list. You define this list using the ERRRES keyword of the JTOPTS initialization statement.

If an error code for a job or started task is in this list, IBM Workload Scheduler for z/OS automatically places the job or started task on the ready list of the operation computer workstation with status A (arriving) and extended status R (error, automatically reset). IBM Workload Scheduler for z/OS does not restart the operation automatically.

Determining the success or failure of a job

This summarizes how IBM Workload Scheduler for z/OS determines the next status of an operation that ends:

1. IBM Workload Scheduler for z/OS creates a job-end event with the highest or last return code, depending on the RETCODE keyword of the EWTROPTS statement.
2. If the job-completion checker (JCC) is active, it gets the event. The JCC can set a new value for the return code. After JCC processing, the event passes to the controller.

   The event reaches the event queue at the controller.
3. If the return code is 0, IBM Workload Scheduler for z/OS sets the operation status to C. Otherwise, it continues checking.
4. If the operation definition specifies no error tracking, IBM Workload Scheduler for z/OS sets the operation status to C. Otherwise, it continues checking.
5. If the return code matches a NOERROR entry (a NOERROR statement or the NOERROR keyword of the JTOPTS statement), IBM Workload Scheduler for z/OS sets the operation status to C. Otherwise, it continues checking.
6. If the return code is less than or equal to HIGHRC (the value in the operation definition or the value on the JTOPTS statement), IBM Workload Scheduler for z/OS sets the operation status to C. Otherwise, it continues checking.
7. If the return code matches an entry on the ERRRES keyword of the JTOPTS statement, IBM Workload Scheduler for z/OS sets the operation status to A, extended status R. Otherwise, it sets the operation status to E, and recovery processing can now occur.

Chapter 20. Restart and cleanup

This chapter describes the restart and cleanup of jobs and started tasks running on OS/390® systems and z/OS environments. Unless otherwise stated, the description applies to both jobs and started tasks.

Restart and cleanup are basically two tasks:

- Restarting an operation at the job-level or the step-level
- Cleaning up the associated data sets

When you restart an operation at step-level, you select a step range: the starting step, the ending step, and any steps to exclude from the re-run. When you perform a cleanup, you take previously allocated data sets and either catalog, uncatalog, or delete them. These tasks can be completed separately or together depending on your preference and Data Processing needs. For example, you can specify the step restart and cleanup of an operation, which are completed at job run time. In other situations, you can run the data set cleanup process separately, before the job reruns. In the second case, the step restart only begins after the cleanup completes.

The OPERATION RESTART AND CLEANUP panel (see Figure 152) is displayed when you request the RC row command for any operation, which ran at least once (this does not include operations which were retrieved from the DB2 history file as Restart and Cleanup cannot be done in this case - message EQQM600E will be issued), from any of the following operation lists in the MODIFY CURRENT PLAN panel:

- Ended-in-error operation list
- Operation list
- Operation displayed when you request to rerun an occurrence

```
EQQRCLSE --------------- OPERATION RESTART AND CLEANUP -----------------------
Option ===>

Application           : APLICSIMONA  01/02/05 19.19
Operation             : CPU1 10
Jobname and jobid     : JOBSAMP JOB00163
Expanded JCL          : N


cleanup Result       :


Edit JCL        ===> Y            Edit JCL before Restart (SR/JR only)


Select one of the following:

1 STEP RESTART                    Request a Step Restart
2 JOB RESTART                     Request a Job  Restart
3 START CLEANUP                   Request Cleanup
4 START CLEANUP WITH AR           Request Cleanup with AR task
4 DISPLAY CLEANUP                 Display Cleanup result
```

Figure 152. EQQRCLSE - Operation restart and cleanup

The restart and cleanup options are the following:

- Step restart

- Job restart
- Start cleanup
- Start cleanup with AR
- Display cleanup

The restart function is closely connected to the cleanup and automatic recovery functions. See “Data set cleanup” on page 380 and Chapter 17, “Planning for recovery and restart,” on page 343 for an overview of these functions and a description of how to activate them.

Note that in EQQRCLSE you can also change the proposed value for the following field:

- EDIT JCL
  - This field is applicable only to the STEP RESTART and JOB RESTART options. DEFAULT is the last value used in the ISPF dialog. To edit the JCL that will be resubmitted via the SR or JR options, you must set this field to YES.

To execute the Restart and cleanup function, the EQQCLEAN pre-step is added as the first step in the submitted JCL. This happens also when the cleanup actions are not triggered from ISPF but are started automatically by the Controller.

Since the EQQCLEAN step has to be added before all other existing steps, when an INCLUDE statement is present before the first step in a JCL, the EQQCLEAN step is added before that INCLUDE. Therefore, you should avoid specifying the JOBLIB DD in an INCLUDE or you should list this kind of INCLUDE (containing JOBLIB or other JCL statements that need to be placed before the EXEC) using the RCLOPTS SKIPINCLUDE keyword.

Note: The usage of this parameter does not solve the JCL errors caused by INCLUDEs that contain both JOBLIB and EXEC statements. They must be split into two separate INCLUDEs: one for the JOBLIB and one for the EXECs.

If the INCLUDE that contains the JOBLIB statement is nested within other INCLUDEs , you must add the most external INCLUDE to the SKIPINCLUDE list, as this is the only one visible to the JCL tailoring process.

This problem does not occur with expanded JCL because it does not contain INCLUDE statements.

Note:

1. With PQ87904 APAR, when the EQQCLEAN step fails with RC>=8, then all subsequent steps in the job are forced to FLUSH. This causes the operation to be marked as Ended-in-error with the 'Status of operation on workstation' set to CLNP, whichever completion checking logic has been implemented.
2. Same restrictions apply as for changing the operation status to ready by selecting option 6 (GENERAL) from the MODIFYING AN OPERATION IN THE CURRENT PLAN panel. In particular, a step or job restart request might imply a request to change to ready the status of an operation with conditional successors already started, completed, suppressed by condition, or ended in error. In this case the scheduler issues message EQQM208E. Only when rerunning an occurrence you might indirectly obtain this kind of change.

Restarting an operation at step or job level

This section explains how to restart an operation associated to jobs and started tasks. It also explains how to select the steps that will be included in the restarted job.

To perform a new rerun of a job, including the needed cleanup actions at job run time, select the JOB RESTART option.

To perform a step restart, including the necessary cleanup actions at job run time, select the STEP RESTART option. From this step on, the operation statuses are automatically changed to `waiting`. This option differs from JOB RESTART in that:

- The restartability of steps is checked according to information available from previous runs (see "Steps that are not restartable" on page 372 for details).
- Return code simulation is executed to restart from a specific step, that is, IBM Workload Scheduler for z/OS simulates how the preceding steps actually ended. The simulation works in this way:
  - Ending the steps with RC=*nn*, where *nn* is the return code obtained in their last effective run.
  - Flushing the steps, if they were never run or abended.

  You can override the suggested values in the panel and force a different simulation. The reason for running a step restart in this way is to support the IF/THEN/ELSE statements.
- If needed, GDG resolution is executed when normal JCL is used (when expanded JCL is used the GDG resolution is already applied to the JCL, see "GDG resolution" on page 374 for details)

With both JOB RESTART and STEP RESTART option, two types of JCL can be used for job rerun:

- Expanded JCL
- Normal JCL

See "JCL used for restart" for details.

JCL used for restart

The Expanded JCL option applies with the Step Restart and Job Restart functions. The option is related to the CP operation record (built from the AD application definition value) and the default is N. You are allowed to change it using MCP (Modifying the Restart and Cleanup options in the CP). The values allowed for this option are N (No) and Y (Yes). If you select N, you are establishing that the JCL that will be submitted through SR or JR is the normal JCL taken from the JS VSAM files. If you select Y, you are establishing that the JCL is expanded JCL.

- Normal JCL

  Is the normal JCL found in the JS VSAM file or in the customer libraries. It can also be edited using the J row command.
- Expanded JCL

  Is the JCL extracted from the JOBLOG of the last run and is built from the data store. When the data store builds the expanded JCL, the EXEC statements that call for procedures are commented out and the called procedures are inserted in their expanded form. The result is a linear JCL without procedure calls.

EXPANDED JCL

When you use expanded JCL, the same steps (together with the ones in the called procedures and INCLUDE) are re-executed exactly as they were in the previous run.

GDG resolution is performed by data store while it builds the expanded JCL from the JOBLOG: all the GDG data sets names are replaced with their equivalent expanded form (GDGRoot.GnnnnVnn). For this reason, if you rerun a JCL that contains GDGs more than once, and you do not use the expanded JCL in all the re-executions, the name substitution might not be complete.

For example, suppose you run the following JCL:

```
=========
RUN1
=========

//GDGSAMPL JOB
//STEP1 EXEC PGM=IEFBR14
//DD1   DD DSN=MYGDG.ROOT(+1),DISP=(NEW,CATLG)
//STEP2 EXEC PGM=MYPGM2
//STEP3 EXEC PGM=MYPGM3
//STEP4 EXEC PGM=IEFBR14
//DD4   DD DSN=MYGDG.ROOT(+1),DISP=OLD
```

and that the job fails in step2, which ends with RC=12:

```
STEP1 RC=0   --> allocated MYGDG.ROOT.G0001V00
STEP2 RC=12
STEP3 RC=FLUSH
STEP4 RC=FLUSH
```

The JOBLOG provides information only about the GDG allocated in STEP1. Data store is able to resolve the GDG and build the expanded JCL correctly. At this point, you fix the error in MYPGM2 and run a Step restart beginning from STEP2 and using normal JCL:

```
=========
RUN 2
=========
//GDGSAMPL JOB
//STEP1 EXEC PGM=IEFBR14
//DD1   DD DSN=MYGDG.ROOT(+1),DISP=(NEW,CATLG)
//STEP2 EXEC PGM=MYPGM2
//STEP3 EXEC PGM=MYPGM3
//STEP4 EXEC PGM=IEFBR14
//DD4   DD DSN=MYGDG.ROOT(+1),DISP=OLD
```

Now, the job fails in STEP3, which ends with RC=12:

```
STEP1 RC=0      --> simulated step
STEP2 RC=0
STEP3 RC=12
STEP4 RC=FLUSH
```

The JOBLOG contains no information about the GDG because data store was no longer able to resolve it in the expanded JCL (because the previous Step restart was run using normal JCL). You now fix the error in MYPGM3 and run a Step restart beginning from STEP3 and using expanded JCL:

```
=========
RUN 3
=========
//GDGSAMPL JOB
//STEP1 EXEC PGM=IEFBR14
```

```
//DD1   DD DSN=MYGDG.ROOT(+1),DISP=(NEW,CATLG)
//STEP2 EXEC PGM=MYPGM2
//STEP3 EXEC PGM=MYPGM3
//STEP4 EXEC PGM=MYPGM4
//DD4   DD DSN=MYGDG.ROOT(+1),DISP=OLD
```

In this way, even when the data store is unable to resolve a GDG, the necessary changes are nevertheless contained in the submitted JCL.

Expanded JCL is not stored in the JS after a Job or Step restart, because it is always built by data store from the last JOBLOG run.

To decide whether or not to use the expanded form for a specific JCL, consider that expanded JCL is built from the JOBLOG by removing all calls to procedures: as a result, all the references to steps, such as COND or IF THEN REFDD, are changed by data store if the following conditions occur:

- Stepname.Procstep is used: linear JCL cannot contain this kind of step because calls to procedures have been removed. The reference to the step and the step will usually be changed to Procstep only. This might not be enough if Procstep is not unique in the JCL (see the next bullet).
- When Stepname is used and the Stepname is not unique in the JCL. For example, if STEP2 in a procedure has a COND=(0,NE,STEP1), and STEP1 is the first step in the procedure and a previous step of the original JCL, the COND is resolved incorrectly by JES if the step name from STEP1 is not made unique. When these conditions exist, data store generates the required unique step name in the format JJJ*nnnnn* (where *nnnnn* is a number) and adds a comment line just before the changed EXEC statement in the format:

  ```
  //*OLDStep=(xxx)   OLDProcStep=(yyy)   NEWStep=zzz
  ```

  where *xxx.yyy* is the old step name, and *zzz* is the new one.

  To see which steps have changed name in the expanded JCL use the STEP command on the EQQMERSL panel.

The following limitations also occur when you use expanded JCL:

- The change of proc/step names might affect external products that identify with these values.
- JJJ*nnnnn* step names cannot be used in the JCLs, because this might cause incorrect step name substitution.
- Procedures submitted by IBM Workload Scheduler for z/OS must contain the PEND statement.
- Nested external procedures must contain the PEND statement.
- Nested inline procedures cannot be ambiguous. For example, the following nesting is clear:

  ```
  step1 exec pgm=PGM1
  step2 exec PRO1
             step1 exec pgm=PGM2
             step2 exec PRO2
                        step1 exec pgm=PGM3
                        step2 exec PRO23
                                   step1 exec pgm=PGM4
  step3 exec pgm=PGM5
  ```

  On the other hand, the following nesting is ambiguous and might not work properly:

```
step1 exec pgm=PGM1
step2 exec PRO1
           step1 exec pgm=PGM2
           step2 exec PRO2
                      step1 exec pgm=PGM3
                      step2 exec PRO23
                                 step1 exec pgm=PGM4
                      step3 exec pgm=PGM5
           step3 exec pgm=PGM6
step3 exec pgm=PGM7
```

In addition, consecutive inline procedures can cause problems, for example:

```
step2 exec PRO1
step3 exec PRO2
```

To avoid problems, insert a dummy step as follows:

```
step2 exec PRO1
stepD exec pgm=iefbr14
step3 exec PRO2
```

Note: Using expanded JCL does affect how the StepName and ProcStep fields are displayed in the step lists or data set lists shown by the dialog. For example, consider running Restart and Cleanup on the following job:

```
//EXAMPLE JOB
//STEP1 EXEC  PGM=IEFBR14
//STEP2 EXEC  PROC1
```

where PROC1 is the following:

```
//PROC1 PROC
//STEP1  EXEC  PGM=IEFBR14
//STEP2  EXEC  PGM=IEFBR14,COND=(0,NE,STEP1)
// PEND
```

If you select `Expanded JCL=N`, you will see the following values for the `StepName` and `ProcStep` fields in the step list of EQQMERSL panel:

```
...    Step     StepName     ProcStep       PgmName ...
...    No
...    0001                   STEP1           IEFBR14 ...
...    0002    STEP2          STEP1           IEFBR14 ...
...    0003    STEP2          STEP2           IEFBR14 ...
```

If you select `Expanded JCL=Y`, you will see:

```
...    Step     StepName     ProcStep       PgmName ...
...    No
...    0001                   STEP1          IEFBR14 ...
...    0002                   JJJ00001       IEFBR14 ...
...    0003                   STEP2          IEFBR14 ...
```

This is consistent with the nature of expanded JCL. As mentioned before, an expanded JCL is a linear JCL, in which all the procedure calls are expanded and made 'flat'. Therefore, if you want `Expanded JCL=Y`, the step name (which is the procedure invocation step name) will always be blank and the procedure name will always be evaluated with the step name in the JCL procedure (or the job step name, if the step does not invoke a procedure), possibly changed to JJJ*xxxxx* to univocally identify the step tested by the COND parameter.

NORMAL JCL

When you use normal JCL, you can get procedure changes that were applied after the last job run.

If GDG are present, they are resolved transparently, as the JCL is left unchanged. GDG resolution is accomplished at job run time by the substitution of the GDG data set names with their equivalent expanded form (GDGRoot.GnnnnVnn) in the JES control block, using the previous run information. This is accomplished by the EQQCLEAN pre-step.

Additionally, you can use the EQQUXGDG exit to check the GDG name substitution just before EQQCLEAN executes. The exit lets you exclude a GDG from substitution in the same way you can exclude a data set from cleanup with exit EQQUXCAT.

GDG resolution is performed only within a Step Restart path and not in a Job Restart path. A normal JCL will be stored in the JS library at each job or step restart.

In the JES3 environment, the use of the normal JCL has a limitation when a JCL that includes nested procedures, where the steps that call the procedures are not the last ones inside the procedure, ends with a JCL error leading to NORUN steps. In this case, Restart and Cleanup might produce an incorrect step list. Users should modify the failing JCL by adding the PEND statement in the called cataloged PROCs. For example, a nesting like the following, might not work properly:

```
step1 exec pgm=PGM1
 step2 exec PRO1
       step1 exec pgm=PGM2
       step2 exec PRO2
             step1 exec pgm=PGM3
             step2 exec PRO23
                  step1 exec pgm=PGM4
             step3 exec pgm=PGM5
       step3 exec pgm=PGM6
 step3 exec pgm=PGM7
```

Step restart

When you rerun a job, you select the range of the restart. The range of the restart is defined by the first and last step to be included in the rerun. You select the Step Restart option in the OPERATION RESTART AND CLEANUP panel.

Step restart allows you to restart the job or the started task at the step level and performs the appropriate cleanup actions. When you request a step restart, the scheduler shows you which steps are restartable and which is the best step. In any case, you can modify the selection made by the scheduler.

The way in which step restart works is based on the simulation of return codes and on the use of data store. The scheduler adds a pre-step, EQQCLEAN, which performs the simulation from the history of the previous runs. This step also performs the cleanup actions and the needed GDG resolution.

Note: Return code simulation, GDG resolution, and cleanup actions are based on the previous run history and used JCL structure. For this reason, changes to the submitted JCL structure (like adding a step, deleting a step, and changing DD names) might cause unexpected results. For example, the EQQCLEAN program uses the list of step names, and the return codes associated with them, that are provided by the scheduler, so that, if a simulated step no longer exists in the submitted JCL, EQQCLEAN fails with a message about step mismatching. For the same reason, it is preferable not to switch from normal JCL to expanded JCL, and vice versa, because the JCL structure could be different (for example when procedures have been changed in libraries).

To perform a step restart with the appropriate data set cleanup actions, IBM Workload Scheduler for z/OS needs the JCL extracted from the JOBLOG. This JCL must contain the expanded procedures and INCLUDEs because GDG relative numbers must be substituted with the data set names that are actually allocated. This cannot be done using the JCL OVERRIDE statement if GDGs are inside an INCLUDE. This kind of extracted JCL is called expanded JCL. The only source that can build it is the JOBLOG.

Return code simulation allows for support of IF/THEN/ELSE statements as shown in the following example, where you run the following JCL:

```
//JOBSAMP JOB (07A2,D07),MSGLEVEL=(1,1)
//S1 EXEC PGM=MYPROG
//S2 EXEC PGM=IEFBR14
//S3 EXEC PGM=IEFBR14
//S4 EXEC PGM=IEFBR15
//SIF IF S1.RC EQ 4 THEN
//S5 EXEC PGM=IEFBR14
//EIF ENDIF
//*
```

In this example, steps S1, S2, and S3 are executed and are ended with RC=4, RC=0, RC=0; S4 is abended with S806, and S5 is flushed.

If you select a step restart from step S4 (after fixing the error causing the abend), steps S1, S2, and S3 will be simulated with return code 4, 0, 0, while S4 and S5 will be executed. Return code simulation guarantees that the //SIF statement check will be correctly evaluated by JES, allowing execution of S5. You have to select the step range from the EQQMERSL panel (STEP RESTART SELECTION LIST panel), as shown in Figure 153 where the JCL used is the one of the previous example.

```
EQQMERSL ---------------- STEP RESTART SELECTION LIST -------- Row 1 of 5

Primary commands:  GO  - to confirm the selection, END - to save it,
                    CANCEL - to exit without saving, STEP -to show Step Info
User Selection:    S -Start restart step E -Last restart step
                   X -Step excluded (simulated flushed)
                   F -Step excluded (simulated with specified RC)
                   I -Step included if inside restart range,
                    otherwise simulated with specified RC.


Application           : APLICSIMONA       01/02/05 19.19
Operation             : CPU1 10
Jobname and jobid     : JOBSAMP           JOB00163

Best Restart Step     : S3               0003
Current selected Step : S3               0003

Usr Act Rest Step StepName ProcStep PgmName  Step      Step       Compl.
Sel Sel      No                              Type      Status     Code
'    I   Y    0001           S1    MYPROG   Normal    Executed   0004
'    I   Y    0002           S2    IEFBR14  Normal    Executed   0000
'    I   Y    0003           S3    IEFBR14  Normal    Executed   0000
S    S   B    0004           S4    IEFBR15  Normal    Abended    S806
'    I   N    0005           S5    IEFBR14  Normal    Flushed    FLUSH
```

Figure 153. EQQMERSL - Step restart selection list

Figure 153 shows that step S4 is selected as the restart point (with the S row command), and the restarted job will end at step S5 (the end step defaults to the last step). The scope of the restart are steps 4 to 5.

To change the completion code values for the steps that will be simulated, do the following after setting the code value:

- For steps outside the restart range, enter the I or F row command.
- For steps inside the restart range, enter the F row command.

For example, to set code value 0008 for step S4, you must use row command F, while for step S2 you might use row command I.

The 'Rest' column shows if a step is restartable or not. Steps S4 and S5 are marked as not restartable because they follow the abended step S3. The logic used to decide this is described in the "Steps that are not restartable" on page 372 section. Usually you cannot override suggested logic (that is, you can start from step S1, S2, and S3, but you cannot start from step S5) unless a specific keyword was specified in the Controller Initial statement file (see the RCLOPTS STEPRESCHK keyword for details).

The 'Step Type' column shows if this is a simulated, normal, or EQQCLEAN step. As this is the first run of the job, all steps are marked as `Normal`. To display the step name change table, enter the primary command STEP on the EQQMERSL panel. The EQQMERSI panel is displayed:

```
EQQMERSI -------------- STEP INFORMATION LIST   ------------- Row 1 of 5

Command ===>                    Scroll ===> PAGE

Expanded JCL can change original step names. It is a flat JCL built
from JOBLOG removing the procedure calls and leaving only their
steps. Steps inside procedures are always changed as the double
name reference (e.g. STEP1.STEP2) is reduced to a single reference
(e.g. STEP2). New StepName is only displayed if it was changed.

Application           : APLICSIMONA  01/02/05 19.19
Operation             : CPU1 10
Jobname and jobid     : JOBSAMP           JOB00163

Step Old      Old      New
No   StepName ProcStep StepName PgmName
0001          S1                MYPROG
0002          S2                IEFBR14
0003          S3                IEFBR14
0004          S4                IEFBR15
0005          S5                IEFBR14
```

Figure 154. EQQMERSI - Step information list

Return code simulation logic

The Step Restart of a job is performed by return code simulation. The Scheduler obtains a history of the previous runs, the step execution, and the return codes from the Operinfo record. Then it adds a pre-step named EQQCLEAN to the JCL. The list of simulated steps and return codes serves as input for EQQCLEAN.

At run time, EQQCLEAN checks the JES control blocks and alters them to force the simulated return codes so that IF THEN ELSE and COND can follow the correct logic.

Abended steps are simulated as flushed for the following reasons:

- IF THEN ELSE or COND related to abended steps are supposed to be run immediately at abend time. The flushed simulation avoids the duplicate execution of these steps.

- If the abended steps were not simulated as flushed, JES would flush all the steps following the abended steps again.

Steps that are not restartable

Cataloging, re-cataloging, and uncataloging operations cannot, by themselves, hinder the capability to restart, because it is possible to use EQQCLEAN. However, there are some cases where a step is not restartable and the logic applied by IBM Workload Scheduler for z/OS is the following:

- The step must be re-executable (see the "Re-executing steps" section)
- The step must not satisfy any of the following conditions:
  - The step follows the abended step.
  - The step includes a DDNAME that is listed in the parameter DDNOREST (in the RCLOPTS initialization statement).
  - The step includes a DDNAME that is listed in the parameter DDNEVER (in the RCLOPTS initialization statement). In this case the preceding steps are also not restartable.
  - The step is a cleanup step.
  - The step is flushed or not run, and the step is not simulated. The only exception is when the step is the first to be flushed in the JCL, all the following steps are flushed, and the job did not abend.
  - The data set is not available, and the disposition is different from NEW.
  - The data set is available, but all the following conditions exist:
    - The disposition type is OLD or SHR.
    - The normal disposition is different from UNCT.
    - The data set has the disposition NEW before this step (the data set is allocated by this JCL).
    - The data set has been cataloged at the end of the previous run and a CAT action is performed in one of the steps that follow.
  - The step refers to a data set with DISP=MOD, unless the step never ran in the previous job runs (flushed or NORUN).
  - Restarting the job from this step entails the running of a step that cannot be rerun.

Data set availability

The scheduler determines the availability of a data set by using information from the previous job runs. In some cases, the scheduler is not able to determine availability where there have been no actions against the data set in the previous runs. Thus, the scheduler establishes availability as follows:

- The data set is available and cataloged if there are no JCL statements that allocate it in the job.
- The data set is *not* available if there are JCL statements that allocate it in the job.

For example, a step refers to an existing data set with the disposition SHR. This step has never run, thus the data set is available.

Re-executing steps

This section refers only to a Step Restart; it does not apply to a Job Restart.

The idea of a re-executable step is different from the one of a restartable step, as it can be considered a subset of a restartable step:

- A restartable step is always a re-executable step.

- A re-executable step might be restartable or not.

A step can be re-executed if it does not refer to any data sets or if it includes a DDNAME that is listed in the parameter DDALWAYS (in the RCLOPTS initialization statement). Otherwise, if the step does refer to a data set, it can be re-executed if the data set meets one of the three following conditions:

- The disposition type is NEW. With JES you cannot execute or restart from a step that has a back reference (REF=) in the VOL parameter to a previous step that has not been executed. In IBM Workload Scheduler for z/OS you cannot use this type of restart.
- The disposition type is MOD, and the data set is allocated before running the step, unless the step never ran in the previous job runs (flushed or NORUN).
- The disposition type is OLD or SHR, and the data set is either of the following:
  - Allocated before running this step.
  - Available and has one of the following characteristics:
    - The normal disposition is UNCATLG.
    - The data set is not allocated in the JCL before this step.
    - The data set is cataloged before running this step.
    - The data set has been cataloged at the end of the previous run and no catalog action is taken in any of the steps that follow.

Best restart step

The scheduler suggests the best restart step in the job, depending on how the job ended in the previous run. Table 21 summarizes how the scheduler selects the best restart step.

Table 21. Determining the best restart step

How the Job Ended	Best Restart Step
The job terminated in error with an abend or JCL error for non-syntactical reasons.	Last restartable step
There was a sequence of consecutive, flushed steps.	Last restartable step
The last run was a stand-alone cleanup action performed according to the IMMEDLOGIC(FIRSTSTEP) parameter.	First restartable step
All other situations.	First restartable step

Example of step restart

Continuing with the JCL example, you accept the suggested best S3 and enter the GO command to confirm the selection. At this point, having selected in panel EQQRCLSE the option Edit JCL= YES, the edit JCL panel is shown. You fix the error causing the abend (IEFBR15) and confirm the restart by entering first GO, and then Y, in the final confirmation panel.

The job is run, adding another step named EQQCLEAN that will execute the return code simulation for steps S1, S2, and S3. Then, EQQCLEAN also causes the re-execution of step S4 and the execution of step S5.

The following messages are logged to the JES message log:

```
EQQCN00I START CLEANUP AND/OR RET-CODE SIMULATION PROCESS(ES).
EQQCN18I SNUM STEPNAME PROCNAME RC
EQQCN02I 002       S1          0004
```

```
EQQCN02I 003       S2           0000
EQQCN02I 004       S3           0000
EQQCN99I CLEANUP AND/OR RET-CODE SIMULATION PROCESS(ES)ENDED.
```

You select the step restart again, and the following panel is displayed:
From the panel you can see that the EQQCLEAN step has been added. Steps S1,

```
EQQMERSL ----------------STEP RESTART SELECTION LIST --------Row 1 of 5

Primary commands: GO -to confirm the selection, END -to save it,
            CANCEL - to exit without saving, STEP -to show Step Info
User Selection: .S -Start restart step E -Last restart step
             .X -Step excluded (simulated flushed)
F -Step excluded (simulated with specified RC)
I -Step included if inside restart range,
       otherwise simulated with specified RC.

Application:     APLICSIMONA 01/02/05 19.19
Operation:       CPU1  10
Jobname and jobid:  JOBSAMP  JOB00164
Best Restart Step:  S1    0002
Current selected Step: S1 0002

Usr  Act Rest Step   StepName ProcStep PgmName  Step      Step      Compl.
Sel  Sel      No                                Type      Status    Code
X    X   N    0001   EQQCLEAN EQQCLEAN EQQCLEAN cleanup  Executed   0000
'    I   B    0002            S1       MYPROG   Simulated Not Exec. 0004
'    I   Y    0003            S2       IEFBR14  Simulated Not Exec. 0000
'    I   Y    0004            S3       IEFBR14  Simulated Not Exec. 0000
'    I   Y    0005            S4       IEFBR14  Normal    Executed  0000
'    I   Y    0006            S5       IEFBR14  Normal    Executed  0000
****************************** Bottom of data ******************************
```

Figure 155. Example of the beginning of a step restart

S2, and S3 are shown as simulated and steps S4, and S5 as successfully executed.

GDG resolution

GDG resolution is the possibility to re-execute a job using exactly the same GDG data set used in the previous run. This is needed in a step restart mainly to avoid JCL errors, but also to use the same GDG data set as if the job had been executed in one run only.

GDG resolution will be performed in different ways depending on whether you are using normal or expanded JCL.

With a normal JCL, GDG resolution is performed by overwriting the GDG names with their expanded form (GDGRoot.GnnnnVnn) in the JES control block, just before the job run.

With expanded JCL, GDG resolution is performed by overwriting the GDG names with their expanded form (GDGRoot.GnnnnVnn) in the expanded JCL as it is produced. See “JCL used for restart” on page 365 for more details.

For example, assume that you run the following JCL:

```
//GDG00001 JOB (9805,SS),'D-JOB',MSGLEVEL=(1,1)
//STEP0 EXEC PGM=IEFBR14
//STEP1 EXEC PGM=IEFBR14
//DD01 DD DSN=MYGDG.ROOT(+1),UNIT=3390,
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),SPACE=(TRK,(1,1)),
// VOL=SER=TWS01,DISP=(NEW,CATLG,DELETE)
//STEP2 EXEC PGM=IEFBR15
//DD21 DD DSN=MYGDG.ROOT(+1),DISP=SHR
```

The resulting JOBLOG will be the following:

```
            J E S 2  J O B  L O G  --  S Y S T E M  E S 3 3  --  N O D E

JOB00107 ---- MONDAY,    09 JUN 2009 ----
JOB00107  IRR010I  USERID OPCSTC   IS ASSIGNED TO THIS JOB.
JOB00107  ICH70001I OPCSTC   LAST ACCESS AT 11:25:40 ON MONDAY, JUNE 9,
JOB00107  $HASP373 GDG00001 STARTED - INIT 1    - CLASS A - SYS ES33
JOB00107  IEF403I GDG00001 - STARTED - TIME=11.52.19
JOB00107  -                                        --TIMINGS (MINS.)--
JOB00107  -JOBNAME STEPNAME PROCSTEP   RC   EXCP  CPU  SRB  CLOCK  SERV  PG  PAGE  SWAP  VIO SWAPS STEPNO
JOB00107  -GDG0001          STEP0      00   8      00   00   00    279   1   0     0     0   0     1
JOB00107  -GDG0001          STEP1      00   8      00   00   00    287   1   0     0     0   0     2
JOB00107  CSV003I REQUESTED MODULE IEFBR15  NOT FOUND
JOB00107  CSV028I ABEND806-04  JOBNAME=GDG00001  STEPNAME=STEP2
JOB00107  IEA995I SYMPTOM DUMP OUTPUT
                  SYSTEM COMPLETION CODE=806  REASON CODE=00000004
                   TIME=11.52.19  SEQ=00394  CPU=0000  ASID=0016
                   PSW AT TIME OF ERROR  070C1000   811C020A  ILC 2  INTC 0D
                     NO ACTIVE MODULE FOUND
                     NAME=UNKNOWN
                     DATA AT PSW  011C0204 - 9FB0181C  0A0D18FB  180C181D
                     GPR  0-3  00001C00  84806000  00FCF568  00000010
                     GPR  4-7  000000FF  006E7DE8  00000004  0000000C
                     GPR  8-11 006D5450  811BF750  011C074F  00000000
                     GPR 12-15 84806000  006D5450  811C018C  00000004
                   END OF SYMPTOM DUMP
JOB00107  IEF450I GDG00001 STEP2 - ABEND=S806 U0000 REASON=00000004
                         TIME=11.52.19
JOB00107  -GDG0001            STEP2   *S806  13      .00  .00   .00  1126   1    0     0     0   0   3
JOB00107  -GDG00001           STEP2   *S806  13      .00  .00   .00
JOB00107  IEF404I GDG00001 - ENDED - TIME=11.52.19
JOB00107  -GDG00001 ENDED.  NAME-D-JOB                TOTAL CPU TIME=
JOB00107  $HASP395 GDG00001 ENDED
------ JES2 JOB STATISTICS ------
  09 JUN 2009 JOB EXECUTION DATE
           10 CARDS READ
           82 SYSOUT PRINT RECORDS
            0 SYSOUT PUNCH RECORDS
            5 SYSOUT SPOOL KBYTES
         0.00 MINUTES EXECUTION TIME

        1 //GDG00001 JOB (9805,SS),'D-JOB',MSGLEVEL=(1,1)
        2 //TIVDST00 OUTPUT JESDS=ALL,DEST=TWSFDEST          inserted by scheduler
        3 //TIVDSTAL OUTPUT JESDS=ALL                        inserted by scheduler
        4 //STEP0 EXEC PGM=IEFBR14
        5 //STEP1 EXEC PGM=IEFBR14
        6 //DD01  DD   DSN=MYGDG.ROOT(+1),UNIT=3390,
          //      DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),SPACE=(TRK,(1,1)),
          //      VOL=SER=TWS01,DISP=(NEW,CATLG,DELETE)
        7 //STEP2 EXEC PGM=IEFBR15
        8 //DD21  DD   DSN=MYGDG.ROOT(+1),DISP=SHR

ICH70001I OPCSTC   LAST ACCESS AT 11:25:40 ON MONDAY, JUNE 9, 2009
IEF142I GDG00001 STEP0 - STEP WAS EXECUTED - COND CODE 0000
IEF373I STEP/STEP0   /START 2009160.1152
IEF374I STEP/STEP0   /STOP  2009160.1152 CPU    0MIN 00.00SEC SRB    0MIN 00.00S
IEF236I ALLOC. FOR GDG00001 STEP1
IGD100I 0118 ALLOCATED TO DDNAME DD01     DATACLAS (        )
IEF142I GDG00001 STEP1 - STEP WAS EXECUTED - COND CODE 0000
IEF285I   MYGDG.ROOT.G0126V00                     CATALOGED
IEF285I   VOL SER NOS= TWS01 .
IEF373I STEP/STEP1   /START 2009160.1152
IEF374I STEP/STEP1   /STOP  2009160.1152 CPU    0MIN 00.00SEC SRB    0MIN 00.00S
IEF236I ALLOC. FOR GDG00001 STEP2
IEF237I 0118 ALLOCATED TO DD21
CSV003I REQUESTED MODULE IEFBR15  NOT FOUND
CSV028I ABEND806-04  JOBNAME=GDG00001  STEPNAME=STEP2
```

```
IEA995I SYMPTOM DUMP OUTPUT
SYSTEM COMPLETION CODE=806  REASON CODE=00000004
 TIME=11.52.19  SEQ=00394  CPU=0000  ASID=0016
 PSW AT TIME OF ERROR  070C1000   811C020A  ILC 2  INTC 0D
   NO ACTIVE MODULE FOUND
   NAME=UNKNOWN
   DATA AT PSW  011C0204 - 9FB0181C  0A0D18FB  180C181D
   GPR  0-3  00001C00  84806000  00FCF568  00000010
   GPR  4-7  000000FF  006E7DE8  00000004  0000000C
   GPR  8-11 006D5450  811BF750  011C074F  00000000
   GPR 12-15 84806000  006D5450  811C018C  00000004
 END OF SYMPTOM DUMP
IEF472I GDG00001 STEP2 - COMPLETION CODE - SYSTEM=806 USER=0000 REASON=0004
IEF285I   MYGDG.ROOT.G0126V00                     KEPT
IEF285I   VOL SER NOS= TWS01 .
IEF373I STEP/STEP2   /START 2009160.1152
IEF374I STEP/STEP2   /STOP  2009160.1152 CPU    0MIN 00.00SEC SRB    0MIN 00.00S
IEF375I  JOB/GDG00001/START 2009160.1152
IEF376I  JOB/GDG00001/STOP  2009160.1152 CPU    0MIN 00.00SEC SRB    0MIN 00.00S
```

From this JOBLOG you can see that STEP0 has been executed, STEP1 has been executed and allocated GDG data set MYGDG.ROOT.G0126V00, while STEP2 abended and used the just allocated GDG data set MYGDG.ROOT.G0126V00 as input.

Now, you decide to fix the error causing the abend and restart from STEP2, re-using the previously allocated GDG MYGDG.ROOT.G0126V00. To obtain this, you can use normal JCL (set Expanded JCL to NO).

When you execute the step restart, the job completes successfully and the JOBLOG is the following:

```
        J E S 2  J O B  L O G  --  S Y S T E M  E S 3 3  --  N O D E

JOB00110 ---- MONDAY,    09 JUN 2009 ----
JOB00110  IRR010I  USERID OPCSTC   IS ASSIGNED TO THIS JOB.
JOB00110  ICH70001I OPCSTC   LAST ACCESS AT 12:14:32 ON MONDAY, JUNE 9,
$HASP373 GDG00001 STARTED - INIT 1    - CLASS A - SYS ES33
JOB00110  IEF403I GDG00001 - STARTED - TIME=12.15.08
JOB00110 EQQCN00I START CLEANUP AND/OR RET-CODE SIMULATION PROCESS(ES).
JOB00110 EQQCN18I SNUM STEPNAME PROCNAME    RC
JOB00110 EQQCN02I 002           STEP0      0000
JOB00110 EQQCN02I 003           STEP1      0000
JOB00110 EQQCN22I START GDG NAME SIMULATION PROCESS
JOB00110 EQQCN26I SNUM DSNAME                                      RELNUM
JOB00110 EQQCN25I 004      MYGDG.ROOT.G0126V00                       +001
JOB00110 EQQCN23I GDG NAME SIMULATION PROCESS ENDED
JOB00110 EQQCN99I CLEANUP AND/OR RET-CODE SIMULATION PROCESS(ES) ENDED.
JOB00110 - --TIMINGS (MINS.)--
JOB00110 -JOBNAME  STEPNAME PROCSTEP  RC    EXCP CPU    SRB  CLOCK   SERV  PG PAGE SWAP  VIO SWAPS STEPNO
JOB00110 -GDG0001  EQQCLEAN EQQCLEAN  00    45   .00    .00  .00     2450  1  0    0     0   0     1
JOB00110 -GDG0001           STEP0     FLUSH 0    .00    .00  .00     0     1  0    0     0   0     2
JOB00110 -GDG0001           STEP1     FLUSH 0    .00    .00  .00     0     1  0    0     0   0     3
JOB00110 -GDG0001           STEP2     00    8    .00    .00  .00     289   1  0    0     0   0     4
JOB00110  IEF404I GDG00001 - ENDED - TIME=12.15.08
JOB00110 -GDG00001 ENDED.  NAME-D-JOB                TOTAL CPU TIME=
JOB00110  $HASP395 GDG00001 ENDED
------ JES2 JOB STATISTICS ------
  09 JUN 2009 JOB EXECUTION DATE
           22 CARDS READ
          808 SYSOUT PRINT RECORDS
            0 SYSOUT PUNCH RECORDS
           50 SYSOUT SPOOL KBYTES

         0.00 MINUTES EXECUTION TIME
```

```
        1 //GDG00001 JOB (9805,SS),'D-JOB',MSGLEVEL=(1,1)
        2 //TIVDST00 OUTPUT JESDS=ALL,DEST=TWSFDEST                inserted by scheduler
        3 //TIVDSTAL OUTPUT JESDS=ALL                               inserted by scheduler
        4 //EQQCLEAN EXEC EQQCLEAN,EQQPASS='RMM=N'
        5 XXEQQCLEAN PROC
        6 XXEQQCLEAN EXEC PGM=EQQCLEAN,REGION=0M,TIME=1440,PARM='&EQQPASS'
          IEFC653I SUBSTITUTION JCL - PGM=EQQCLEAN,REGION=0M,TIME=1440,PARM='RMM
        7 //STEPLIB  DD  DISP=SHR,DSN=TWS81.SERVICE.APFLIB1
        8 //         DD  DISP=SHR,DSN=TWS81.SERVICE.APFLIB
        9 XXEQQCLNDD DD DUMMY
       10 //EQQSIMDD DD *
          X/EQQSIMDD DD DUMMY
       11 //EQQGDGDD DD *
          X/EQQGDGDD DD DUMMY
       12 //EQQDUMP  DD SYSOUT=*
          X/EQQDUMP  DD SYSOUT=*
       13 //SYSPRINT DD SYSOUT=*
          X/SYSPRINT DD SYSOUT=*
       14 XXSYSUDUMP DD SYSOUT=*
       15 //SYSOUT   DD SYSOUT=*
          X/SYSOUT   DD SYSOUT=*
       16 //SYSDUMP  DD SYSOUT=*
       17 XX PEND
       18 //STEP0 EXEC PGM=IEFBR14
       19 //STEP1 EXEC PGM=IEFBR14
       20 //DD01  DD   DSN=MYGDG.ROOT(+1),UNIT=3390,
          //      DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),SPACE=(TRK,(1,1)),
          //      VOL=SER=TWS01,DISP=(NEW,CATLG,DELETE)
       21 //STEP2 EXEC PGM=IEFBR14
       22 //DD21  DD   DSN=MYGDG.ROOT(+1),DISP=SHR

 STMT NO. MESSAGE
        4 IEFC001I PROCEDURE EQQCLEAN WAS EXPANDED USING SYSTEM LIBRARY USER.PRO
ICH70001I OPCSTC   LAST ACCESS AT 12:14:32 ON MONDAY, JUNE 9, 2009
IEF236I ALLOC. FOR GDG00001 EQQCLEAN EQQCLEAN
IEF237I 0118 ALLOCATED TO STEPLIB
IEF237I 0121 ALLOCATED TO
IEF237I DMY  ALLOCATED TO EQQCLNDD
IEF237I JES2 ALLOCATED TO EQQSIMDD
IEF237I JES2 ALLOCATED TO EQQGDGDD
IEF237I JES2 ALLOCATED TO EQQDUMP
IEF237I JES2 ALLOCATED TO SYSPRINT
IEF237I JES2 ALLOCATED TO SYSUDUMP
IEF237I JES2 ALLOCATED TO SYSOUT
IEF237I JES2 ALLOCATED TO SYSDUMP
IEF142I GDG00001 EQQCLEAN EQQCLEAN - STEP WAS EXECUTED - COND CODE 0000
IEF285I   TWS81.SERVICE.APFLIB1                          KEPT
IEF285I   VOL SER NOS= TWS01 .
IEF285I   TWS81.SERVICE.APFLIB                         KEPT
IEF285I   VOL SER NOS= TWS03 .
IEF285I   OPCSTC.GDG00001.JOB00110.D0000101.?          SYSIN
IEF285I   OPCSTC.GDG00001.JOB00110.D0000102.?          SYSIN
IEF285I   OPCSTC.GDG00001.JOB00110.D0000103.?          SYSOUT
IEF285I   OPCSTC.GDG00001.JOB00110.D0000104.?          SYSOUT
IEF285I   OPCSTC.GDG00001.JOB00110.D0000105.?          SYSOUT
IEF285I   OPCSTC.GDG00001.JOB00110.D0000106.?          SYSOUT
IEF285I   OPCSTC.GDG00001.JOB00110.D0000107.?          SYSOUT
IEF373I STEP/EQQCLEAN/START 2009160.1215
IEF374I STEP/EQQCLEAN/STOP  2009160.1215 CPU    0MIN 00.01SEC SRB    0MIN 00.00S
IEF202I GDG00001 STEP0 - STEP WAS NOT RUN BECAUSE OF CONDITION CODES
IEF272I GDG00001 STEP0 - STEP WAS NOT EXECUTED.
IEF373I STEP/STEP0   /START 2009160.1215
IEF374I STEP/STEP0   /STOP  2009160.1215 CPU    0MIN 00.00SEC SRB    0MIN 00.00S
IEF202I GDG00001 STEP1 - STEP WAS NOT RUN BECAUSE OF CONDITION CODES
IEF272I GDG00001 STEP1 - STEP WAS NOT EXECUTED.
IEF373I STEP/STEP1   /START 2009160.1215
IEF374I STEP/STEP1   /STOP  2009160.1215 CPU    0MIN 00.00SEC SRB    0MIN 00.00S
```

```
IEF236I ALLOC. FOR GDG00001 STEP2
IEF237I 0118 ALLOCATED TO DD21
IEF142I GDG00001 STEP2 - STEP WAS EXECUTED - COND CODE 0000
IEF285I   MYGDG.ROOT.G0126V00                    KEPT
IEF285I   VOL SER NOS= TWS01 .
IEF373I STEP/STEP2   /START 2009160.1215
IEF374I STEP/STEP2   /STOP  2009160.1215 CPU    0MIN 00.00SEC SRB    0MIN 00.00S
IEF375I  JOB/GDG00001/START 2009160.1215
IEF376I  JOB/GDG00001/STOP  2009160.1215 CPU    0MIN 00.01SEC SRB    0MIN 00.00S
```

From this JOBLOG you can see that:

- STEP0 and STEP1 were correctly simulated (see EQQCN02I messages).
- STEP2 was executed correctly using as input MYGDG.ROOT.G0126V00.
- The submitted JCL was run with the relative numbers unchanged.
- The GDG MYGDG.ROOT(+1) was correctly overwritten (see message EQQCN25I).

To obtain the same result, you could also have used the following expanded JCL:

```
//GDG00001 JOB (9805,SS),'D-JOB',MSGLEVEL=(1,1)
//TIVDST00 OUTPUT JESDS=ALL,DEST=TWSFDEST
//TIVDSTAL OUTPUT JESDS=ALL
//STEP0 EXEC PGM=IEFBR14
//STEP1 EXEC PGM=IEFBR14
//DD01  DD DSN=MYGDG.ROOT.ROXGDG.G0126V00,UNIT=3390,
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=800),SPACE=(TRK,(1,1)),
//             VOL=SER=TWS01,DISP=(NEW,CATLG,DELETE)
//STEP2 EXEC PGM=IEFBR14
//DD21  DD DSN=MYGDG.ROOT.ROXGDG.G0126V00,DISP=SHR
```

With the normal JCL, you could also execute a step restart while retaining previously allocated GDG data set, while this is not possible with expanded JCL. For example, If you want to run a step restart from STEP2, while retaining the previously allocated GDG data set MYGDG.ROOT.G0126V00, and allocating a new generation GDG, you can:

- Select normal JCL.
- Customize user exit EQQUXGDG to retain GDG root MYGDG.ROOT data sets for GDG00001 JOB.
- Exclude the scratch of MYGDG.ROOT.G0126V00 from the action list.
- Set STEP1 as the restart step.

For details about EQQUXGDG, see *Customization and Tuning*.

GDG resolution considerations

GDG resolution is slightly different depending on the type of JCL:

- Expanded JCL:

  Data store gets the information about GDG data sets from the JOBLOG of the last run only. All the GDG data sets for which information is directly available (SYSMGS contains a GnnnnVxx expansion message), are resolved immediately with the use of such information. The GDG data sets for which information is not directly available (such as GDG in flushed steps) are resolved with the following DIFF mechanism: If a resolved GDG data set exists with the same GDG root data store, calculate the difference between the two relative numbers to obtain the absolute value. For example, if data set GDGRoot(+1) was resolved as GDGRoot.G0025V00, the unresolved GDG data set GDGRoot(+2) will be resolved as GDGRoot.G0026V00.

This might cause numbers to wrap around. For example, if the resolved GDG data set is GDGRoot(+1)⇔GDGRoot.G9999V00, the unresolved GDG data set GDGRoot(+2) will be resolved as GDGRoot.G0001V00. As a consequence, if there are skipped GDG generation numbers, the resolution might be incorrect.

The DIFF mechanism implies also that different versions (such as V00 and V01) could lead to incorrect resolutions: GDG resolution is not supported for this kind of JCL. For example, suppose you run the following JCL having GDGROOT(0) = GDGROOT.G0004V00 before the first job run:

```
//JOB XXX
//STEP1 EXEC PGM=IEFBR14
//DD1  DD DSN=GDGROOT(+1),DISP=(NEW,CATLG)
//STEP2 EXEC PGM=IEFBR14
//DD2  DD DSN=GDGROOT.G0005V01,DISP=(NEW,CATLG)
//STEP3 EXEC PGM=IEFBR14
//DD3  DD DSN=GDGROOT(+1),DISP=OLD
//STEP4 EXEC PGM=IEFBR14
//DD4  DD DSN=GDGROOT(+2),DISP=OLD
```

The result of the first run will be:

```
  STEP1 ==> allocates GDGROOT.G0005V00
  STEP2 ==> allocates GDGROOT.G0005V01
  STEP3 ==> refers    GDGROOT.G0005V01
  STEP4 ==> refers    GDGROOT.G0006V00
```

Now execute a second run, restarting from STEP3 and excluding STEP4. The result will be:

```
STEP3 ==> refers via GDG simulation GDGROOT.G0005V01
```

Now execute a third run, restarting from STEP1. The result will be a JCL error due to incorrect GDG resolution. This happens because the JOBLOG of the last run had information only about:

```
STEP3 GDGROOT(+1) = GDGROOT.G0005V01
```

and the DIFF mechanism is not able to distinguish when to use V01 and when to use V00.

- Normal JCL:

  Same as in expanded JCL with an additional iteration of the resolution process using information from all the previous job runs whenever unresolved GDGs still exist. Resolution is performed by the Controller and not by Data store.

Job restart

Job restart lets you restart the entire job and performs the appropriate cleanup actions. For more information about data set cleanup, see “Data set cleanup” on page 380. As you are restarting the job from the beginning, there is no simulation of preceding steps. There will also be no resolution of GDG relative numbers when normal JCLs are used. On the contrary, if expanded JCL is used, GDG resolution will always be applied. (see “JCL used for restart” on page 365 and “GDG resolution” on page 374 for details.)

Start cleanup

To perform cleanup actions only (no restart), select the START CLEANUP option in the OPERATION RESTART AND CLEANUP panel. All the data sets, starting from the first step, are considered for the cleanup actions. The type of cleanup action depends on the following conditions:

- The status of the data set when cleanup is requested.

- The DISP parameter specified in the JCL.

For more information about data set cleanup, see "Data set cleanup."

Start cleanup with AR

Start cleanup with AR behaves as the Start cleanup option, with the difference that the list of data sets is created considering the restart step detected by the automatic recovery function. If the cleanup type of an operation is set to manual and the automatic recovery function detects a restart step for that operation, the automatic recovery actions are postponed until the appropriate cleanup actions are complete. To perform the cleanup actions, you need to request them by selecting the Start Cleanup with AR option in the panel that is displayed.

The Start cleanup with AR action is performed only if the cleanup type is set to manual and the automatic recovery function detects that a job restart is required. If a job restart is not required and in the AROPTS statement CHKRESTART=NO, use the Start cleanup function to confirm or discard any pending cleanup action.

Display cleanup

To see the results of a data set cleanup, select the DISPLAY CLEANUP option on the OPERATION RESTART AND CLEANUP panel. The results refer only to the last cleanup completed.

Data set cleanup

This section shows how IBM Workload Scheduler for z/OS can help with the recovery and restart of z/OS jobs and started tasks by:
- Deleting data sets that were created in a job
- Uncataloging data sets that were cataloged in a job
- Cataloging data sets that were uncataloged in a job.

In this section, the term *job* refers both to a z/OS job and to a started task, unless otherwise stated. Data set cleanup is available for jobs that are tracked by the scheduler on the z/OS operating system and are in the current plan.

There are two types of data set cleanup:
- Cleanup that is based on the history of a failed job run. This section describes this type in detail.
- Preventive cleanup that you can perform before a job runs. This type of cleanup runs a general cleanup of data sets, which is useful if you do not know the exact state of the data sets. If you prefer to cleanup before a job first runs, look at the EQQDELDI member in the supplied sample library. This describes a program that deletes data sets with the NEW disposition that are not referenced with a different disposition (OLD or SHR) in previous job steps. EQQDELDS is an optional part of the product, which can be used to avoid "not catlg 2" situations.

Selecting cleanup options

See "What you need for restart and cleanup" on page 345 for the initialization options that you need for cleanup. When you have specified the initialization options, your cleanup options are: Automatic, Immediate, or Manual.

Automatic, immediate, and manual cleanup

You can specify the type of cleanup you require from any of the following:
- APPLICATION DESCRIPTION panel (see "Options that apply to jobs and started tasks" on page 161 for more information)

- JOB DESCRIPTION panel
- Batch loader
- Program interface
- MODIFY CURRENT PLAN (MCP) panel

To perform the type of cleanup you require, specify either the Automatic, Immediate, or Manual option for each operation. If you require no cleanup, specify None.

Because in some cases EQQCLEAN might delete a data set by mistake, it is recommended that you protect critical data sets from deletion by using either the RCLOPTS parameters (DDPROT, DDPRMEM, DSNPROT, DSNPRMEM) or the EQQUXCAT exit.

Automatic

Cleanup actions are started either by a pre-defined trigger or from the panels. The controller automatically determines the cleanup actions to be taken and also inserts them as the first step in the JCL of the restarted job. With this option the cleanup will automatically rerun an occurrence when the job is ready and no other conditions keep the job from rerunning.

Note that, whenever the RCLOPTS GDGSIMAUTO keyword has been set, operations having clean up type automatic have the GDG resolution process applied when internally rerun and expanded jcl is not used. For details, see the following sections about GDG simulation process. With internal rerun, we mean all types of rerun not started directly by dialogue. For example, when an operation is rerun because its status is set to ready due to the successful end of its predecessor.

Immediate

The job is cleaned up as soon as it fails. If a tracked job ends in error, and you have specified Immediate for the operation, the controller checks for data set information in the current plan, according to the following criteria:

If the automatic recovery action is to restart the operation

Checks for data set information starting from the step indicated by the automatic recovery function.

If the automatic recovery action is not to restart the operation

- If RCLOPTS IMMEDLOGIC(FIRSTSTEP) was specified (this is also the default), checks for data set information starting from the first step up to the last step of the job (included).
- If RCLOPTS IMMEDLOGIC(BESTSTEP) was specified, from the best step suggested.

If data set information is found, the controller submits a stand-alone cleanup job, otherwise sets the cleanup status to Complete.

Manual

Cleanup is controlled manually. If a tracked job ends in error and manual cleanup actions have been defined for the operation, or when a rerun is requested for an operation that specifies Manual, you must initiate the cleanup action from the MODIFYING CURRENT PLAN panel. The panel shows what action the scheduler will take for each of the affected data sets. You can exclude the action for any or all of the data sets, if required. When you initiate the cleanup action, the controller submits a standalone cleanup job. In each case, actions for data sets belonging to flushed steps are not performed. Actions are also not performed for data sets referenced in

previous steps that have a disposition of OLD, SHR, or MOD, whenever these steps are included in the new run.

Note that the manual cleanup option has the same effect as the automatic cleanup option, if you run a Fast Step Restart or a Fast Job Restart function. In fact, in these cases, you run the Step Restart or the Job Restart process with a unique command, and you are not allowed to change by panel the actions that the scheduler will take for each of the affected data sets.

Job and step-level cleanup

With step-level cleanup, you can perform cleanup actions for a range of steps. On the other hand, job-level cleanup is for all steps up to the last step executed.

Cleanup logic selects all data sets eligible for deletion depending on the range of selected steps and the options specified in the RCLOPTS initialization statement.

Cleanup marks all data sets that are defined with DISP=NEW as eligible for potential deletion. If they belong to flushed steps, or are referenced in previous steps with a disposition of OLD, SHR, or MOD, then they are not marked for action.

To start cleanup actions from the MCP panel, use the RC row command from one of the following lists:

- Ended-in-error-list
- Operation list when you modify an operation
- Operation list when you rerun an occurrence
- Dependency status change list

In each case, the OPERATION RESTART AND CLEANUP main menu is displayed. You can choose a step-level restart, job restart, a cleanup without restart, or cleanup results for a specific operation.

The operator can reject the deletion if it is not appropriate in the context of the job stream to be restarted.

Accessing the restart and cleanup data sets, the controller reads the historical data set information and decides the required cleanup actions depending on the step range. Consider this example of the events for restart and cleanup:

```
⋮
//S1 EXEC PGM=P1
//S2 EXEC PGM=P2
//S3 EXEC PGM=P3
//DD1 DD DSN=TEST.FILE.ONE,DISP=(NEW,CATLG,DELETE),
//VOL=SER=TSOL05,SPACE=(TRK,(1,1)),UNIT=3390,
//DCB=(BLKSIZE=3120,LRECL=80,RECFM=FB)
//S4 EXEC PGM=P4
//DD1 DD DSN=TEST.FILE.TWO,DISP=(SHR,UNCATLG)
//S5 EXEC PGM=P5
//S6 EXEC PGM=P6
//S7 EXEC PGM=P7
//S8 EXEC PGM=P8
```

This is the sequence of events for restart and cleanup:

1. The job fails at step S6.
2. From the error list, you restart the job from step S5.

3. The scheduler does not take any cleanup actions, because steps S3 and S4 are outside the scope of the restart.
4. The job fails again.
5. You restart it from step S2.
6. The scheduler now deletes the data set that was created in the first run in step S3. This does not happen for release 2.1 or earlier of the scheduler.
7. The scheduler catalogs the data set that was uncataloged in step S4. This does not happen for release 2.3 or earlier of scheduler.

When are cleanup actions performed?

If you specified RCLEANUP=YES in the OPCOPTS initialization statement, the scheduler performs cleanup actions depending on the cleanup option defined at operation level.

If you define an operation with the automatic cleanup option, cleanup actions can be started internally or from the panels. Usually, cleanup actions are executed as a first step at run time. If you define an operation with immediate cleanup type, the scheduler initiates the actions as soon as the job fails, with these exceptions:

- The job fails with an error code that is set before, or during, job submission:
  OSEQ
  OSUB
  OSUF
  OSUP
  OJCV
  JCLI
  LOOP
- The job fails with one of these codes:
  MCP
  OSSQ
  OSSS
  OFSQ
  OFSS
  OFSC

  These error codes indicate that workload restart has failed, or that the operation has been manually set to error. The scheduler automatically changes the cleanup action from Immediate to Manual.

If you define an operation with the manual cleanup option, the scheduler starts cleanup actions only when you initiate it from Modify Current Plan. In any case, the cleanup process can be launched for a selected operation without restarting it (unless the cleanup option is set to none).

If both automatic recovery and cleanup actions are defined for an operation, the scheduler performs the cleanup actions first.

What actions are taken for affected data sets?

Cleanup actions are designed to restore the catalog entries that were modified by the job to the state that they were in before the job started. Cleanup either deletes or uncatalogs data sets.

When the scheduler performs cleanup processing for a job, data sets and generation data groups (GDG) generations that have been created in that job are

either deleted or uncataloged. Uncataloged data sets are cataloged. Table 22 describes the action that the scheduler takes for each data set disposition.

Table 22. Cleanup actions for data set dispositions in a job

DISP Reference to the data set	Data Set Allocated and Cataloged at Job Start	Reference to a Previous Step	SMS in the Environment	Protected by RCLOPTS	Cleanup Actions
NEW, CATLG	YES	YES	No impact	No impact	None
		NO	No impact	YES	None
				NO	DELETE
	NO	No impact	No impact	No impact	None
NEW, KEEP	YES	YES	No impact	No impact	None
		NO	No impact	YES	None
				NO	None or DELETE2
	NO	No impact	No impact	No impact	None
OLD, UNCATLG	YES	No impact	YES	No impact	None
			NO	YES	None
				NO	CATALOG
	NO	No impact	No impact	No impact	None
SHR, UNCATLG	YES	No impact	YES	No impact	None
			NO	YES	None
				NO	CATALOG
	NO	No impact	No impact	No impact	None
MOD, CATLG	YES	YES	No impact	No impact	None
		NO	YES	YES	None
				NO	None or DELETE1
			NO	YES	None
				NO	Uncatalog
	NO	No impact	No impact	No impact	None
MOD, UNCATLG	YES	No impact	No impact	YES	None
				NO	CATALOG
	NO	No impact	No impact	No impact	None
, , CATLG (abnormal step end)	YES	YES	No impact	No impact	None
		NO	No impact	YES	None
				NO	DELETE
	NO	No impact	No impact	No impact	None
, , UNCATLG (abnormal step end)	YES	YES	No impact	No impact	None
		NO	No impact	YES	None
				NO	CATALOG
	NO	No impact	No impact	No impact	None

Table 22. Cleanup actions for data set dispositions in a job (continued)

DISP Reference to the data set	Data Set Allocated and Cataloged at Job Start	Reference to a Previous Step	SMS in the Environment	Protected by RCLOPTS	Cleanup Actions
1 The Cleanup action depends on the value specified in the SMSMODDELETE parameter in DSTOPTS: **None** If SMSMODDELTE(NO) **Delete** If SMSMODDELTE(YES) 2 The Cleanup action depends on where the data set is allocated: **None** If the data set is allocated on a tape **Delete** If the data set is allocated on a DASD					

If you restart a job from a specified step, the scheduler does not try to restore a data set catalog status that was changed before the restart step.

For example, the job in Figure 156 was tracked by the scheduler, failed at the third step **3**, and had immediate cleanup defined. The cleanup actions are the following:

1 This data set would be uncataloged.

2 This data set would be cataloged.

3 This data set would be cataloged.

```
//STEP1 EXEC PGM=FIV
//DDX   DD DSNAME=IM.TEST.SHIP,DISP=(NEW,CATLG),UNIT=TAPE, 1
//         VOLUME=SER=T2,LABEL=(3,NSL),RETPD=188
//STEP2 EXEC PGM=EQQYCOM
//DDY   DD DSNAME=IM.TEST.PANELS,DISP=(OLD,UNCATLG),UNIT=3400, 2
//         VOLUME=SER=10222,LABEL=4
//STEP3 EXEC PGM=NOPGM
//DDZ   DD DSNAME=IM.TEST.HELP,DISP=(SHR,UNCATLG),UNIT=3400, 3
//         VOLUME=SER=10222,LABEL=4
```

Figure 156. Example of cleanup action for a job

Actions for data sets with DISP=NEW are not executed when they belong to flushed steps or when they were referenced in previous steps with DISP=SHR, OLD, or MOD, which are included in the new run range.

SMS

SMS does not allow UNCATALOG without DELETE, therefore the only valid action performed by the scheduler is DELETE.

Depending on the value specified in the SMSMODDELETE parameter of DSTOPTS, the SMS data sets allocated with DISP=(MOD, CATLG, CATLG) are deleted at restart. For more details about the DSTOPTS statement, see *Customization and Tuning*.

All SMS data sets to be processed by EQQCLEAN must have DSNs whose high level qualifier is by default defined as an SMS dataset in the SMS ACS (Automatic Class Selection) rules. EQQCLEAN cannot process as an SMS data set, a dataset

whose HLQ is not defined in the ACS rules as an SMS data set, and that is an SMS data set only because of a unit or STORCLASS class override in the JCL.

Migrated data sets

If a data set is migrated by DFHSM (VOLSER=MIGRAT) between creation and the time when cleanup attempts to take some action for the job, the scheduler uses the HDELETE macro to complete the action.

Generation data groups

In a non-SMS environment, the entry for the data set will be removed from the GDG base, leaving the generation data set uncataloged. In either environment, DELETE causes the data set to be scratched, and its entry in the catalog to be removed. The absolute generation name is used during cleanup processing (GDGRoot.GnnnnVnn).

The definition of the GDG base determines whether a generation data set is removed from the VTOC and the catalog, when the maximum number of generations for a GDG base is reached in a job. The scheduler does not try to override these rules. You cannot restore GDGs that have rolled off the group as a result of new data sets created in the failing job. Cleanup can only reset the catalog; it cannot recover data that has been deleted.

When specifying operation details for a job that has GDG, you can decide whether or not to use expanded JCL. At job or step restart you will be able to confirm or override your choice. To decide which kind of JCL to use, see "JCL used for restart" on page 365 and "GDG resolution" on page 374.

Multi-volumes

The restart and cleanup function can fail if a data set is referenced in the job by the keyword: `UNIT=(XXXX,Y)` or `VOLUME=(,,,X,SER=(YYYY,ZZZZ,...))` for multi-volume data sets.

Place the multi-volume data set at the end of the JCL.

Protecting data sets from unintentional deletion

IBM Workload Scheduler for z/OS provides different ways to protect data set from unintentional deletion. They are:

- Using a DD name that matches one of the names specified in the RCLOPTS DDPROT keyword.
- Adding the data set name to the list of protected data set in the RCLOPTS DSNPROT keyword.
- Implementing the EQQUXCAT user exit that is called just before the data set is deleted.

Recovering from workstation failures

The scheduler can transfer operations from one workstation to another in the event of a failure or of the unavailability of a workstation. If you specify that operations be automatically rerouted to alternate workstations, ensure that your systems are symmetrical as far as data set and catalog references are concerned.

This is the effect of the first parameters of the WSFAILURE and the WSOFFLINE keywords of the JTOPTS statement on cleanup processing:

ERROR
All operations with the *immediate* cleanup type are changed to *manual* cleanup. This means that you must initiate or discard the action from the MODIFY CURRENT PLAN panel.

RESTART
The cleanup action is discarded.

LEAVE
The cleanup action is determined by the succeeding status of the operation.

How does cleanup work?

The scheduler cleans up the data set of a job in one of the following ways:

- At the time the job is submitted by the controller, a step is added to the JCL before the existing steps. The name of the added step is EQQCLEAN. It uses the list of data sets to be deleted, cataloged, or uncataloged as input. This list is obtained from the history of previous runs. To get the history, the controller requests the job log from the data store and then merges the history in the local repository of the controller.
- A single-step job, created by the controller, is executed before the job run.

If automatic job recovery is used, cleanup and automatic recovery cooperate to ensure that cleanup actions are either completed, or revoked before any automatic recovery action is started for the operation. For information about automatic job recovery, see Chapter 21, "Automatic recovery of jobs and started tasks," on page 395.

Note that a user exit, EQQUXCAT, is available to be called by EQQCLEAN to discard specific cleanup actions at job run time. For details, see the *Customization and Tuning* manual.

Fast step restart

When you invoke the step restart function, you are required to go through several panels before the step restart is actually run. For example, the STEP RESTART SELECTION LIST panel (EQQMERSL) is displayed for you to select the restart range. The CLEANUP ACTION LIST panel (EQQMCMDL) might be displayed to let you change the cleanup action list. The editing panel (EQQMMJCL) might be displayed to let you edit the JCL during restart. Also, confirmation panels (EQQMERJP, EQQMERTP) are shown. To skip these panels, leaving all choices as defaults, you can invoke the Fast Step Restart function.

Like the Step Restart function, Fast Step Restart lets you restart a job or a started task at the step level and performs the appropriate cleanup actions. Unlike Step Restart, it lets you do it with a single command. Fast Step Restart is based on the same simulation mechanism from the history of the previous runs as the Step Restart function. The EQQCLEAN step is added and performs the simulation of return codes, cleanup actions, and resolution of GDGs, but defaults are used where selections were allowed with the Step Restart. See "Return code simulation logic" on page 371, "Data set cleanup" on page 380, and "GDG resolution" on page 374 for details.

The Fast Step Restart function can be requested for any operation, which ran at least once, by issuing the FSR command from any of the following operation lists in the MODIFY CURRENT PLAN panels:

- Ended-in-error operation list

- Operation list
- Operation displayed when you request to rerun an occurrence

Note: The first time you issue the FSR command, message EQQM601I (Scheduler has requested needed JOBLOG information to process the command) is displayed if the JOBLOG information is not yet available to data store. In this case, you must issue the FSR command again. Message EQQM676I (Fast step restart is being processed) is then displayed and, unless other warnings are issued, the operation is finally completed.

Defaults

- Expanded JCL
  - The Expanded JCL value used during Fast Step Restart function is the value found in the related CP operation record (built from the AD application definition value unless later modified by the user via MCP).
- Restart Range
  - When you request a Fast Step Restart, you take defaults for the first and last step to be included in the rerun. The first restart step is defaulted to the best step identified by the scheduler, if any. If there are no restartable steps and therefore there is no best step, the process is stopped and an appropriate message is issued.

Fast job restart

The Fast Job Restart function allows you to restart a job entirely and to perform the appropriate cleanup actions. Unlike the Job Restart function, Fast Job Restart lets you process a Job Restart with a single command. Because you are restarting the job from the beginning, there is no simulation of preceding steps. There is also no GDG relative numbers resolution, if normal JCL is used. If Expanded JCL is used, instead, GDG resolution is applied, based on the history of the previous runs. See “Data set cleanup” on page 380, “JCL used for restart” on page 365, and “GDG resolution” on page 374 for details.

The Fast Job Restart function can be requested for any operation, which ran at least once, by issuing the FJR command from any of the following operation lists in the MODIFY CURRENT PLAN panels:

- Ended-in-error operation list.
- Operation list.
- Operation displayed when you request to rerun an occurrence.

Note: The first time you issue the FJR command, message EQQM601I (Scheduler has requested needed JOBLOG information to process the command) is displayed if the JOBLOG information is not yet available to data store. In this case, you must issue the FJR command again. Message EQQM677I (Fast job restart is being processed) is then displayed and, unless other warnings are issued, the operation is finally completed.

Defaults

- Expanded JCL
  - The Expanded JCL value used by the Fast Job Restart function is the value found in the related CP operation record (built from the AD application definition value, unless later modified by the user via MCP).

Fast start cleanup

The Fast Start Cleanup function allows you to perform the appropriate cleanup actions for a job and, unlike the Start Cleanup function, Fast Start Cleanup lets you process a Start Cleanup with a single row command.

Because you are issuing a fast path command, all the data sets that are not protected, starting from the first step, will be considered for the cleanup actions; that is, there is no possibility to exclude data sets from the cleanup list. See "Data set cleanup" on page 380 for further details.

This function can be requested for any operation, which ran at least once, by issuing the FSC command from any of the following operation lists in the MODIFY CURRENT PLAN panels:

- Ended-in-error operation list
- Operation list
- Operation displayed when you request to rerun an occurrence
- List dependencies that will be changed at rerun

Note: The first time you issue the FSC command, message `EQQM601I` (OPC has requested needed `JOBLOG` info to process the command.) is displayed if the `JOBLOG` information is not yet available to Data store. In this case, you must issue the FSC command again. Message `EQQM692I` (Fast Start Cleanup is being processed) is then displayed and, unless other warnings are issued, the controller submits a standalone cleanup job.

Considerations for event-triggered tracking

In some cases, a job is submitted from outside IBM Workload Scheduler for z/OS by using event-triggered tracking (ETT). When you set the ETT criteria for job-name replace tracking to YES, consider that:

- You must add additional JCL to enable data set cleanup. To make a copy of the SYSOUT, which is then captured by the data store, add the following to the JESDS statement:

  ```
  //TIVDSTST OUTPUT CLASS=*
  //TIVDST00 OUTPUT JESDS=ALL,DEST=OPCA
  //TIVDSTAL OUTPUT JESDS=ALL
  //TIVDSTUS OUTPUT DEST=OPCA
  ```

  The result provides a second output from the job taken from the data store to enable the jobs or steps to be restarted.
- A job added using ETT, with job-name replace option set to YES, might produce a stand-alone cleanup job. In this case, the job-submit exit (EQQUX001) cannot affect the owner ID of the stand-alone cleanup job.

For more information about ETT, see "Adding occurrences by event-triggered tracking" on page 478.

Generating copies for data store

Both the Joblog retrieval and the Restart and cleanup functions require for job output that an "extra" copy of the JESDS spool data sets be generated for processing by the IBM Workload Scheduler for z/OS DATASTORE started task on its reserved destination queue. This data is captured into the DATASTORE SDF and UDF data sets (STRUCTURED and UNSTRUCTURED DATA FILES) and used to create restart JCL and determine what catalog cleanup might be required to restart a specific job at the user-selected restart point.

To generate job output copies, the controller automatically adds statements to each JCL before it submits it, for example:

```
//TIVDST00 OUTPUT JESDS=ALL,DEST=TWSFDEST                INSERTED BY TWS
//TIVDSTAL OUTPUT JESDS=ALL                              INSERTED BY TWS
//TIVDSTUS OUTPUT DEST=TWSFDEST                          INSERTED BY TWS
```

The type and number of statements vary depending on the characteristics of the JCL, for example:

- If a user SYSOUT is set to YES at the operation level.
- If the JESDS keyword is already used by the JCL.
- If a DEFAULT output is defined in the JCL.

The TIVDSTxx OUTPUT JCL statements are inserted into each job as its JCL is prepared for submission by the PRE-SUBMIT subtask in the IBM Workload Scheduler for z/OS Controller. Use the EQQUX013 user exit to select the jobs for which you do not need to generate additional copies, because you do not need to retrieve the joblog and use the restart and cleanup function. The EQQUX013 user exit allows the Work Station Analyzer to return an error code that prevents the jobs that are being submitted from being tailored with the //TIVDSTxx OUTPUT statements. For additional details, refer to *Customization and Tuning*.

The TIVDST00 statement is inserted into ALL scheduled jobs and started tasks. It generates the extra copy of the JESDS=ALL output required by the IBM Workload Scheduler for z/OS Data Store.

If the job did not already contain at least one JESDS=ALL OUTPUT statement, and only the TIVDST00 statement was added, that statement would "hi-jack" the one-and-only "normal" copy of the joblog output to the data store destination. So, in this case, the TIVDSTAL statement is added to make sure there are two copies of this output, one for normal processing and a second one for the data store.

The TIVDSTUS statement is added on a job-by-job basis, depending on whether the operation has cleanup option "USER SYSOUT ==> YES". Its purpose is to generate an extra copy of any user-allocated SYSOUT datasets (//xxxxxxxx DD SYSOUT=*) for the DATASTORE to capture and process. USER SYSOUT is not needed for any IBM Workload Scheduler for z/OS R&C processing but users might want to be able to browse it through the "L" row command in the IBM Workload Scheduler for z/OS dialogs.

Note:

1. OUTPUT statements with JESDS=ALL must be inserted after the job card, but prior to any EXEC statements. Because an INCLUDE member might contain an EXEC statement, the default processing is for the IBM Workload Scheduler for z/OS pre-submit code to stop scanning the JCL for OUTPUT statements when it encounters the first INCLUDE. Thus, if a given job has OUTPUT statements with JESDS=ALL after an INCLUDE, that statement will not be found by IBM Workload Scheduler for z/OS and a TIVDSTAL OUTPUT statement will be inserted when it is not needed. This causes an unwanted extra copy of the JESDS=ALL output to be generated.
2. OUTPUT statements with JESDS=ALL must be inserted AFTER any JOBLIB or JOBCAT statements. So, if a job has INCLUDES which contain these statements, the TIVDSTxx OUTPUT statement is inserted prior to the JOBLIB/JOBCATs, and the job will fail with a JCL ERROR.

Both of the above reported problems are easily resolved.

If the TIVDSTxx OUTPUT statements are to be inserted AFTER an INCLUDE, put the name of the INCLUDE MEMBER in the RCLSKIP INCLNAME() list in the parmlib member pointed to by the CONTROLLER RCLOPTS SKIPINCLUDE() keyword.

Note:

If a specific INCLUDE member contains both JOBLIB and JOBCAT statements and EXEC statements, the TIVDSTxx OUTPUT statement cannot be validly placed either before, or after that INCLUDE. Thus, the INCLUDE must be broken into two or more separate members and the JCL adjusted appropriately in the job to be scheduled and submitted by IBM Workload Scheduler for z/OS.

If, on the other hand, you submit a JCL externally to IBM Workload Scheduler for z/OS and not from a controller (for example, via ETT with the jobname replacement option set to YES), you need to add similar statements to the JCL yourself. Otherwise, data store cannot archive the output.

The purpose of the //TIVDST*xx* cards, that are added by the controller, is only to create extra copies for data store, without altering the behaviour of the previous job. The //TIVDST*xx* cards are reserved and customers should not use this type of names.

This automatic copy generation does not work in the following cases:

- For a user SYSOUT that is defined in expanded procedures. Data store cannot archive this kind of user SYSOUT.
- For jobs that end in JCL error when the error type prevents JES from processing the JESDS statement. No copies are generated, neither of the MVS joblog nor of the user SYSOUT. Data store cannot archive this type of joblog.

Automatic copy generation requires some additional JCL tailoring by the controller in the following cases:

- When the submitted JCL refers to a started task. The controller adds a JOB card statement, because the JESDS statement works only if the JOB card is present.
- Whenever the started task is run by only one procedure, adding the JOB card statement is not enough. The controller also adds a step statement that calls the procedure at the end of the JCL. For example, the controller changes the following JCL:

  ```
  //MYSTC PROC
  //MYSTC EXEC PGM=IEFBR14
  ```

  to:

  ```
  //MYSTC JOB MSGLEVEL=(1,1)
  //TIVDST00 OUTPUT JESDS=ALL,DEST=TWSZDEST             INSERTED BY TWS
  //TIVDSTAL OUTPUT JESDS=ALL                           INSERTED BY TWS
  //MYSTC PROC
  //MYSTC EXEC PGM=IEFBR14
  //PEND
  //TIVDSPRO EXEC MYSTC
  ```

  where the reserved destination is TWSZDEST. The statements in bold are added to the JCL.

Note: When the TIVDSPRO step is added to tailor the JCL, the referback of type STARTING does not work. The STARTING referback can be used when the started

task invokes procedures having COND statements that point to original started task JCL. For example, the following started task:

```
//FRED     PROC
//S1        EXEC PGM=IEFBR14
//S2        EXEC XXXSPRO
// PEND
```

where XXXSPRO is:

```
//XXXSPRO PROC
//S1 EXEC PGM=IEFBR14,COND=(0,NE,STARTING.S1)
//PEND
```

will be tailored before submission as:

```
//FRED     JOB MSGLEVEL=(1,1)
//FRED     PROC
//S1        EXEC PGM=IEFBR14
//S2        EXEC XXXSPRO
//PEND
//TIVDST00 OUTPUT JESDS=ALL,DEST=TWSZDEST                    INSERTED BY TWS
//TIVDSTAL OUTPUT JESDS=ALL                                  INSERTED BY TWS
//TIVDSPRO EXEC FRED
```

and this will cause the following JCL error:

```
10 IEF645I INVALID REFERBACK IN THE COND FIELD
```

To avoid this type of problem, you should either not use the STARTING referback, or update the JCL by changing STARTING to TIVDSPRO.

JCL changes considerations

The Restart and Cleanup function is based on information from the previous run. In particular, for step restart, the step list obtained from the previous run is used to run the return code simulation. The same considerations apply also to GDG simulation. To accomplish this, the EQQCLEAN pre-step (the one running data set cleanup, step RC simulation, and GDG data set simulation) identifies and locates the steps and data set to be handled using the list of steps and data set built from the controller, based on step names, DD names, and data set names taken from the previous run.

As a consequence, Restart and Cleanup might fail if either of the following situations occurs:

- The JCL structure is changed (via exit01, ISPF, directives like FETCH, BEGIN, or END) in a way that makes the list passed by the controller no longer valid (for example, by changing the name of a step to be simulated).
- Any data sets obtained from the previous run is renamed or deleted in a way that makes the list passed by the controller no longer valid.

As a consequence, if the JCL structure is changed (via exit01, ISPF, directives like FETCH, BEGIN, or END) in a way that makes the list passed by the controller no longer valid (for example, by changing the name of a step to be simulated), Restart and Cleanup might fail.

If the JCL is changed via user exit EQQUX001, the exit will know if it is called in a restart and cleanup path by checking the CALTYP parameter.

Usually, EQQUX001 is used to add pre-step EQQDELDS. If this happens, it should be done every time the exit is called, so that the step list used by the RC function

is consistent with the real JCL step list. To prevent EQQDELDS from being re-executed in the following run, add a DD DUMMY with the DDNAME listed in the RCLOPTS DDNEVER parameter: this makes the EQQDELDS step never re-executable on Step Restart.

Also, to prevent EQQDELDS from being re-executed at Job Restart, customize the EQQUX001 exit to invoke the EQQDELDS program with NOREEX set to YES in the following runs of the job (as shown in the sample provided with IBM Workload Scheduler for z/OS). In this way, the execution of EQQDELDS is simulated.

Remember that if EQQCLEAN is present, it must always appear as the first step in the sequence. If you decide to add EQQDELDS, place it following EQQCLEAN.

In general, you should not:

- Remove reserved IWSZ statements such as:
  - TIVDSTxx OUTPUT statements
  - //*OLDSTEP= --
  - //* .....$SUBJCL
- Change the name of an existing step.
- Change the name of an existing DD.
- Change the name of an existing data set name.
- Delete a step (unless done via EQQUX001 at each call, so that the submitted JCL will never contain that step).
- Insert a step (unless done via EQQUX001 at each call, so that the submitted JCL will always contain this step).
- Delete a DD that is not a DUMMY DD (unless done via EQQUX001 at each call, so that the submitted JCL will never contain that DD).
- Delete or rename a data set that was obtained from a previous run and that is needed to perform step restart actions.
- Insert a DD that is not a DUMMY DD (unless done via EQQUX001 at each call, so that the submitted JCL will always contain that DD).

But you can:

- Change the VOLSER of an existing DD
- Change the SPACE parameter for an existing DD
- Alter SYSIN data if needed.
- Alter Job Card to set a password or user.
- Insert a control statement such as /*JOBFROM.
- Add steps at the end of the JCL.

If the JCL is refreshed or changed in a Restart and Cleanup function, new and changed variables will be replaced with the current value in AD variable tables.

See also “Limitation on the number of job steps” on page 394.

EQQCLEAN Pre-step insertion considerations

The IBM Workload Scheduler for z/OS controller can insert the pre-step EQQCLEAN into the JCL before submitting it, to perform:

- The Cleanup together with the job, and/or

- A Step Restart simulating the Restart and Cleanup and GDG, when you requested in the appropriate panel

This means that the EQQCLEAN pre-step can be inserted when requested by:
- A user command in a panel, when Restart and Cleanup Step Restart was selected
- A rerun of a job with the cleanup type set to Automatic

In both these situations, you cannot see or modify the EQQCLEAN pre-step when editing the JCL, because the submitted JCL is stored in JS VSAM without the pre-step. Only when you edit the JCL through the Restart and Cleanup, Step Restart or Job Restart, and the expanded JCL type was requested, you can see the EQQCLEAN pre-step, though the changes cannot be seen. The JCL of expanded type is never stored in JS VSAM.

When you insert the EQQCLEAN pre-step in a JCL, consider that:
- It must be inserted after the JOB statement.
- It must be inserted immediately before the first EXEC statement.
- If there are INCLUDE statements before the first EXEC statement, insert the pre-step before the INCLUDE statements. However, if the INCLUDE statements are listed in the RCLOPTS SKIPINCLUDE keyword, this rule does not apply. In this case, insert the pre-step immediately before the first EXEC statement.

Because the IBM Workload Scheduler for z/OS Controller inserts the EQQCLEAN pre-step without knowing the contents of the INCLUDE statements (handled by JES), these type of statements in a JCL could cause, in particular conditions, a wrong positioning of the EQQCLEAN pre-step. To prevent EQQCLEAN pre-step from wrong positioning, use the RCLOPTS SKIPINCLUDE keyword. For details about RCLOPTS SKIPINCLUDE, refer to the *Customization and Tuning*.

See also “Limitation on the number of job steps.”

Limitation on the number of job steps

The default maximum number of steps that can be included in each job is 255. If this number is exceeded, the following message is issued:

```
IEFC602I EXCESSIVE NUMBER OF EXECUTE STATEMENTS
```

The allowed maximum decreases by one, each time one of the following steps is added:
- An EQQDELDS step via EQQUX001.
- An EQQCLEAN step as part of restart and cleanup processing.
- A dummy last step if the RCLOPTS DUMMYLASTSTEP keyword is used.

If you add two of the steps above, the limitation for the maximum number of steps in each IBM Workload Scheduler submitted job goes down to 253. If you add all three steps, it becomes 252.

Chapter 21. Automatic recovery of jobs and started tasks

IBM Workload Scheduler for z/OS supports the automatic recovery of failed jobs or started tasks if the job or started task fails. You can specify that IBM Workload Scheduler for z/OS should also recover jobs or started tasks automatically in the event of a system failure within the sysplex. A similar function is available without XCF. In this case, however, you must issue the command to recover operations manually, using the panels.

Specifying recovery criteria

You specify the recovery criteria as part of the JCL for the operation in the form of special control statements. In the case of jobs, the recovery instructions must be inserted between the JOB statement and the first execution step (after the JOBLIB or JOBCAT statement and in-stream procedures, if present). IBM Workload Scheduler for z/OS ignores recovery instructions within in-stream procedures. So for started tasks (where the whole JCL is an in-stream procedure) place any recovery statements before the PROC statement.

Using these statements, you specify the type of error for which the recovery is attempted and how the recovery is achieved. If the error type is not one that you have covered in your specification, the failed operation remains in the Operations Ended-in-Error list.

IBM Workload Scheduler for z/OS retrieves the JCL for automatic recovery from the JCL repository (JS) data set. This means that automatic recovery can take place only for jobs or started tasks submitted by IBM Workload Scheduler for z/OS.

The automatic recovery function takes over when a job or started task ends in error. At that time, this information is available:

- The error code for the operation. This can be:
  - The abend code of an abending step
  - The return code of the last step
  - An error code set by IBM Workload Scheduler for z/OS, such as JCLI, CCUN, JCL, CLNO, CLNA, CLNC, CAN, PCAN, CLNP, OF*xx*, or OS*xx*
  - An error code set by the job completion checker

    Note: Automatic recovery is not applicable for error codes, such as OSUP, that refer to jobs that have not reached the job queue.
- The name of the abending step, if the error is associated with a step.
- Step completion codes and step names for all steps executed. The step completion code is either an abend code or a return code.

If the error occurs in the initialization phase or in the completion phase of the job or started task, no step information is available. Statements that specify recovery actions for certain steps are not applicable to such errors.

IBM Workload Scheduler for z/OS begins the automatic recovery process by scanning the job for the first `//*%OPC RECOVER` statement where:

- The step name matches the name of the failing step from the operating system.

- The error code matches the error code from the job and started-task tracking function.
- The return code matches the step return codes or abend codes from the job and started-task tracking function.
- The RECOVER statement is unconditional (it specifies no step name, error code, return code, or abend code).

This means you should place the RECOVER statements with the most restrictive matching conditions before the RECOVER statements that deal with more general cases.

For example, assume there are three recovery procedures for a job. R1 is set up to handle errors of type E. R2 is set up to handle errors of type T, which includes error type E. R3 is a general recovery procedure for all errors in the job. The RECOVER statements should be placed in this order:

```
//*%OPC RECOVER   if error E      - actions R1
//*%OPC RECOVER   if error type T - actions R2
//*%OPC RECOVER   unconditionally - actions R3
```

This ensures that errors are handled by the RECOVER statement that is designed to handle it best.

When a matching statement is found, the recovery actions are controlled by the parameters on that statement. The RECOVER statement can specify these actions:

- Restart the current occurrence at the failed operation, with or without JCL changes.
- Restart the current occurrence at another operation.
- Add occurrences of special recovery applications. Make the restart of the failed occurrence dependent on the completion of the recovery occurrences. This action lets you, for example, perform a data set recovery before restarting your main application. See "Adding predecessor recovery occurrences to the current plan" on page 414.
- Release a dependent occurrence.
- Restart the current occurrence at the failed step or at another step, with any of these JCL modifications:
  - Delete steps
  - Add recovery steps
  - Change JCL statements in a program exit module
- Remain in error status.

The rule that controls how IBM Workload Scheduler for z/OS selects the failed step is described in "Deciding which step of an operation has failed" on page 413. For example, the error selection criteria **if error E** might match more than one failed step. In this case, IBM Workload Scheduler for z/OS selects the first step in the job that meets the criteria specified in the RECOVER statement. If this is not correct, you must change your RECOVER statements so that the correct step is chosen.

You can disable and enable the recovery function from the SERVICE FUNCTIONS panel. Also, you can set defaults so that the recovery function does not react to certain errors or reacts only at certain times unless specific requests are made.

When a RECOVER statement is matched against an error condition, the statement is changed to a JCL comment. If the job is rerun, it no longer functions as a RECOVER statement. Other RECOVER statements in the JCL remain active.

Automatic recovery processing and data set cleanup

If a failing job operation has a cleanup action defined and it contains automatic recovery statements requiring a job restart, cleanup action is performed before automatic recovery. The process is as follows:

1. The automatic recovery function detects the recovery statements and check the type of cleanup.
2. If the cleanup type is set to None, the recovery actions are immediately performed. If the cleanup type is set to Immediate or Manual, the recovery actions are postponed.
3. For the immediate cleanup type, the cleanup actions are started automatically by the scheduler. For the manual cleanup type, you need to request the cleanup actions by selecting the Start Cleanup with AR option.
4. Automatic recovery processing waits until after IBM Workload Scheduler for z/OS finishes the data set cleanup. When the cleanup status is set to Complete, the recovery actions are performed.

   If the cleanup type is set to Automatic, no recovery action is taken and an error message is issued.

If you specify the other cleanup types, manual or automatic, the recovery action does not occur and an error message is issued.

If you defined RESSTEP as an automatic recovery statement in the JCL, IBM Workload Scheduler for z/OS performs the cleanup action according to the RESSTEP instructions. This means that the RESSTEP is considered as the starting step and the last step is considered as the ending step. If, after all the automatic recovery actions are performed, the operation fails again, a stand-alone cleanup action is started based on the value set in RCLOPTS IMMEDLOGIC:

- If IMMEDLOGIC(BESTSTEP), the action starts from the best step
- If IMMEDLOGIC(FIRSTSTEP), the action starts from the first step

For detailed information about the RCLOPTS statement, see the *Customization and Tuning*.

In some situations, you might decide to create a logic for job runs that bypasses the need for data set cleanup. You do not have to wait for the cleanup, because automatic recovery adds a new occurrence, which does not depend on the cleanup of the data set. When you specify in the AROPTS initialization statement the CHKRESTART(Y) parameter, the recovery actions are executed immediately whether or not data set cleanup is required.

The example in Figure 157 on page 398 shows how data set cleanup and automatic recovery can work together to ensure that a job is cleaned up and restarted.

```
//*
//*%OPC RECOVER ERRSTEP=STEPFAIL,JOBCODE=JCL,DELSTEP=STEPFAIL
//*%OPC SCAN
//STEP1    EXEC PGM=IEFBR14
//DD1  DD  DSN=EID.EID4R2.CATTEST,DISP=(,CATLG),
//         UNIT=SYSDA,SPACE=(CYL,(1,1),RLSE),
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=12100)
//STEPFAIL EXEC PGM=IEFBR14
//DD3  DD  DSN=DSN.NOT.CATLG,DISP=(OLD,DELETE,DELETE)
//STEP2 EXEC PGM=IEFBR14
//DD2  DD  DSN=EID.EID4R2.CATTEST,DISP=(OLD,DELETE,DELETE)
//
```

Figure 157. Example of data set Cleanup with Automatic Job Recovery

In Figure 157, the job is designed to fail in STEPFAIL with a JCL error. Automatic recovery statements specify that when this error occurs, the step is to be deleted and the job rerun. Without data set cleanup, the job fails immediately in STEP1 with a JCL error: duplicate data set. When cleanup is active for the operation, the automatic recovery action is postponed until the cleanup action is completed or discarded.

For more information, see Chapter 20, "Restart and cleanup," on page 363.

Automatic recovery and restart

When automatic recovery (AR) actions require that an operation is rerun, consider that the following situation occurs. This is important to define the appropriate recovery statement (for example, using unique step names).

If the operation is a job
: The operation is rerun by inserting the parameter RESTART=*stepname* in the JOB statement, where *stepname* is the value set in the RESSTEP parameter. When a job restart is requested, the RESTART keyword can be omitted.

If the operation is a started task
: The operation is rerun by inserting the parameter COND=ONLY in all the steps that precede the restart step, unless a specific *stepname* is not identified (job restart).

Consider that the kind of tailoring required by the AR tasks (for example, add a step, delete a step, add the RESTART keyword, and so on) might cause the following limitations:

- Nested procedures
- INCLUDE statements
- IF/THEN/ELSE/ENDIF statements
- GDG data sets

The use of the Automatic Recovery parameters ERRSTEP, STEPCODE, or RESSTEP is mutually exclusive with the STEP option of the $EJ command introduced with z/OS V1.13. If both are used, the Automatic Recovery fails and the message EQQC047E is issued in the message log.

Recovery of operations when a workstation becomes inactive

In the event of a system failure, the computer workstation representing that system can be automatically set to inactive if XCF is available. If XCF is not available, you can manually set the workstation to inactive using the panels. See "Specifying workstation destinations" on page 67. Operations that have not yet started on an inactive workstation can be rerouted to an alternate workstation. Refer to "Redirecting work to alternate workstations" on page 628 for more information about redirecting work to alternate workstations.

The status IBM Workload Scheduler for z/OS assigns to operations that were started when the workstation became inactive is decided by the WSFAILURE and WSOFFLINE keywords of the JTOPTS statement. Refer to *Customization and Tuning*. If you decide to mark these operations as ended-in-error, they are given an error code of OS*xx* or OF*xx* (where *xx* is the status and extended status of the operation).

These operations are handled the same way as other operations that have ended in error. If a RECOVER statement has been defined to cover the situation, as defined by the job code and step code, it is invoked in the same way as for other operation failures.

The automatic-recovery-control statement

Each automatic-recovery-control statement describes an error situation and the recovery actions for it.

Use these rules to code RECOVER statements:

- Each statement must begin on a new 80-byte logical record.

  The symbols `//*%OPC` must appear in bytes 1 to 7 and be followed by at least one blank.

  `//*%OPC RECOVER`
  : Identifies a RECOVER statement

  `//*%OPC`
  : Identifies a RECOVER continuation statement

  The automatic recovery function also inserts informational statements in the JCL:

  `//* OPC`
  : Identifies a message statement

  `//*>OPC`
  : Identifies a comment statement

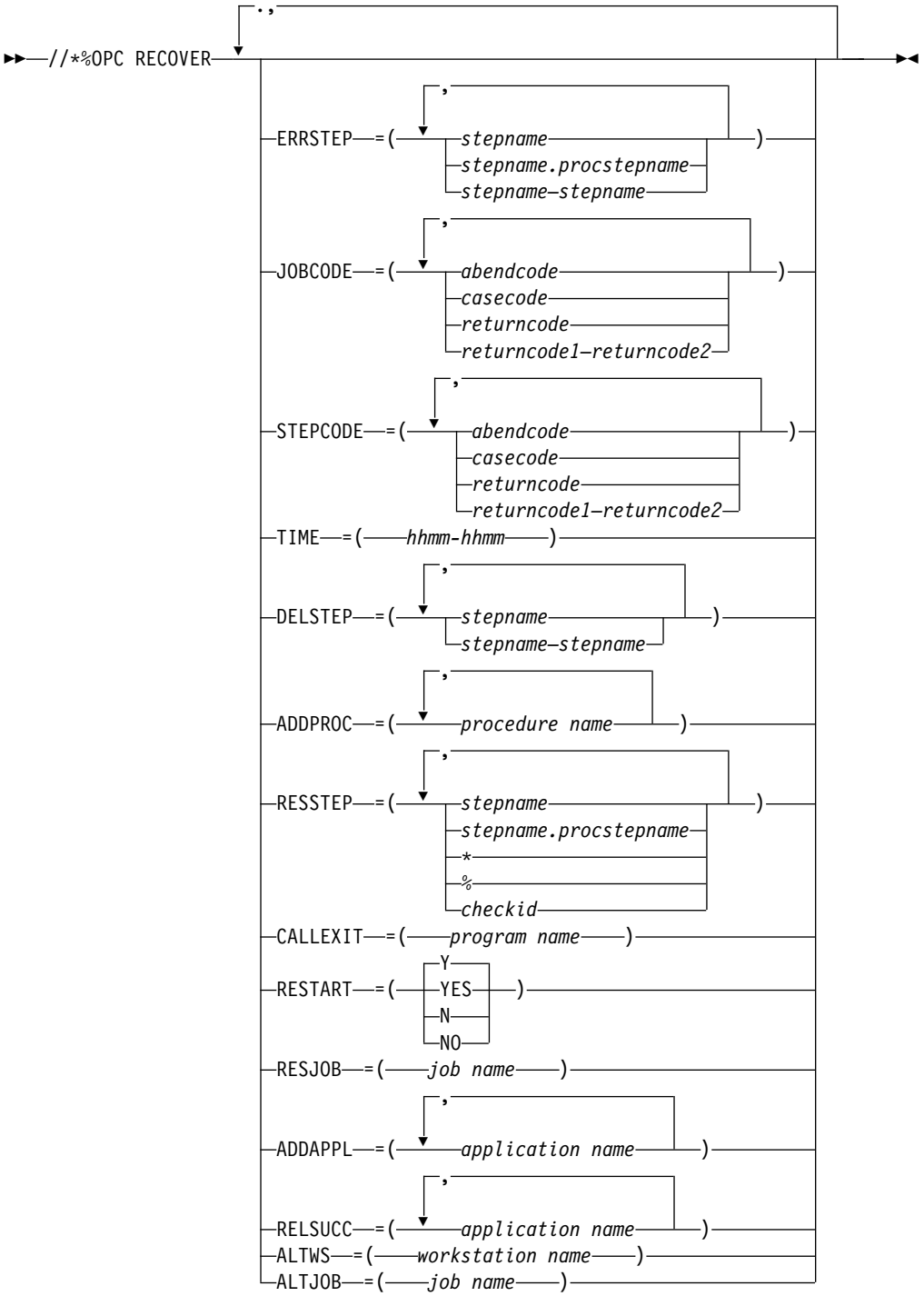
  See "Message and comment statements" on page 417 for more information.
- You cannot use variables anywhere in the RECOVER statement.
- The parameters are optional; you can code them in any sequence.
- Each parameter consists of a keyword followed by an equals sign and variable information.
- Parameters are separated by commas.
- You cannot code the same keyword more than once on the same statement.
- If you code only one parameter value, you do not need to enclose it in parentheses; for example, `JOBCODE=PCHK`.
- Bytes 72 to 80 are ignored by the automatic recovery function.
- When the total length of fields on a control statement exceeds 71 bytes, continue the statement using the following continuation conventions:

1. Interrupt the field after a complete or partial parameter, including the comma that follows it, before byte 72.
2. Code the identifying continuation characters `//*%OPC` followed by at least one blank in bytes 1 to 7 of the statement that follows.
3. Continue the interrupted operand in any position from bytes 9 to 16.

- When automatic recovery is related to non-z/OS trackers, limit the RECOVER statement to one card (avoid continuation).

RECOVER statement syntax

The syntax of the RECOVER statement follows. If you are unfamiliar with syntax diagrams, see"How to read syntax diagrams" on page xx.



Statement parameters

All RECOVER statement parameters are optional. There are three RECOVER statement categories: selection, JCL rebuild, and recovery action. IBM Workload Scheduler for z/OS supports parameters that refer to job steps only for jobs on host systems or jobs that run on fault-tolerant workstations *and* use a centralized script. For jobs that run on fault-tolerant workstations that do *not* use a centralized script, you must use the RECOVERY statement in the job definition to perform actions (see *Customization and Tuning* for instructions).

Selection parameters

These selection parameters specify the error situations that the RECOVER statement handles:

ERRSTEP
Restricts the RECOVER statement to be valid only for those steps specified.

Note: The automatic recovery function acts on information received about a job or started task failing step, but, because a job or started task might have several potential failing steps, it is the RETCODE keyword of the EWTROPTS statement that determines which of these steps should be passed to the automatic recovery function. If this failing step corresponds to a step specified by ERRSTEP, automatic recovery occurs.

IBM Workload Scheduler for z/OS supports this parameter only for jobs on host systems. This parameter is not supported when the EWTROPTS STEPEVENTS(ABEND) option is used.

JOBCODE
Restricts the RECOVER statement to be valid only for those job completion codes and return codes specified.

STEPCODE
Restricts the RECOVER statement to be valid only for those step return codes specified. IBM Workload Scheduler for z/OS supports this parameter only for jobs on host systems. This parameter is not supported when the EWTROPTS STEPEVENTS(ABEND) option is used.

TIME Restricts the RECOVER statement to be valid only in the time range specified.

Note: Review the EXCLUDECC and EXCLUDERC keywords of the AROPTS statement, which specify codes for which no automatic recovery is done. For information about the AROPTS statement, see *Customization and Tuning*.

JCL rebuild parameters

These JCL rebuild parameters control the rebuilding of the JCL:

DELSTEP
Specifies a step or a list of steps that should be deleted from the inline JCL before rerunning the failed operation. You can also specify a range of step names to delete. IBM Workload Scheduler for z/OS supports this parameter only for jobs on host systems.

ADDPROC
Specifies the name, or a list of names, of JCL procedure library members to be added to the inline JCL before rerunning the failed operation.

RESSTEP
Specifies the name of the job or started-task step at which the operation should be restarted. IBM Workload Scheduler for z/OS supports this parameter only for jobs on host systems. If the operation specifies a data set cleanup action, IBM Workload Scheduler for z/OS performs the cleanup actions for all steps from the RESSTEP value up to and including the last step executed.

Note: RESSTEP on the RECOVER statement is a different, and simpler, function than the step-restart function in the MODIFYING THE CURRENT

PLAN panel. MCP step restart retrieves the job log and uses it to rebuild the JCL. RESSTEP does not require the job log, unless data set cleanup is involved.

CALLEXIT
Specifies the name of a program exit module that should be called before the restart.

Recovery action parameters

These recovery action parameters specify the actions to take for recovery:

RESTART
Specifies if the occurrence is to be restarted.

RESJOB
Specifies the name of the job or started task from which the occurrence must be rerun.

ADDAPPL
Specifies an application or a list of applications to be added as occurrences in the current plan.

RELSUCC
Specifies the application ID of a successor occurrence, or a list of IDs.

ALTWS
Specifies the name of an alternate workstation on which to run the operation.

ALTJOB
Specifies an alternate job or started-task name to use when the job is restarted. This is used in a MAS complex to allow the restart of a job that has not yet ended as far as JES is concerned.

This action parameter does not apply to operations that are run on z-centric agent workstations.

Selection parameters

When a job or started task ends in error, this information is available for all executed steps:

- Step name
- Abend code, if step abended
- Return code, if step did not abend

The selection parameters use this information:

ERRSTEP
If the recovery specification is for a specific step within a JCL procedure, specify ERRSTEP=*stepname.procstepname*.

If the recovery specification is for specific step within standard JCL, specify ERRSTEP=*stepname*.

Each step name you specify must correspond to a step in the job or started task. All steps in the JCL should have a name; these names should be unique.

Default: The recovery specification is for all steps.

JOBCODE
The code can be an abend code, an error code set by IBM Workload Scheduler for z/OS or JCC, a case code, a return code, or a return code

range. (For more information on case codes, see "Case code lists" on page 418.) The values are those given as the error code on the HANDLING OPERATIONS ENDED IN ERROR panel in the MODIFYING THE CURRENT PLAN panel.

The JOBCODE keyword values are:

S*xxx* Specifies a system abend code.

U*xxx* Specifies a user abend code.

xxxx Specifies a case code or an error code set by IBM Workload Scheduler for z/OS, either directly or by using the job completion checker.

n Specifies a return code.

x-y Specifies a return code range, where *x* and *y* represent positive decimal values.

The codes specified in the JOBCODE parameter are tested against the return code of the first abending step or against the job code as set by IBM Workload Scheduler for z/OS when the job or started task ends. This step is called the *terminating step*.

Note: When specifying the JOBCODE keyword values, you must use the formats of the system abend code, user abend code, and job return code described in Chapter 19, "Setting error codes," on page 359.

You can also specify abend codes in generic form. Therefore, an asterisk (*) can represent any character, or any group of characters, in those positions where it is placed. A code can contain more than one asterisk only if each asterisk is separated from the next by another character.

Note: The JOBCODE=* notation covers all possible user and system abend codes; it does not cover return codes. To cover all possible return codes, specify a return code range in the form:

```
JOBCODE=x-y
```

where *x* and *y* represent positive decimal values.

A return code cannot be greater than 4095. To specify a range of values, set *x* to the lower value and *y* to the higher value. To specify all return codes greater than or equal to a certain value, set *x* to that value and *y* to 4095.

If you specify the ERRSTEP parameter as well as JOBCODE, the step that terminated the job or started task must be specified by the ERRSTEP parameter; otherwise, the RECOVER statement criteria are not met, and the statement is ignored.

Default: The default depends on whether the STEPCODE parameter is specified:

- STEPCODE specified: the JOBCODE default is no recovery, and the recovery is controlled by the STEPCODE parameter.
- STEPCODE not specified: the JOBCODE default is recovery for all codes, except those for which no automatic recovery is specified by the EXCLUDECC and EXCLUDERC keywords of the AROPTS statement. For details about AROPTS, see *Customization and Tuning*.

STEPCODE

The STEPCODE keyword value can be:

S*xxx* Specifies a system abend code.

U*xxx* Specifies a user abend code.

xxxx Specifies a case code.

n Specifies a return code.

x-y Specifies a return code range, where *x* and *y* represent positive decimal values.

'FLSH'
Specifies that the step was flushed.

The return codes of the executed steps are tested against the parameter values and, if there is a match, the RECOVER statement is eligible for processing. The STEPCODE parameter can be used to test the result of all executed steps, whereas JOBCODE tests only the result of the terminating step.

Note: When specifying the STEPCODE keyword values, you must use the formats of the system abend code, user abend code, and job return code described in Chapter 19, "Setting error codes," on page 359.

Abend codes can also be specified in generic form. Therefore, an asterisk (*) can represent any character, or any group of characters, in those positions where it is placed. Only the first character of the abend code must be necessarily specified, any asterisk must follow that character. A code can contain more than one asterisk only if each one is separated by another character.

If ERRSTEP is specified, the STEPCODE values are tested only against the return codes of the steps specified in the ERRSTEP parameter. If no ERRSTEP parameter is specified, the STEPCODE value is tested against the return codes of all executed and flushed steps.

A return code cannot be greater than 4095. To specify all return codes greater than or equal to a certain value, set *x* to that value and *y* to 4095.

When using this parameter, all steps in the JCL should have a name; these names should be unique within the job or started task.

IBM Workload Scheduler for z/OS treats the first step that abended as the terminating one. The JOBCODE values are tested against this step. With COND=EVEN specified on the EXEC statement, steps that follow an abending step might still be executed. So you can use the STEPCODE parameter to test for an abend in such a step.

Default: Return codes from steps other than the terminating one do not cause automatic recovery. The return code from the terminating step is handled as described for the JOBCODE parameter.

TIME The time is specified in the form *hhmm*, where *hh* is the hour from 00 to 24, and *mm* is the minute from 00 to 60. This is the time when the recovery is automatic.

For example:

TIME=0700-1600
No recovery actions occurs between 4 p.m. and 7 a.m.

TIME=2200-0800
IBM Workload Scheduler for z/OS does automatic recovery only between 22.00 and 8.00.

TIME=0000-2400
Recovery can be automatic at any time.

TIME=0000-0000
Recovery is not started unless there is manual intervention.

The recovery actions for a job or started task that remains in the ended-in-error list can be manually started up later. (See "Recovery actions from the Modifying Current Plan panel" on page 416.) Such requests override any TIME value specified.

Default: The recovery specification is for the time range specified by the STARTIME and ENDTIME keywords of the AROPTS statement. For more details about AROPTS, see *Customization and Tuning*.

JCL rebuild parameters

When a recovery statement is selected, IBM Workload Scheduler for z/OS uses these parameters to build the JCL stream that is used to restart the operation.

DELSTEP
DELSTEP specifies job or started-task steps to be deleted if the RECOVER statement is activated. Only one step of each name is deleted, so ensure that all your step names are unique.

Note:

1. Steps within in-stream procedures and started tasks cannot be deleted.
2. IF-THEN-ELSE-ENDIF construct statements are recognized. IF-THEN-ELSE-ENDIF statements are deleted when a sequence of delete lines, one or more steps as specified by DELSTEP, contains both the IF-THEN statement and the matching ENDIF statement, and possibly an ELSE statement. IF-THEN-ELSE-ENDIF statements which have their counterparts outside the delete sequence are kept.

   The delete sequence begins with an EXEC statement and continues to the line immediately before the EXEC statement of the next step to be retained in the JCL record. However, IF-THEN-ELSE-ENDIF statements immediately preceding this delete sequence are taken into account. That is, statements separated from the delete sequence by comment statements or subsequent IF-THEN-ELSE-ENDIF statements. In this sequence of lines preceding the delete sequence IF-THEN statements are converted to comment lines if the delete sequence contains the matching ELSE and/or ENDIF statements.

   In the delete sequence IF-THEN-ELSE-ENDIF statements are retained if the matching statement is not within the immediately preceding lines or not in the delete sequence. If an ELSE and the matching ENDIF is found but the corresponding IF-THEN statement is not, then only the ELSE statement is deleted, or converted to a comment statement. The ENDIF is retained for the IF statement in a preceding section of the JCL.

   To summarize the IF-THEN-ELSE-ENDIF handling:

   - IF-THEN statements might be changed to comment statements by inserting *> in columns 3 and 4. This is done when the IF-ENDIF is in front of a sequence of JCL lines to be deleted and the matching ENDIF is within the delete sequence.
   - Statements are left in the JCL when required because the matching statements are not available in the sequence of JCL lines to be deleted.

There is no check that the result is a valid job. The result is not valid if all steps are deleted between an IF-THEN statement and a corresponding ELSE statement. The result is also not valid if an IF-THEN statement remaining in the JCL references the name of a step to be deleted.

Default: No steps are deleted.

ADDPROC

This parameter specifies the names of JCL procedures to include in the JCL if recovery occurs. The JCL procedure library members are in the procedure library with ddname EQQPRLIB.

Note: This is not a JES procedure library but an internal procedure library specific to IBM Workload Scheduler for z/OS.

The added JCL is placed after the RECOVER statements in the JCL in the order the names appear in the ADDPROC parameter. This makes it necessary to have the RECOVER statements after in-stream procedures in the JCL file.

A useful technique is to have any procedures you want to add included in the JCL. The JCL is then invoked by including an EXEC statement, which calls the procedure. The EXEC statement itself is within a procedure invoked by ADDPROC. This reduces the risk of calling a procedure that is not available in EQQPRLIB.

Note: If you include an in-stream procedure, remember that it must always begin with a PROC statement and end with a PEND statement.

Default: No JCL is added.

RESSTEP

For a job, this specifies a value for the RESTART parameter on the JOB statement of the failing job.

For a started task, a COND=ONLY parameter is added to all EXEC statements that precede the specified step. If a COND parameter already exists in a step, it is commented out before the COND=ONLY is added.

The value of the RESSTEP parameter is enclosed in parentheses and is used either as the RESTART parameter or as the first step that COND=ONLY is not added to. If the JOB statement already contains a RESTART value, it is replaced by the RESSTEP value. However, if RESTART=Y is not specified in the recovery statement, RESSTEP is not active, meaning that the job is not rerun. If the restart step name is within a JCL procedure, specify *stepname.procstepname*.

*** (asterisk)**

Specifies that the job or started task should be restarted at the first step (possibly a step of a cataloged procedure).

% (percent)

Specifies that the job or started task should be restarted at the failing step. “Deciding which step of an operation has failed” on page 413 describes which step is selected if more than one step has failed, and also if the error cannot be associated with a particular step.

If % is specified, make sure that all steps in the in-stream JCL have a unique name. Do not specify % for a started task if the JCL file includes procedure calls.

A checkpoint ID can also be specified. The SYSCHK DD statement must then be present in the step JCL. The checkpoint name must not contain special characters, such as commas, blanks, or parentheses.

Default: The JOB statement is unchanged.

CALLEXIT

The CALLEXIT parameter specifies an exit routine to be called if this RECOVER statement is activated. The exit is called for each JCL line, and the exit can decide to accept the line without any changes, modify it, insert one or several JCL lines, or delete it. The exit also has the option of stopping the restart and recovery of the failing job or started task.

For more details, see *Customization and Tuning*.

Default: No exit is called.

Action parameters

These parameters specify the action that IBM Workload Scheduler for z/OS should take when the recovery statement is invoked.

RESTART

RESTART=Y causes the job or started task to be rerun, either from the failing operation or, if you specified RESJOB, from an earlier operation within the occurrence.

RESTART=N prevents the restart. It can be used with ADDAPPL when the recovery actions are to be done by a separate application. It can also be used to select cases for which no recovery should be performed or when testing the recovery procedure. The operation remains in ended-in-error status. JCL rebuild and other requested actions are performed, however. This includes also the cleanup actions that are performed according to the RESSTEP specified. If no value is specified for RESSTEP, the default (Restart from begin) is used and no JOB card tailoring is requested.

Default: RESTART=Y.

RESJOB

The RESJOB parameter handles failures at an occurrence level, not within the failing job or started task itself.

The occurrence of the application is rerun from the first preceding computer workstation operation, whose name matches the job name specified in the RESJOB parameter. If the job name specified cannot be found in a computer operation preceding the failed operation in the same occurrence, no automatic recovery occurs and the job or started task remains in the error handling list with an extended status code indicating an automatic recovery error.

The indicated operation must be a predecessor to the failed operation or be the failed operation itself.

Note: External successors cannot be handled automatically. Therefore the set of operations selected for rerun that can be completed at failure time must not have any external successors.

The rerun operation must be defined on an automatically reporting computer workstation.

The parameter is ignored if RESTART=N is specified.

Default: Rerun from the failed operation.

ADDAPPL

Here you specify a list of applications. Occurrences of these applications are added to the current plan if this RECOVER statement is invoked.

- If RESTART=N is specified, the applications are independent of the failed occurrence.
- If RESTART=Y is specified, the recovery applications are added to the current plan as predecessors to the failing operation or, if RESJOB is specified, to the operation where restart is being attempted. How a predecessor operation is selected is described in "Adding predecessor recovery occurrences to the current plan" on page 414.

Added applications are independent of each other. A maximum of 40 application occurrences can be added.

For example, suppose a database update fails. A rerun of the failed job is necessary but must be postponed to a later time. However, a database restore job must be run to repair the database before the online users require the database. This recovery situation can be specified as:

```
//*%OPC RECOVER JOBCODE=SCHK,RESTART=N,ADDAPPL=A301RORG
```

This means that, on case code SCHK, do not rerun the failing operation. (For information on case codes, see "Case code lists" on page 418.) However, add an occurrence of the application A301RORG to the current plan, without a dependency to the failing operation and leave the failing operation in ended-in-error status.

Default: No application occurrences are added.

Note:

1. When automatic recovery adds an occurrence to the current plan, input arrival and deadline times are not taken from the application description. Instead the occurrence is given an input arrival of the time the add is run, according to the time on the z/OS system where the controller is started and the deadline is set for 8 hours after input arrival. If an occurrence of that application already exists with this input arrival time, then one minute is added to the time until a time is reached when the occurrence can be included. If the added occurrence includes time-dependent operations with specific input arrival times, then the operations are started at the specified time.
2. An occurrence that has been added to the current plan by automatic job recovery does not become the predecessor to an occurrence that is added later by daily planning, even if normal dependency criteria are met.

RELSUCC

This parameter specifies which external successors to the failing operation are allowed to run even if their predecessor operation has ended in error.

The external successors to the failing operation are checked, and the dependencies between the failed operation and the specified successors are deleted at recovery time.

The effect is that this predecessor (the failed operation) is reported as complete to the external successor, and the successor-predecessor chaining is removed. The external successor becomes ready if its other predecessors are completed. The dependency does not exist when the failed occurrence is rerun.

Even if one successor is released, other successors might be waiting for the failed occurrence to complete. These might be successors not yet in the current plan. Assume that W is a weekly application and D is a daily application that is dependent on W. If W fails and there is a RECOVER statement causing the release of that day's D, the occurrence of D the next day also waits for W to complete, but without any automatic release.

You can specify a maximum of 40 application IDs.

Default: None.

ALTWS
Specifies the name of an alternate workstation on which to run the operation. The ALTWS parameter overrides the alternate workstation defined in the workstation description. You can use this parameter, for example, with the TIME parameter to specify alternate workstations for an operation, depending on the time of day. This parameter is not supported for automatic recovery of jobs using a centralized script.

Default: None.

ALTJOB
Specifies an alternate job or started-task name to use when the job is restarted. The name applies only to this particular occurrence. This parameter is not supported for automatic recovery of jobs using a centralized script.

Default: The job or started-task name is not changed.

Recovery coding examples

This section contains five examples of JCL for automatic job or started-task recovery.

Example 1

```
//A103D01  JOB .....
//SALARY   PROC  GENER=+1
//S190     EXEC  PGM=PAX
//PDS      DD    DSN=WATSON,DISP=SHR
//PRELPDS  DD    DSN=T191(&GENER),DISP=(NEW,CATLG,DELETE)
//CARDS    DD    DSN=T830(&GENER),DISP=OLD
//STAT     DD    DSN=T192(&GENER),DISP=(NEW,CATLG,DELETE)
//         PEND
//*%OPC RECOVER ERRSTEP=SAX91,JOBCODE=SALR,TIME=0000-2400,
//*%OPC      DELSTEP=SAX80-SAX91,ADDPROC=SALRECOV
//*%OPC RECOVER ERRSTEP=SAX92...  (for steps after SAX91)
//SAX80    EXEC  PGM=IEBISAM
           .
           .
           .
//SAX91    EXEC  SALARY
           .
           .
           .
 Procedure library member SALRECOV:
//*%OPC RECOVER ERRSTEP=SAX92...  (for steps after SAX91)
//SAX91    EXEC  SALARY,GENER=0
```

In example 1:

The RECOVER statement specifies that, if there is an error in step SAX91 with an error code in the SALR case code list, all steps from SAX80 up to and including SAX91 should be deleted. (For more information on case codes, see "Case code lists" on page 418.) They are replaced by the member SALRECOV from the IBM Workload Scheduler for z/OS procedure library. SALRECOV contains RECOVER statements for the steps after the failed one and an EXEC statement to run the internal procedure, now with a different value on the symbolic parameter to modify the failed step.

Example 2

```
//TI94237A JOB .....
//*%OPC RECOVER JOBCODE=S*37,ADDPROC=SPACECHG
//*%OPC RECOVER JOBCODE=(*,16-4095),RESTART=N,ADDAPPL=REORG
//*%OPC RECOVER JOBCODE=12
//STEP01  EXEC PGM=ATTACH8A,REGION=256K
//SYSOUT  DD   SYSOUT=A
//TSTIN   DD   DSN=TI94237.IN.DATA,DISP=SHR
//TESTWK1 DD   UNIT=3380,SPACE=(CYL,(1,1))
//TESTWK2 DD   UNIT=3380,SPACE=(CYL,(1,1))
//TESTWK3 DD   UNIT=3380,SPACE=(CYL,(1,1))
//TSTOUT  DD   DSN=TI94237.OUT.DATA,DISP=SHR
```

In example 2:

The first RECOVER statement specifies that, for space problems in any of the steps, the member SPACECHG should be added and, the failed job should be restarted (rerun the failed IBM Workload Scheduler for z/OS operation).
The second RECOVER statement specifies that, for any other error code (not in the EXCLUDECC list) and return code 16 or higher, the failed job (IBM Workload Scheduler for z/OS operation) should not be restarted, but the application called REORG should be started.
The third RECOVER statement specifies that, for return code 12, restart should occur at the failed job (IBM Workload Scheduler for z/OS operation).

The preceding actions apply to the time range specified by the STARTTIME and ENDTIME parameters of the AROPTS automatic recovery initialization statement. If the job fails at another time, it gets the ended-in-error status and remain on the ended-in-error list. The scan for recovery statements can be repeated at a later time; see "Recovery actions from the Modifying Current Plan panel" on page 416.

Example 3

```
//AP301A66 JOB ....
//*%OPC RECOVER JOBCODE=NRC4,RESTART=N
//*%OPC RECOVER JOBCODE=(U046,S*37),ERRSTEP=STEP01,
//*%OPC   ADDPROC=(A66RECOV,SPACECHG)
//*%OPC RECOVER JOBCODE=S*37,ERRSTEP=STEP02,
//*%OPC   ADDAPPL=AP301ARA,RESSTEP=%
//*%OPC RECOVER ERRSTEP=STEP02
//STEP01 EXEC  PGM=SORT
//SYSOUT   DD  SYSOUT=A
//SORTIN   DD  DSN=AP301A.SALES.DATA,DISP=OLD,UNIT=3400-6,
//             LABEL=(1,SL)
//SORTOUT  DD  DSN=&&SORTOUT,DISP=(NEW,PASS),UNIT=SYSDA,
//             SPACE=(CYL,(5,1))
//SORTWK01 DD  UNIT=3380,SPACE=(CYL,(1,1))
//SORTWK02 DD  UNIT=3380,SPACE=(CYL,(1,1))
//SORTWK03 DD  UNIT=3380,SPACE=(CYL,(1,1))
//SYSIN    DD  *
  SORT FIELDS=(40,36,CH,A)
  RECORD TYPE=F,LENGTH=80
  END
//STEP02 EXEC PGM=REPORT
//SYSPRINT DD  SYSOUT=A
//REPORTIN DD  DSN=&&SORTOUT,DISP=(OLD,DELETE)
//XXXX     DD  DSN=&&XX,DISP=NEW,UNIT=SYSDA,SPACE=(CYL,(5,1))
```

In example 3:

The first RECOVER statement specifies that, for error code NRC4 (which is a case code set by the job completion checker), no recovery actions should be taken. Assume that NRC4 represents system completion codes such as 0C4 for which no automatic recovery should be done.

The second RECOVER statement specifies that, for space problems in step STEP01, JCL from the IBM Workload Scheduler for z/OS procedure library (which might be a copy of the RECOVER statements for step STEP02 and a space allocation step) should be included, and the failing job (IBM Workload Scheduler for z/OS operation) should be restarted from the beginning.

The third RECOVER statement specifies that, if there are space problems in step STEP02, a new application named AP301ARA is to be added, and the failing job (IBM Workload Scheduler for z/OS operation) must be restarted at step STEP02. The failing job will be a successor operation to AP301ARA and will be started when AP301ARA is completed.

The fourth RECOVER statement specifies that, for STEP02, all the remaining error codes not in the EXCLUDECC list should be restarted from the beginning without any JCL changes or other recovery actions.

If the error occurs outside the time range specified by the STARTTIME and ENDTIME parameters of the AROPTS automatic recovery initialization statement, the job remains in ended-in-error status.

Example 4

```
//FSF007 JOB ...
//*%OPC RECOVER ERRSTEP=UPDATE,ADDAPPL=RECOV1,
//*%OPC  RESTART=N,TIME=0800-1600
//*%OPC RECOVER ERRSTEP=UPDATE,ADDAPPL=RECOV1,TIME=0000-2400
//*%OPC RECOVER TIME=0000-2400
//    EXEC ...
       .
       .
       .
```

In example 4:

The application RECOV1 is added if an error occurs in step UPDATE. During normal working hours, the failed operation remains on the ended-in-error list. At other hours, the operation is restarted from the beginning. For errors in other steps, the operation is restarted from the beginning. In all three cases, an error code in the INCLUDECC list means no recovery.

Example 5

```
//TI94237A JOB .....
//*%OPC RECOVER JOBCODE=S*37,ADDPROC=SPACECHG,
//*%OPC   RESTART=N
//*%OPC RECOVER JOBCODE=(*,16-4095),RESTART=N,ADDAPPL=REORG
//*%OPC RECOVER JOBCODE=8,
//*%OPC   RESTART=N
//STEP01  EXEC PGM=ATTACH8A,REGION=256K
//SYSOUT  DD   SYSOUT=A
//TSTIN   DD   DSN=TI94237.IN.DATA,DISP=SHR
//TESTWK1 DD   UNIT=3380,SPACE=(CYL,(1,1))
//TESTWK2 DD   UNIT=3380,SPACE=(CYL,(1,1))
//TESTWK3 DD   UNIT=3380,SPACE=(CYL,(1,1))
//TSTOUT  DD   DSN=TI94237.OUT.DATA,DISP=SHR
```

In example 5:

This is the same as in example 2, except that this time it is set up for testing the recovery procedure. If the job fails, it has ended-in-error status independent of the error type. The JCL can be inspected and the recovery actions can be started manually via the MODIFYING THE CURRENT PLAN panel.

Deciding which step of an operation has failed

More than one step might meet the criteria set by the selection parameters. If you specify the STEPCODE parameter but not the ERRSTEP parameter, more than one step can have a return code that would cause recovery. If both the STEPCODE and JOBCODE parameters are given but not the ERRSTEP parameter, two or more steps might meet the criteria, one as determined by the JOBCODE, and the others as determined by the STEPCODE. In these cases, the first step that fulfills the selection criteria is selected as the failed step for recovery purposes; for example, when determining the restart step.

A failure can also occur at job or started-task initialization time before a step is entered. Such failures have the error code JCLI or CAN. Assume that a RECOVER

statement is specified that has RESSTEP=% and no ERRSTEP parameter, indicating restart at failing step for any errors in the job. For JCLI and CAN errors, the restart is from the start of the job.

When a job or started task is transferred from one workstation to another and recovery occurs, IBM Workload Scheduler for z/OS assumes that the step that was executing at the time of failure was the step that would have followed the last step that IBM Workload Scheduler for z/OS knows completed (that is, for which it has a step-end event).

JCCE errors mean that the job completion checker (JCC) has terminated its processing of the SYSOUT file. Such errors are not associated with a specific step. If RESSTEP=% is specified but the step return codes show that the executed steps have completed successfully, the job or started task remains on the ended-in-error list. The same is true for other error codes set by JCC.

Adding predecessor recovery occurrences to the current plan

When application occurrences are added to the current plan, as the result of the ADDAPPL automatic recovery statement, and RESTART=Y is specified for the failed occurrence, the failed occurrence is made a successor of the newly added application occurrences. This is to allow for the common situation in which, for example, a data set restore must take place before a job can be rerun. The rerun is dependent on the successful completion of the restore job.

Because external dependency relationships are between particular operations within occurrences, IBM Workload Scheduler for z/OS must work out which operation in the successor occurrence depends on which operation in the predecessor occurrence. The operation IBM Workload Scheduler for z/OS designates (in the failed occurrence) as the restart operation is either:

- The failing operation itself
- The operation given by the RESJOB parameter, if RESJOB is specified

The predecessor operation, in the application occurrences added by recovery, is chosen using the following rules:

1. If the failed occurrence has a defined predecessor in the application added by recovery, this predefined predecessor-successor linkage is maintained.
2. If no such dependency is defined, the default predecessor workstation is used to select the predecessor operation. The default predecessor workstation is defined in the PREDWS keyword of the AROPTS automatic recovery initialization statement (refer to *Customization and Tuning*). The last operation in the application on that workstation is selected as the predecessor operation.
3. If no dependency is defined and no PREDWS name is defined, the last operation, is selected as the predecessor operation.

The last operation mentioned above is the last operation the user specifies when creating the application description, or when the application description was last updated via panels or the PIF.

However, it is recommended that the application description of the failing occurrence has a predecessor defined to the recovery application for the potential restart operation.

When you are defining applications, consider setting up any recovery applications that might be required. If you do not define run cycles for the recovery

applications, the required recovery occurrences are included in the current plan only when the error condition is matched and the recovery action is invoked.

You require a recovery application for any operation in your main application that might cause a RESTART, and for which some “cleaning up” must be done before a rerun.

Status changes

Automatic recovery causes a change in the status and extended status of the operations that are recovered.

When a job or started task that is controlled by IBM Workload Scheduler for z/OS ends abnormally, the corresponding operation appears on the ended-in-error list. The job or started task remains on the ended-in-error list in the following cases:

- There are no recovery specifications for the error.
- RESTART=N is specified in the RECOVER statement.
- An error occurred in the automatic recovery processing.
- Automatic recovery is inactive. You can specify this in the AROPTS initialization statement or using the panels.

In all three cases, the status remains E.

Status

The automatic recovery function gets control for an operation when the operation is set to status E (ended-in-error). If RESTART=Y is specified in the recovery statement that is invoked, an automatic restart is performed, and the status changes. This is the same procedure that would be followed if the operation were rerun using the MODIFYING THE CURRENT PLAN panel. This means that the operation that is selected as the restart point is set to status R, and succeeding operations are set to status W.

Note: This is not the case if you specify the RESTARTABLE attribute when you define an operation. In this case, the operation is replaced on the ready queue of its workstation with status code R.

Extended status

The extended status is also set by the automatic recovery function. Extended status E shows that an error was detected while attempting automatic recovery; extended status R means that automatic recovery has been performed and RESTART was requested.

If no RECOVER statement is invoked for the error, the extended status field is left blank.

If RESTART=N is specified, the extended status field is set to R to show that recovery has taken place.

If an error is detected while processing a RECOVER statement, the extended status field is set to E.

Security in automatic recovery

The current plan is protected from unauthorized update attempts. The level of protection is controlled by use of the AROPTS and AUTHDEF initialization statements. Refer to *Customization and Tuning* for details. Certain automatic recovery functions, such as the ADDAPPL and RELSUCC functions, perform updates to the current plan as part of the recovery procedure.

There are two parameters in the AROPTS statement that you can use to control the authority checking. The USERREQ keyword specifies whether it is possible for authority to be granted if the selected USERID is not known or if no USERID information is available. Using the AUTHUSER keyword you can specify the source from which IBM Workload Scheduler for z/OS should determine the USERID. You can specify:

- The last user to update the JCL
- The authority group of the failing occurrence
- The owner ID of the failing occurrence

When you specify JCLUSER, the last user who updated the JCL is assumed to be responsible for the JCL including its RECOVER statements. IBM Workload Scheduler for z/OS checks that this user has the level of authority required to perform the updates requested by the RECOVER statements.

IBM Workload Scheduler for z/OS finds the user ID of the last user to update the JCL from one of three sources, depending on where the JCL is obtained:

- When the JCL is obtained from the EQQJBLIB data set, the ID of the last user to update the JCL is retrieved from the ISPF statistics in the directory entry for the JCL member. If there is no user ID recorded in the statistics, no authorization checking can be performed.
- When the JCL is entered from the EQQUX002 exit, the updating user ID is passed as a parameter to IBM Workload Scheduler for z/OS so that authorization checking can be performed.
- When the JCL is updated via a panel, the ID of the last user who updated the JCL is stored. This is then used for authorization checking.

Recovery actions from the Modifying Current Plan panel

A job or started task that ends in error is automatically scanned for a RECOVER statement that corresponds to the reported error.

It is possible to invoke this recovery scan manually from the HANDLING OPERATIONS ENDED IN ERROR panel in the MODIFYING THE CURRENT PLAN panel. Selecting an operation with the row command `ARC` starts the scan.

If you invoke recovery from the MODIFYING THE CURRENT PLAN panel, any time restrictions on the RECOVER statements are overridden. That is, recovery occurs immediately, regardless of the TIME parameter that is specified on the RECOVER statement. The RECOVER statement that is invoked matches the original error condition of the operation, as would be the case if the scan were invoked automatically.

It is also possible to specify a RESTART=N parameter on a RECOVER statement and then cause a RECOVER statement scan to take place. This lets you see the effect that invoking the RECOVER statement would have, without causing the operation to be resubmitted. The JCL created in this way will be the JCL that IBM

Workload Scheduler for z/OS uses if the operation is rerun. To get back to the original JCL, you must manually edit the JCL to undo the effects of the recovery statement. This includes amending the RECOVER statement, because it will have been automatically changed to a comment statement. See "Message and comment statements." If you want the original job from EQQJBLIB, an easier method is to delete all the job statements and press PF3 (End) to save, forcing IBM Workload Scheduler for z/OS to take a fresh copy from the library.

Message and comment statements

Automatic recovery can insert message and comment statements in your JCL.

Message statement

The automatic recovery function updates the JCL of the failing operation with information in the form of message statements about the recovery action taken. Also, if an error occurs during the automatic recovery function, IBM Workload Scheduler for z/OS uses message statements to insert an error description in the JCL file saved on the JS data set. The format of the message statement is:

```
//* OPC message-text
```

Comment statement

In addition to making any JCL modifications requested in the RECOVER statement and adding message statements, the selected RECOVER statement is changed to a comment statement. Therefore, the RECOVER statement is treated as such only the first time. You could, however, add the RECOVER statement again using the ADDPROC parameter.

Note: An automatic recovery statement is commented only when the statement has matched a reported error, and the recovery actions have been initiated successfully. Statements that do not match the error remain in the JCL as candidates for subsequent failures.

Logging and failure reporting

Automatic recovery actions are logged in three places:

- On the job-tracking log, for IBM Workload Scheduler for z/OS restart purposes
- On the IBM Workload Scheduler for z/OS message log
- In the IBM Workload Scheduler for z/OS JS data set (in the JCL record of the failed job or started task) in the form of message statements

Successful recovery start

The successful start of recovery actions is recorded in all three places, as described previously. Message statements are added to the JCL to let you reconstruct the recovery activities performed. These messages are usually inserted after the RECOVER statement that they relate to, telling you that recovery has been performed using a preceding RECOVER statement. In addition, all selected RECOVER statements are changed to comment statements.

Unsuccessful recovery start

If an error is detected in a RECOVER statement, messages describing the error are inserted in the JCL, and the incorrect statement (and possibly the position within the statement where the error was detected) is identified. The position is identified by the character A in the inserted message, as indicated in the following example:

```
//*>OPC SCAN
//SAMPLEA JOB (885002,NOBO),SAMPLE,NOTIFY=XMAWS,MSGCLASS=Q,
//  CLASS=B,MSGLEVEL=(1,1),PRTY=1
//*%OPC RECOVER JOBCODE=JCL,RESTART=N,ADAPPL=RECOV
//* OPC MSG:                          A
//* OPC MSG: E  INCORRECT PARAMETER
//STEP1 EXEC PGM=IEFBR14
//DD1  DD  DSN=XMAWS.NOT.THERE,DISP=(OLD,DELETE,DELETE)
//
```

If an exit requests termination of the recovery attempt or if it requests saving of the JCL but no restart, this request is also logged in the JCL. Message statements are added to the JCL close to the RECOVER statement.

If an error cannot be associated with a particular JCL record, message statements are added at the start of the JCL.

Note: RECOVER statements are checked only when a job fails.

Case code lists

You can group return codes, IBM Workload Scheduler for z/OS job codes, and abend codes for the purposes of recovery. Each group is assigned a name, called a *case code*. In the RECOVER statement, you can specify the recovery action for a number of abend situations, using one RECOVER statement and the case codes. The case code definition list is kept in a load module, EQQCASEM. A macro, EQQCASEC, is available to help you set up the case code lists.

With automatic recovery, the case codes are used in the following way: IBM Workload Scheduler for z/OS tries to match the error code from the failing operation with a value specified in the JOBCODE and STEPCODE parameter. If no direct match is found and a case code list exists, IBM Workload Scheduler for z/OS assumes that the codes defined in the JOBCODE and STEPCODE parameters are case codes. It searches the case code list for each parameter value. If it finds a match, implying that the value in the parameter is a true case code, it then seeks to match the error code of the failing operation with the list of return and abend codes associated with the case code. If a match is found and the other RECOVER criteria are met, recovery occurs.

For a description of how you define case codes, see *Customization and Tuning*.

Deactivating and activating automatic recovery

Automatic recovery is performed by a subtask of the IBM Workload Scheduler for z/OS subsystem. You request that this subtask should be started by specifying RECOVERY(YES) on the OPCOPTS initialization statement. If this is specified, automatic recovery is started and stopped when the IBM Workload Scheduler for z/OS subsystem is started and stopped.

Automatic recovery can be deactivated and activated using the SERVICE FUNCTIONS option from the main menu. When automatic recovery is deactivated, the ended-in-error jobs or started tasks remain on the ended-in-error list, independent of RECOVER statements. Requests from the MODIFYING THE CURRENT PLAN panel HANDLING OPERATIONS ENDED IN ERROR panel are, however, honored, regardless of whether automatic recovery is activated or deactivated. See “Recovery actions from the Modifying Current Plan panel” on page 416.

Restarting work on different workstations

When jobs or started tasks are restarted on workstations other than the workstation that they were initially defined on, you should consider:

- Data set availability. All the data sets required by the job or started task should be available on the system associated with the alternate workstation.
- The RACF environment on the system associated with the alternate workstation.
- The initiator structure on the alternate system.

The following points apply to automatic recovery in general:

- Jobs and started tasks should be made (as far as possible) restartable from the failed step. A major problem is the handling of work files conveying information from one step to another. One way of dealing with this is:
  1. At the beginning of the job or started task, add a special step referring to all work files (IEFBR14) with DISP=(OLD,DELETE,DELETE).
  2. When you create the file, code DISP=(NEW,CATLG,DELETE).
  3. When you receive the file and you must pass it to the next step, code DISP=(OLD,PASS,KEEP).
  4. At the end of the job or started task, add an extra step executing IEFBR14 with a DD statement for each work file specifying DISP=(OLD,DELETE,KEEP).
- Files passed across job or started-task steps, and between jobs or started tasks, must be permanent or intermediate files.
- DISP=MOD should be used with care, because it can cause problems with restart.
- It is better to have small, uncomplicated jobs or started tasks with few steps rather than large, complicated jobs or started tasks with many steps. A complicated process should be broken into several smaller jobs or started tasks.
- Cataloging should be performed in a separate job. This is especially important when using generation data group (GDG) data sets. Usually, a job runs with input as generation 0 and output as generation +1. On rerun, input should be referenced as generation -1 and output as generation 0, which would require JCL changes. An alternative method is to catalog the new generation data group in a previous job, as shown in the following example:

  ```
  //A105C01  JOB  ....
  //STEP01   EXEC PGM=IEFBR14
  //A105CTLG DD   DSN=A105.INVOICE.BASE(+1),
  //              DISP=(NEW,CATLG,DELETE),
  //              UNIT=DISK,
  //              SPACE=(CYL,(5,1))
  //* DCB PARMS ARE AVAILABLE IN THE MODEL data set.
  ```

  The following example refers to the generation data group with the former generation 0 as generation -1 and the new generation as generation 0:

  ```
  //A105P01  JOB  ....
  //STEP01   EXEC PGM=A105PGMP
  //A105PIN  DD   DSN=A105.INVOICE.BASE(-1),   INPUT
  //              DISP=OLD
  //A105POUT DD   DSN=A105.INVOICE.BASE(0),    OUTPUT
  //              DISP=OLD
  ```

- Do not use backward references. Backward references to data sets in previous steps make restarts more complicated.
- Avoid the use of return codes to control the execution of successive steps under normal conditions because this can lead to restart problems. Use return codes only to bypass step execution after failure, for example, COND=(0,NE).

- Always code a step name for every step (for example, STEP*nn*, where *nn* is the step sequence number).

Chapter 22. Conditioning the processing of operations

This chapter describes the key concepts about *conditioning your operations* and the guidelines for deciding if and how to create conditions upon which your operations depend.

It contains the following sections:

- "Using conditional dependencies"
- "Evaluating conditions and conditional successor status" on page 422
- "Making an operation dependent on the status or return code of another operation" on page 425
- "Making an operation dependent on another operation step return code" on page 431
- "How to condition the status of operations with predecessors in X status" on page 438
- "Handling recovery using conditional dependencies" on page 440
- "Interactions with other functions" on page 442
- "MCP consistency rules" on page 443
- "Monitoring conditions in the current plan" on page 445
- "Daily plan batch handling of conditional dependencies" on page 449
- "Automatic conditional dependencies resolution" on page 450

Using conditional dependencies

Using conditional dependencies is a powerful way to manage scheduling workflow processing. It allows you to dynamically define alternative branches, for example, to run a recovery alternative flow. These alternative branches, when their processing completes, are automatically removed from the current plan when the daily plan batch is run.

For example, an application developer can use conditional logic to reduce the Total Cost of Ownership (TCO) and increase the automation of the business processes managed using IBM Workload Scheduler for z/OS. By using conditional dependencies while implementing workflow, he can automate the flow to follow alternative branches when a combination of specific criteria on operations occurs.

You can define conditional dependencies at the following levels:

Job level
By conditioning the start of the conditional successor to the check on job return code or status of the conditional predecessor. See "Making an operation dependent on the status or return code of another operation" on page 425 for more details.

Step level
By conditioning the start of the conditional successor to a specific step return code of the conditional predecessor. See "Making an operation dependent on another operation step return code" on page 431 for more details.

Evaluating conditions and conditional successor status

This section describes how the status of a conditional dependency is evaluated. These concepts apply to all conditional dependencies, both those defined at job level and those defined at step level.

A conditional dependency relationship is set up by using a *condition*.

A condition is a set of one or more condition dependencies aggregated by a rule. You can set the *rule* to be satisfied, and so the condition to be true, when one of the following occurs:

- Either all condition dependencies are true (AND)
- Or at least *n* condition dependencies are true (OR)

A *condition dependency* is a specific check of the status or return code of a predecessor operation or of the return code of an operation step.

The operations processing flow is affected by the conditions set and their final status.

The status of a condition is set based on the rule defined and on the statuses of its condition dependencies.

The following sections explain in more detail how to define a condition and its statuses transitions:

- "How to define a rule in a condition"
- "When the scheduler evaluates the status of a condition dependency" on page 423
- "How the scheduler evaluates the status of a condition dependency" on page 423
- "How the scheduler evaluates the status of a condition" on page 424
- "How the scheduler evaluates the status of the conditional successor operation" on page 424

This information can help you to understand how to customize conditions when defining your workflow to satisfy your requirements.

How to define a rule in a condition

You can require either of the following condition rules:

- All the condition dependencies must be true. This corresponds to the AND operator in the Boolean logic.
- At least n out of all the condition dependencies must be true. This corresponds to the OR operator in the Boolean logic.

Within each condition dependency contained in the condition, depending on the type of check that you require on the conditional predecessor, you can specify one of the following types of checks:

RC To check the conditional predecessor return code or abend. The return code can be either numeric or a string, for example OSUF. An abend can be either a system abend, represented by a string starting with S, or user abend, represented by a string starting with U.

ST To check the conditional predecessor status.

In the required check you can use one of the following logical operators:

GE Greater than or equal to. Valid only for RC condition type.

GT Greater than. Valid only for RC condition type.

LE Less than or equal to. Valid only for RC condition type.

LT Less than. Valid only for RC condition type.

EQ Equal to.

NE Not equal to. Use it to specify conditions on final statuses only C (Completed), E (Ended-in-error), or X (Suppressed by condition).

RG Range. Valid only for RC condition type.

Note: If you use the NOERROR or highest return code capabilities, the *original return code* is used to evaluate a condition dependency.

When the scheduler evaluates the status of a condition dependency

The status of condition dependencies and, consequently, the status of the condition to which they belong, is evaluated when the conditional predecessor has one of the following statuses:

S Started

E Ended in Error

C Completed

X Suppressed by Condition

or when a step-end event is received.

The condition dependency is evaluated only when a path in the plan exists, otherwise the condition dependency remains Undefined until a manual intervention or a Rerun is done.

A possible path for the conditional predecessor exists when at least one of the following conditions occurs:

- The job is set to C and a normal successor exists.
- There is at least one conditional successor that has all the subsets of conditions referencing that conditional predecessor true according to the condition rules.

How the scheduler evaluates the status of a condition dependency

Before evaluating a condition dependency, the scheduler considers the current existence of at least one possible path for progression.

Based on these evaluations, the condition dependency status can be:

U (Undefined)
When the check cannot be performed or when a possible path for progression does not exist in the plan.

T (True)
When both the following conditions occur:

- A possible path for progression exists in the plan.

- When the evaluation was made and the result matches the expected value.

F (False)
When both the following conditions occur:
- A possible path for progression exists in the plan.
- The evaluation was made and the result does not match the expected value.

How the scheduler evaluates the status of a condition

The condition status can be any of the following values:

U (Undefined)
When the rule cannot be evaluated yet.

T (True)

If the rule is set to AND
When ALL condition dependencies are true.

If the rule is set to OR (at least *n* condition dependencies must be true)
When at least *n* condition dependencies are true.

F (False)

If the rule is set to AND
When at least one condition dependency is false.

If the rule is set to OR (at least *n* condition dependencies must be true)
When at least *n* condition dependencies cannot be true.

How the scheduler evaluates the status of the conditional successor operation

Because the status of an operation depends on the status of its conditions and on the status of its normal predecessors, the status of an operation is set to one of the following values:

X (Suppressed by Condition)
When at least one condition is F (False).

Note: When evaluating conditional successors status, predecessor operations in status X are considered equal to predecessor operations in status C.

R (Ready)
When its normal predecessors are C or in X status and all its conditions are T (True).

W (Waiting)
When at least one normal predecessor is not C or X or at least one condition is U (Undefined).

Note: If you define both conditional and normal dependencies on an operation, the normal dependency is managed as a conditional dependency that is true when the status of the predecessor operation is C. For this reason, when conditions are defined, to have the predecessor operation completed successfully is not sufficient to let the successor operation start, but instead the following considerations are applied:

- The conditions can be evaluated because a path for progression exists in the plan.
- The status of all conditions is considered to calculate the conditional successor operation status.

Making an operation dependent on the status or return code of another operation

Use a job-level conditional dependency when you want a successor job to start depending on a combination of one or more return codes or statuses of predecessor jobs.

Figure 158 shows the two different types of job level conditions, one based on the predecessor return code and the other based on the predecessor job status.

For example, using the return code as condition type, you can define that operation OP2 is dependent on operation OP1, specifying that OP2 must run when OP1 ends with a return code in the range from 1 to 3.

For example, using the status as condition type, you can define that operation OP4 is dependent on operation OP3 , specifying that OP4 must run when OP3 status is E (Ended-in-error):

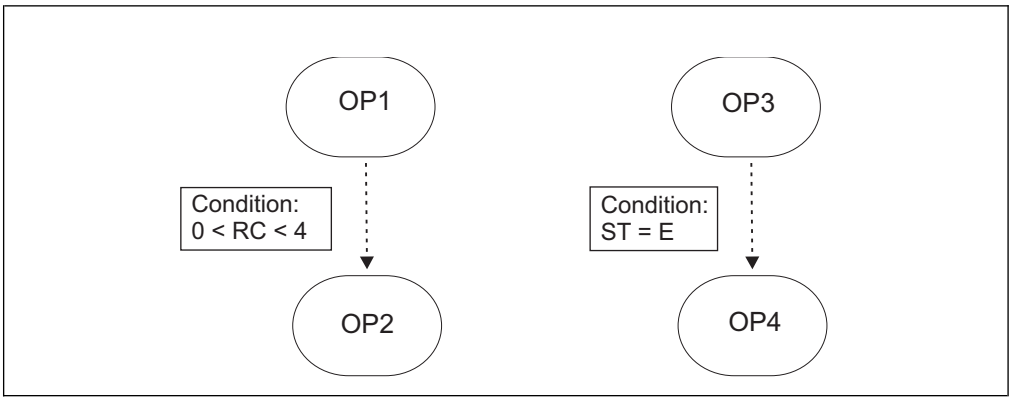


Figure 158. Example of a condition dependency definition

Examples of job conditional dependencies evaluation

This section contains an example showing how the operation processing flow is affected when using job-level conditions.

The workflow is required to run according to the following conditions:

- JOB1 ends successfully only when RC=0, RC=4, or RC=8 is returned. Any different result causes the job to end in error.
- JOB2 must run if JOB1 ends successfully with RC=4.
- JOB3 must run if JOB1 ends successfully with RC=8.
- JOB2 and JOB3 are skipped if JOB1 ends successfully with RC=0.
- JOB5 runs unconditionally when both JOB1 completes successfully and the two jobs, JOB2 and JOB3, are either completed or skipped.

To implement these requirements for the workflow, you can set the following conditions:

- Use NOERROR to force the JOB1 status to C (Completed) for RC=4 and RC=8.
- Make JOB5 a normal successor of JOB1, JOB2, and JOB3.
- Define a condition on JOB2, the conditional successor, to run it when JOB1 status is C and JOB1 RC=4.
- Define a condition on JOB3, the conditional successor, to run it when JOB1 status is C and JOB1 RC=8.

An alternative way to implement these requirements, without using the NOERROR function, is described in "An example of using recovery jobs to implement workflow" on page 441.

In Figure 159, dotted lines represent conditional dependencies and straight lines represent normal dependencies.

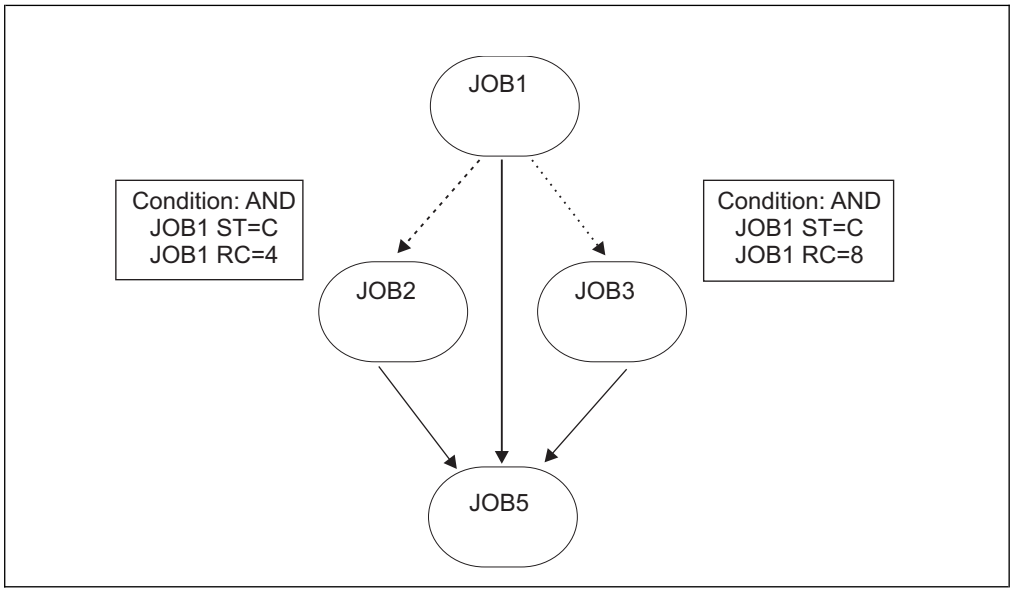


Figure 159. Example of conditioning operations

The operations processing proceeds based on the possible JOB1 status and return code:

JOB1 ends with status C and RC=0

Figure 160 on page 427 shows the operation processing flow:

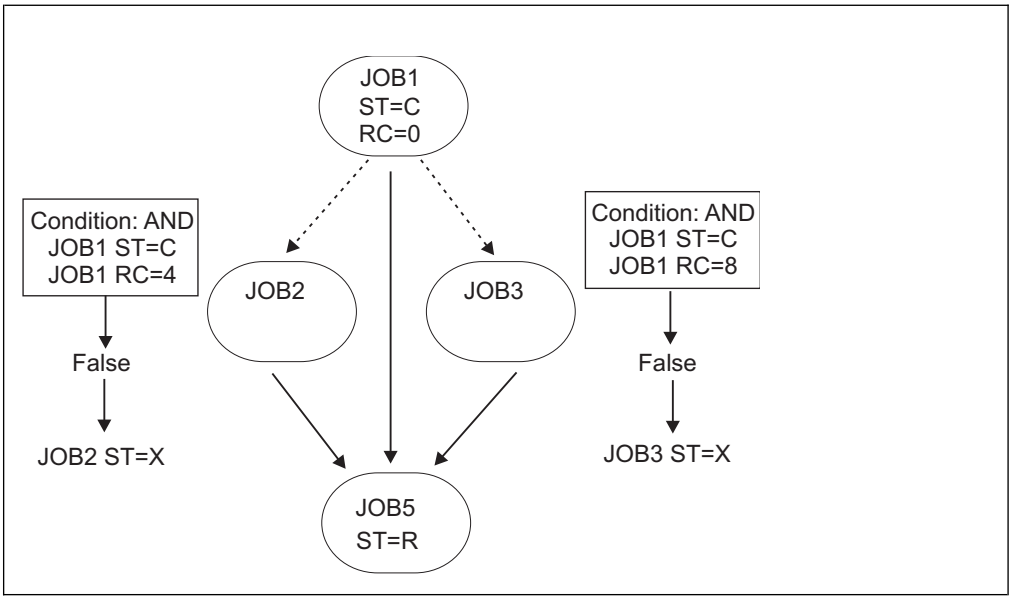


Figure 160. Successors status evaluation if JOB1 ends with status C and return code 0

A possible path exists because JOB1 has completed successfully and a normal successor, JOB5, exists. Because a path exists, the successor conditions can be evaluated.

- JOB1 condition is false because JOB1 return code is not 4. JOB2 status is set to X.
- JOB3 condition is false because JOB1 return code is not 8. JOB3 status is set to X.
- JOB5 has three predecessors with statuses C, X, and X so JOB5 status becomes R (Ready).

JOB1 ends with status C and RC=4; JOB2 runs successfully

Figure 161 shows the operation processing flow:

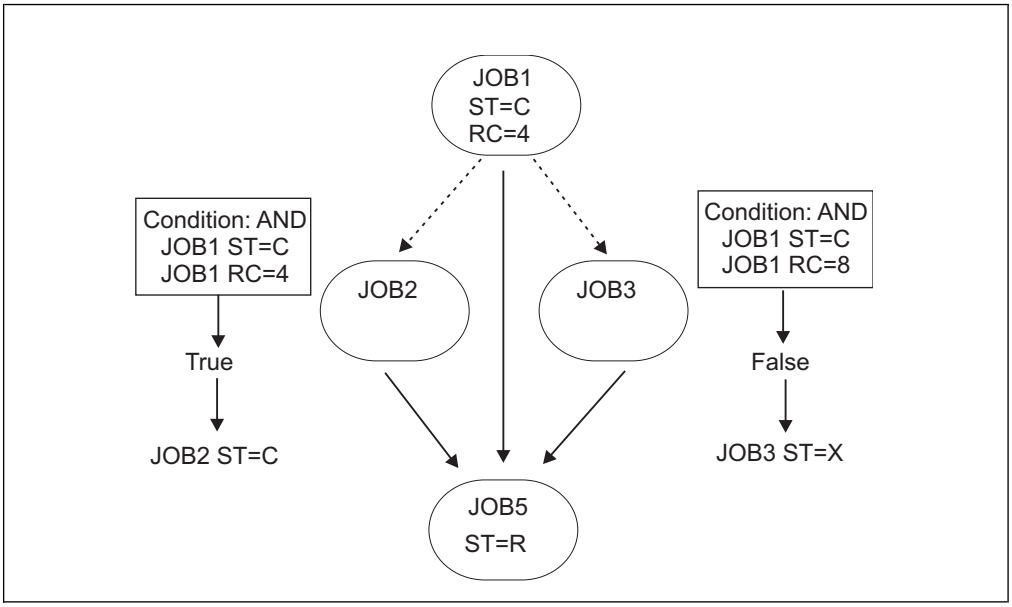


Figure 161. Successors status evaluation if JOB1 ends with status C and return code 4 and JOB2 runs successfully

A possible path exists because JOB1 has completed successfully and a normal successor, JOB5, exists. Because a path exists, the successor conditions can be evaluated.

- JOB2 condition is true because JOB1 status is C and RC=4. JOB2 status runs and then successfully completes.
- JOB3 condition is false because JOB1 return code is not 8. JOB3 status is set to X.
- JOB5 has three predecessors with statuses C, C, and X so JOB5 status becomes R.

JOB1 ends with status C and RC=4; JOB2 ends in error

Figure 162 shows the operation processing flow:

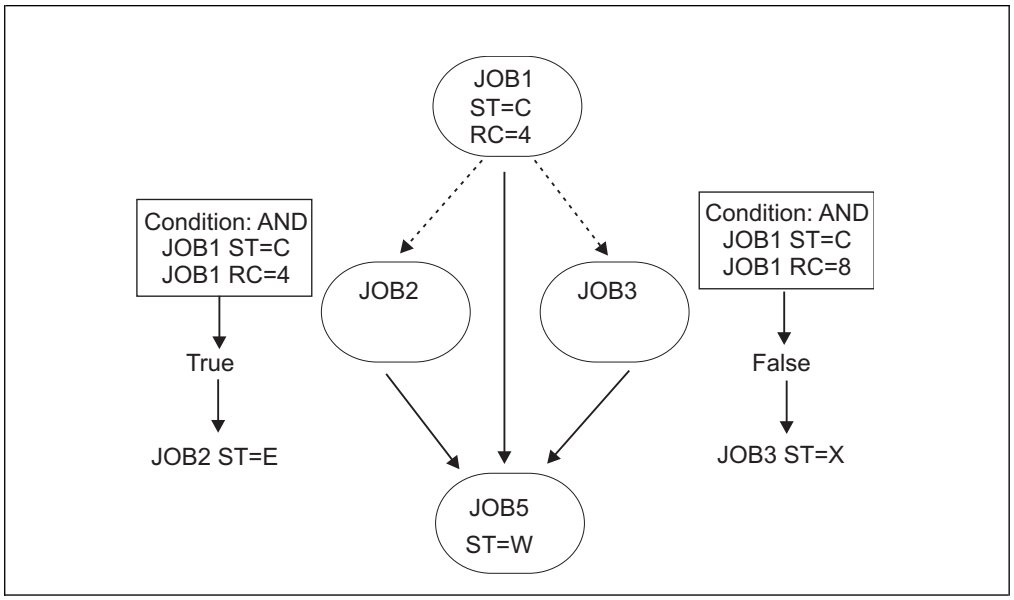


Figure 162. Successors status evaluation if JOB1 ends with status C and return code 4 and JOB2 ends in error

A possible path exists because JOB1 has completed successfully and a normal successor, JOB5, exists. Because a path exists, the successor conditions can be evaluated.

- JOB2 condition is true because JOB1 status is C and RC=4. JOB2 runs, but ends in error
- JOB3 condition is false because JOB1 return code is not 8. JOB3 status is set to X.
- JOB5 has three predecessors with statuses C, E, and X so JOB5 status is set to W(Wait).

Now the operator can examine the reason why JOB2 failed and then either rerun the occurrence or fix the error and continue the processing.

JOB1 ends with status E and RC=U2345

Figure 163 on page 429 shows the operation processing flow:

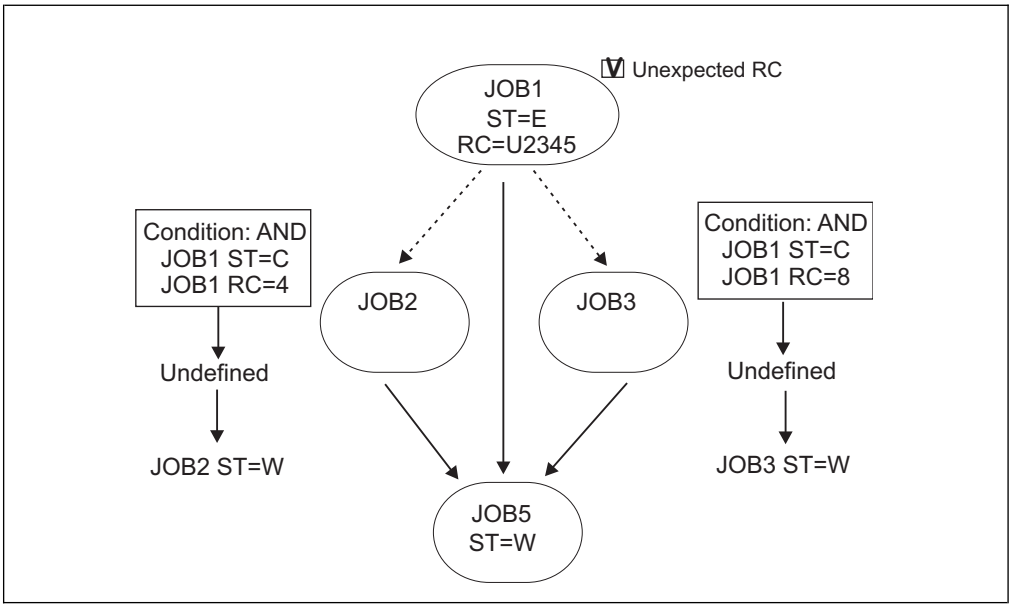


Figure 163. Successors status evaluation if JOB1 ends with status E and return code U2345

In this case no path for progression exists in the plan, therefore the conditions evaluations cannot be finalized.

- The condition on JOB2 is left U (Undefined), even though both condition dependencies are false. JOB2 status is set to W.
- The condition on JOB2 is left undefined, even though both condition dependencies are false. JOB3 status is set to W.
- JOB5 has three predecessors with statuses E, W, and W. JOB5 status is set to W.
- JOB1 is marked with the Unexpected RC flag and the warning message EQQE141W is logged in the Controller MLOG and in the system log.

Now the operator can examine the reason why JOB1 failed, check if the condition definitions are correct, and then either rerun the occurrence or fix the error and continue the processing.

Job conditional dependencies key concepts and restrictions

Consider the following key concepts when using conditional dependencies:

- You cannot have mixed combinations of AND and OR operators within the same condition, but you can define more than one conditional dependency on a single operation and link them using dummy operations.
- Because internal and external dependencies are managed differently in IBM Workload Scheduler for z/OS, it is important to know that conditional dependencies are considered to be external dependencies, even if they link operations belonging to the same application occurrence in the plan. This means that:
  - Because all operations belonging to the same application must be chained using normal dependencies, in some cases it might be necessary to provide a common normal predecessor or successor to the conditional predecessor and conditional successor operations to join the operations together. For more information, see "How to ensure application consistency using FOP" on page 430.
  - Within the same application you cannot define an operation both as conditional predecessor and as a normal predecessor for a specific operation.

  - When adding an occurrence to the plan, set Dependency Resolution to YES to add conditions even if they involve only internal predecessors. To set the Dependency Resolution to YES when the condition addition is the result of a match in the ETT criteria, you must set the value in the DR column to Y in the definition of the ETT Tracking Criteria.
- You cannot change the status of an operation, out of rerun path, if you have a condition on it which is not True. This is because a condition whose status is not T (True) is equivalent to an external predecessor that is not C (Completed).
- You cannot change the status of an operation, out of Rerun path, if you have a conditional successor in status C, X, E, or S. This is because you cannot have a successor that is already processed, successfully or not.
- You cannot use conditional dependencies on a non-centralized end-to-end operation because the IBM Workload Scheduler Symphony file does not support conditional dependency. However, you can specify an end-to-end operation as a conditional predecessor.

How to ensure application consistency using FOP

About this task

The scheduler informs you, by issuing an "APPLICATION INCONSISTENT" message when trying to save your application, if a common dependency might be needed to link either side of a condition relationship. You can do this by using a dummy operation on a non-reporting general workstation or by using an actual predecessor of the conditional predecessor operation, if one already exists within the same application.

For example, Figure 164 shows an example that would cause an "APPLICATION INCONSISTENT" message to be displayed because JOB4 has only one predecessor, which is conditional.

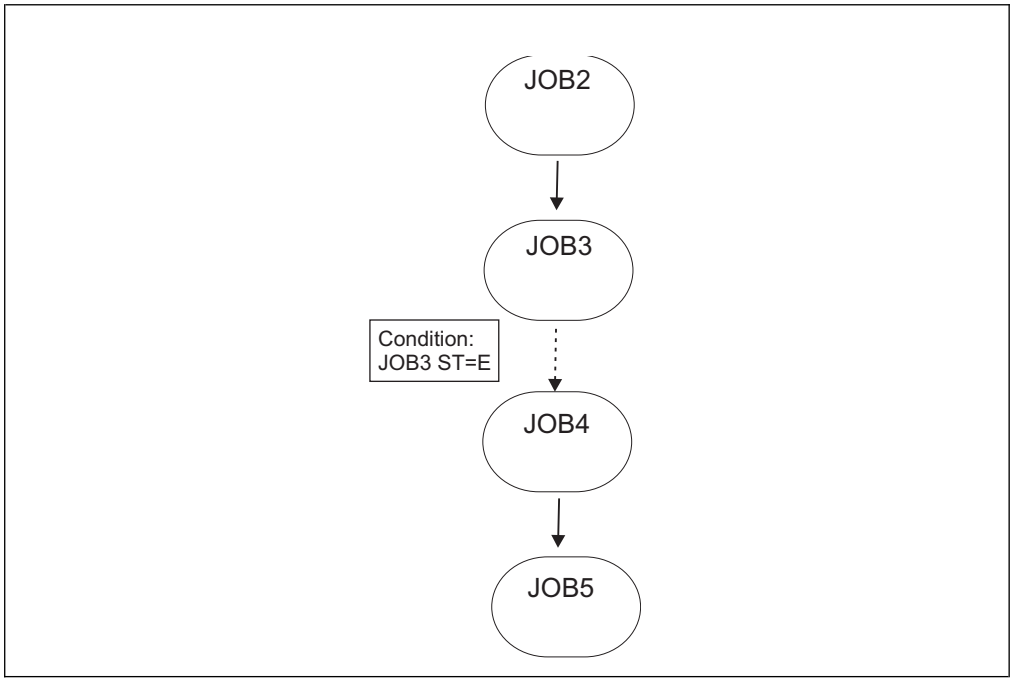


Figure 164. An example of APPLICATION INCONSISTENT problem

To avoid the APPLICATION INCONSISTENT error from occurring, without modifying the job processing flow and logic within the application, it is sufficient to make the following changes:

1. Add a dummy operation JOB1 as First Operation (FOP).
2. Set JOB1 as normal predecessor for JOB2, so that JOB1 is completed as soon as the occurrence starts to run.
3. Set JOB1 as normal predecessor for JOB4, and also for all operations that have only conditional predecessors.

For more information about using a FOP operation, see Chapter 27, "Loop detection and analysis," on page 549. Figure 165 shows the result of these changes:

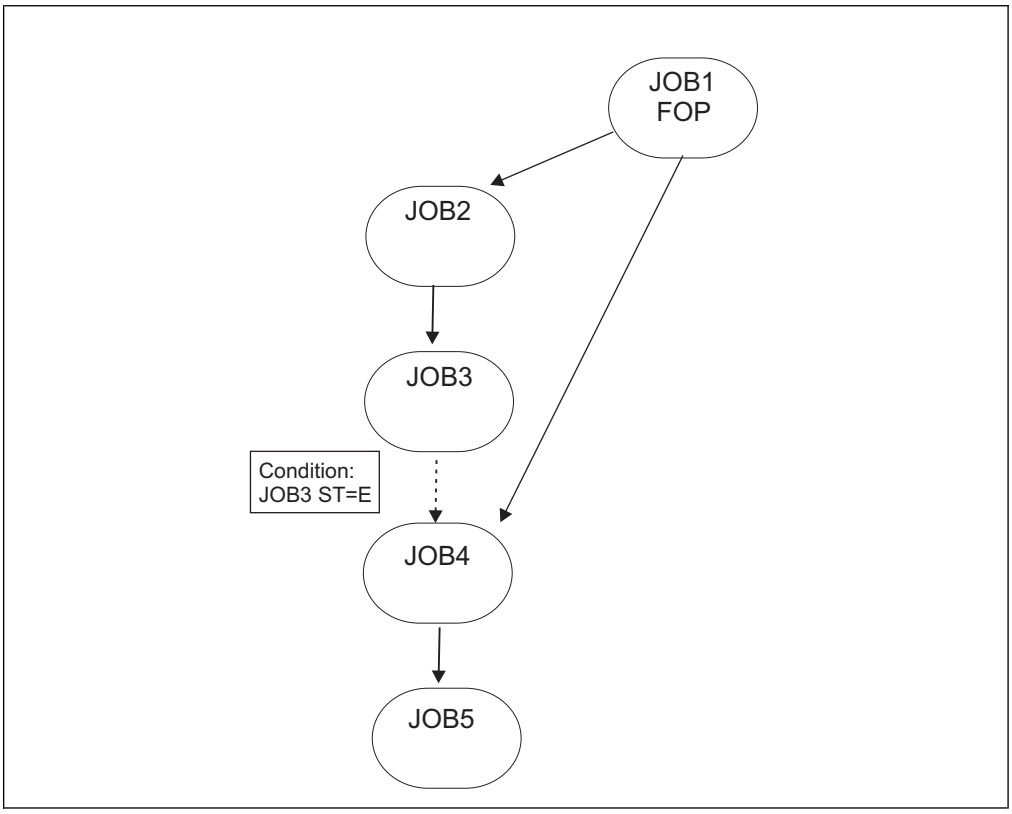


Figure 165. An example of how to fix an APPLICATION INCONSISTENT problem

Making an operation dependent on another operation step return code

In IBM Workload Scheduler for z/OS, jobs can comprise several steps whose return codes might condition the start of successor jobs.

In some instances the business logic might mean that a successor to a long running job could, in theory, actually start on the completion of a step part way through the long running job, instead of waiting for the entire predecessor job to complete. Traditional dependencies force you to wait for the entire job to complete, thereby incurring extra time that could be saved if the successor could start in parallel part way through the long running job.

With job-level condition dependencies, it is possible to split the long running JCL into smaller jobs, thereby allowing more parallel processing, and a more granular visibility of the workflow. In some cases though, it is not possible to split a large job into smaller components.

If the long running job cannot be split, a successor job can be made dependent on a step within a long running job using *step-level condition dependencies*. This means that the successor is allowed to start, if the named step completes with stated return codes, before the entire long running job completes, shortening overall processing time.

Step-level condition dependencies apply only to operation step-end return codes and, if a possible path for progression exists in the plan, are evaluated as soon as that step-end return code is generated.

As for job-level condition dependencies, step-level conditional dependencies can be added in the plan at run time and monitored from the ISPF panels and from the Dynamic Workload Console.

Note: By default IBM Workload Scheduler for z/OS tracks job processing using appropriate events about job start and job end. If you want to use the step dependency capability, configure IBM Workload Scheduler for z/OS to track step-end events. See "How to activate step dependency evaluation" on page 433 for more information.

How to identify a step

A step has the following identifiers:

STEPNAME
It is the procedure invocation step name. It is blank if the step is not in a procedure.

PROCSTEP
It is the step name in the JCL procedure or the job step name if the step is not in a procedure.

The following rules apply to these step identifiers:

- If you specify blank for both STEPNAME and PROCSTEP, the return code dependency applies to the entire job.
- The combination of STEPNAME blank and PROCSTEP not blank is not supported.

When you define or change a step-level dependency in the database or in the current plan:

- Do not specify a step that is duplicated in the corresponding JCL.
- Consider that blank PROCSTEP and STEPNAME delays the check at job completion time.

Note: The scheduler cannot check the actual step names in the JCL, which might be located in any user library of the tracker system and updated independently of the database definitions.

How to activate step dependency evaluation

If you want the scheduler to check step dependencies, you must ensure that the event writer options, defined by using the EWTROPTS initialization statement, contain one of the following parameters:

- STEPEVENTS(ALL)
- SDEPFILTER

If you want to use the SDEPFILTER parameter, you must define the programmer name keyword in the JOB card of any JCL corresponding to a condition dependency at step level. The SDEPFILTER parameter must specify a selected subset of the programmer name keyword. For more information about how to set the SDEPFILTER parameter, see *Customization and Tuning*.

Note: Use the SDEPFILTER parameter as an alternative to the STEPEVENTS(ALL) if you want to reduce the load on scheduling performance.

How a step dependency is evaluated

The scheduler considers the step entries segment of the current plan job name table to obtain updated results about step-end events.

The step dependency is evaluated at step-end time or at job-end time, including jobs manually set to C (Complete) or E (Ended-in-error), whenever no step-end information is available.

The criteria used to evaluate a step dependency are the same as those described in "Evaluating conditions and conditional successor status" on page 422, with the following two exceptions:

- The return code (RC) is the only valid check for step dependency.
- If at job-end time the step dependency is not yet evaluated the evaluation is made as described in the following section "How the evaluation is done when no step-end event is received."

How the evaluation is done when no step-end event is received

It might happen that, at job-end time, a step dependency is not yet evaluated, because the event writer did not receive the step-end event for one of the following reasons:

Configuration error
The EWTROPTS initialization statement, for the tracker event-writer task, does not activate the step-end event generation.

Definition error
There is an error in the step dependency definition. For example, the step name specified in the dependency definition does not match any step in the JCL that actually ran.

In both cases the scheduler does the following actions:

- Sets the condition to U (Undefined) status.
- Marks the condition with the missing step-end flag.
- Logs the EQQE127W message in the controller MLOG and in the system log.
- Keeps the status of the conditional successor as W (Wait).

From the ISPF panels you can do the following actions to manage your workload if a missing step-end occurs:

Monitor missing step-end information
A column in the condition dependency list identifies the single dependencies that are undefined because of missing step-end information. For details, see the description of the BROWSING CONDITION DEPENDENCIES panel in Figure 180 on page 448.

Reset the step dependency status
You are allowed to reset the U (Unresolved) step dependency to T (True) or F (False) in the current plan using a row command. For more information, see "Changing and adding conditional dependencies" on page 599.

Examples of step-level conditional dependencies evaluation

If you configured IBM Workload Scheduler for z/OS to track step-end events, then the step dependencies are checked at step-end time when the return code value is available.

This section contains an example showing how operation processing flow is affected when using step-level conditions.

Figure 166 shows an example of conditional dependency logic at job step level. In the figure, dotted lines represent conditional dependencies and straight lines represent normal dependencies.

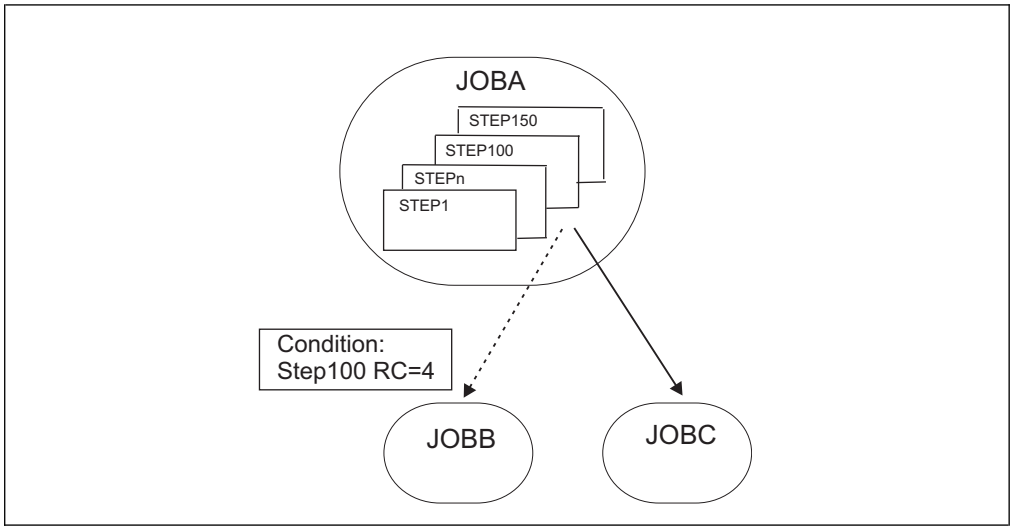


Figure 166. Example of step-level dependency

In this example:

- JOBB can start if STEP100, belonging to JOBA, ends with RC=4.
- JOBC is a normal successor of JOBA and therefore starts if JOBA status is C (Completed).

The operation processing proceeds based on possible STEP100 return codes and `JOB_A` statuses:

STEP100 ends with RC=4; JOBA status is not yet completed
Figure 167 on page 435 shows the operation processing flow:

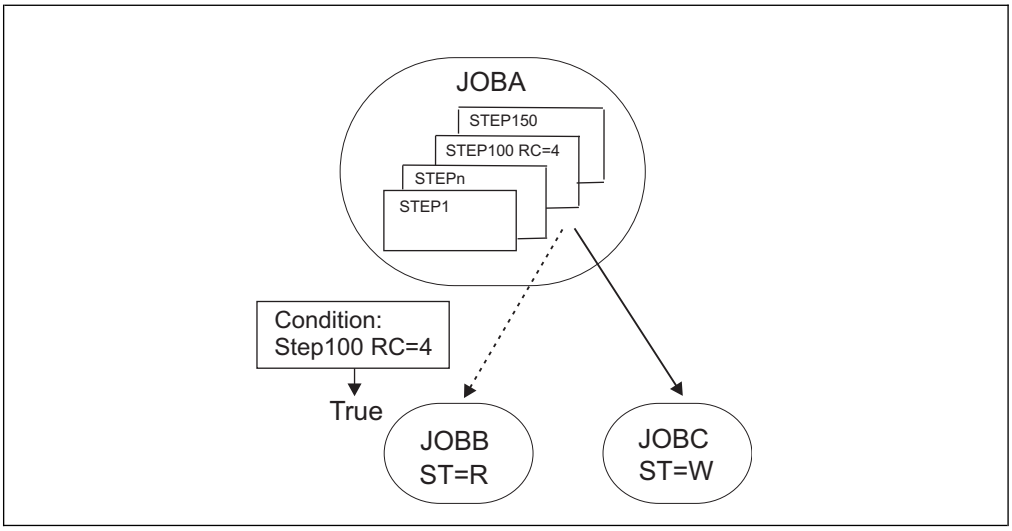


Figure 167. Step dependency status evaluation if Step100 ends with return code 4 and JOBA status is not yet completed

A possible path exists because the step dependency is true and therefore a conditional successor exists. The successor conditions can be evaluated.

JOBB can start processing, if free from other dependencies, even if JOBA has not yet ended processing.

STEP100 ends with RC=8; JOBA status is not yet completed

Figure 168 shows the operation processing flow:

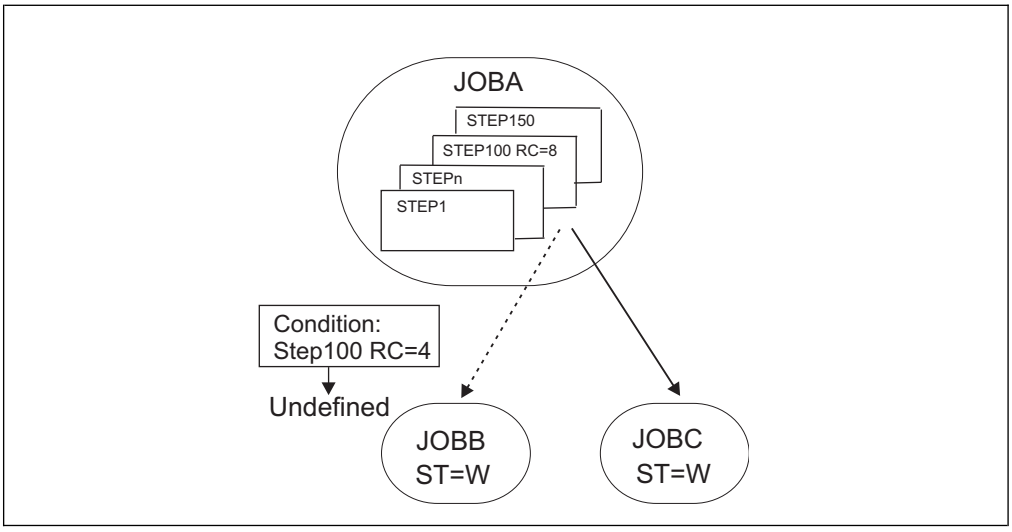


Figure 168. Step dependency status evaluation if Step100 ends with return code 8 and JOBA status is not yet completed

Even though STEP100 ended with a return code different from 4, the successor conditions cannot be evaluated yet because JOBA is not completed and so an existing path in the plan does not exist.

- The step-level condition is set to U (Undefined).
- JOBB status is set to W (Wait).

The condition is evaluated again as soon as JOBA ends processing.

STEP100 ends with RC=8; JOBA ends successfully

Figure 169 shows the operation processing flow:

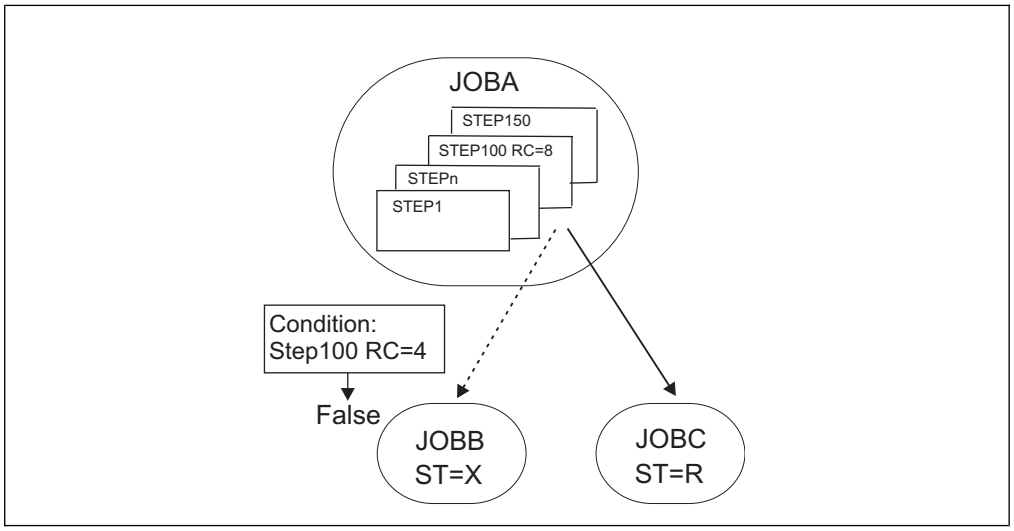


Figure 169. Step dependency status evaluation if Step100 ends with return code 8 and JOBA ends successfully

A possible path exists because JOBA has completed successfully and a normal successor, JOBC, exists. The step-level condition is evaluated again.

- JOBC can start processing, if free from other dependencies.
- The step-level condition status is set to F (False).
- JOBB status is set to X (Suppressed by condition).

STEP100 ends with RC=8; JOBA ends in error

Figure 170 shows the operation processing flow:

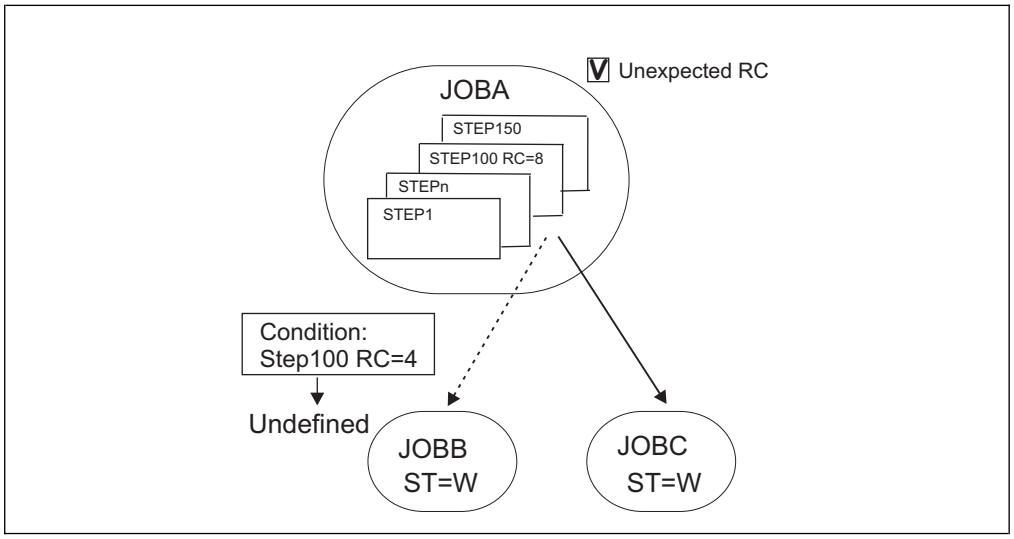


Figure 170. Step dependency status evaluation if Step100 ends with return code 8 and JOBA ends in error

In this case a possible path in the plan does not exist.

- JOBA ended in error, therefore its normal successor, JOBC is set to W (Wait).

- The step-level condition is not evaluated again and so its status remains U (Undefined) and JOBB status remains W (Wait).
- JOBA is marked with the Unexpected RC flag and the warning message EQQE142W is logged in the controller MLOG and in the system log.

Now the operator can examine the reason why JOBA failed and then either rerun the occurrence or fix the error and continue the processing.

No step-end event is received for STEP100; JOBA ends successfully

Figure 171 shows the operation processing flow:

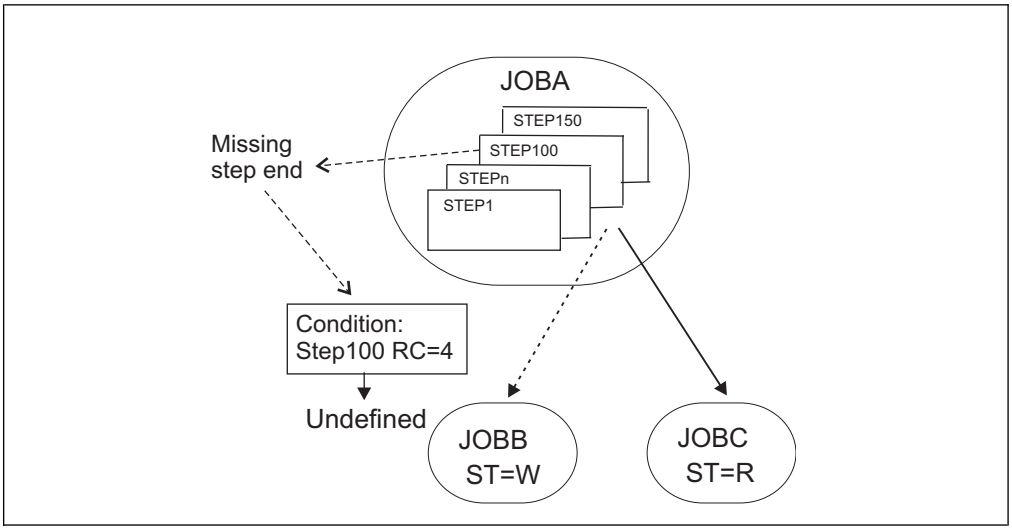


Figure 171. Step dependency status evaluation if no step-end event is received for Step100 and JobA ends successfully

A possible path exists because JOBA has completed successfully and a normal successor, JOBC, exists.

- JOBC can start processing, if free from other dependencies.
- The step-level condition is left U (Undefined) and the warning message EQQE127W is logged in the controller MLOG and in the system log.
- JOBB status remains W.

No step-end event is received for STEP100; JOBA ends in error

Figure 172 on page 438 shows the operation processing flow:

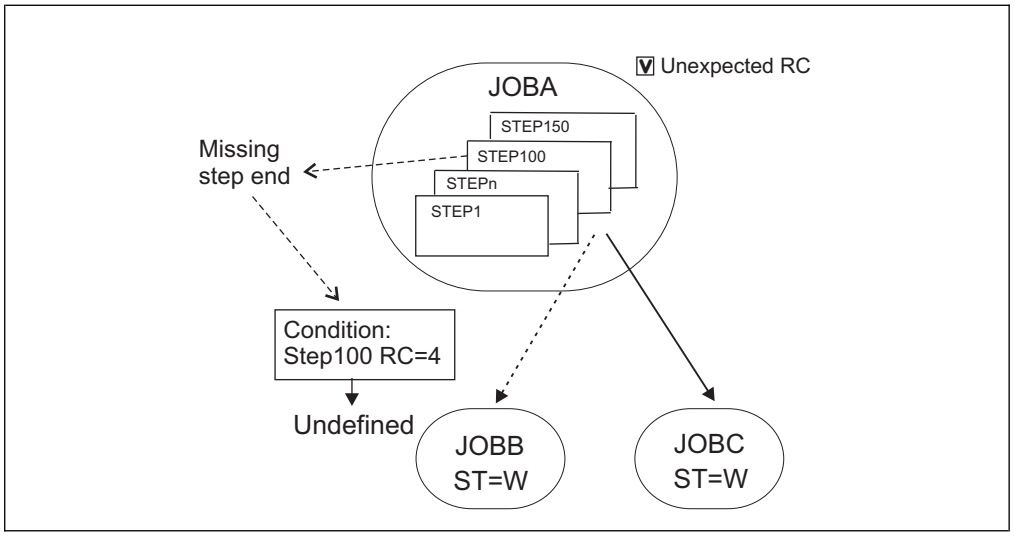


Figure 172. Step dependency status evaluation if no step-end event is received for Step100 and JOBA ends in error

In this case a possible path in the plan does not exist:

- JOBC status remains W (Wait).
- The step-level condition is left as U (Undefined) and the warning message EQQE127W is logged in the controller MLOG and in the system log.
- JOBB status remains W.
- JOBA is marked with the Unexpected RC flag and the EQQE141W message is logged.

How to condition the status of operations with predecessors in X status

An operation in X status is equivalent to a NOPED operation; it does not run but its normal successors can start.

This section describes two possible ways to condition the status of operations with predecessor operations in X status.

How to propagate the X status in a branch

You might want to modify how the X (Suppressed by condition) status is managed, for example, by allowing the X status to be propagated along a whole branch. To do this you must link operation successors using condition on predecessor status C (Completed), as displayed in Figure 173 on page 439:

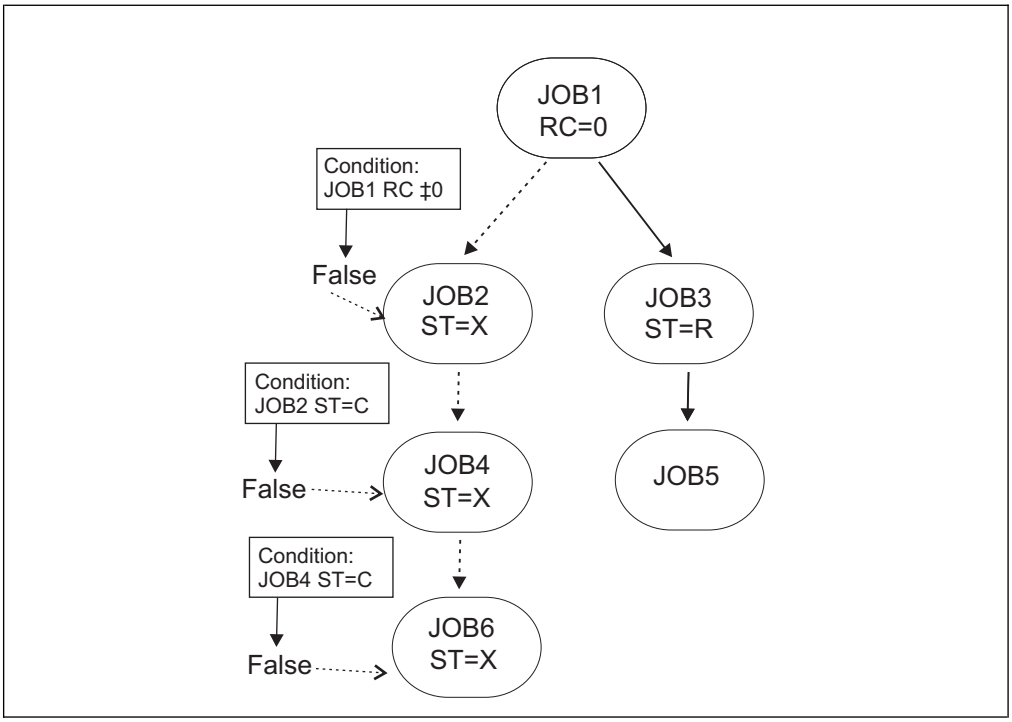


Figure 173. An example of X status propagation

A possible path exists because JOB1 is completed and a normal successor, JOB3, exists. The successor conditions can be evaluated.

- JOB2 condition is false because JOB1 return code is 0. JOB2 status is set to X.
- JOB4 condition is false because JOB2 status is not C. JOB4 status is set to X.
- JOB6 condition is false because JOB4 status is not C. JOB6 status is set to X.

In this way you can propagate the X status in the branch.

How to set to W the status of an operation with predecessors in X status

You might want to modify how the X (Suppressed by condition) status is managed, for example, by allowing the status of the successor to become W (Wait) if the status of the predecessor is X. Figure 174 on page 440 shows how you do this:

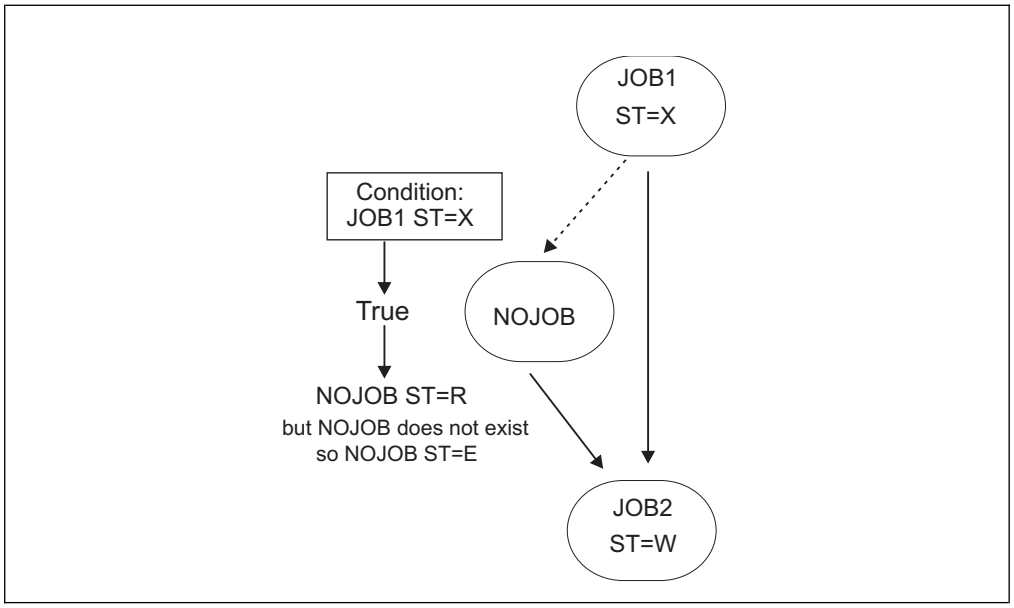


Figure 174. An example of how to set to W the status of an operation with predecessors in X status

This example uses as conditional successor a non-existing NOJOB operation so that, when the scheduler tries to run, it fails and the NOJOB operation status is set to E (Ended-in-error).

- JOB2 condition is true because JOB1 status is X. NOJOB can start.
- NOJOB status is set to E because the operation does not exist in the database.
- JOB2 status is set to W.

Note: To accomplish the same result, avoiding to collect an error message because of the non-existing job, you can use a General Completion Only workstation.

Handling recovery using conditional dependencies

Using conditional dependencies, the error status of a job can be used as a criteria for starting a successor, when this successor is used as a recovery job.

By setting to Y the *COND RECOVERY JOB* option for an operation, you define that the operation is used as the recovery job for a conditional predecessor.

Any conditional predecessor that Ended-in-Error, with a status or error code matching a condition dependency defined for the job, does not prevent the daily plan process from removing the occurrence to which the predecessor belongs. To check if the status E (Ended-in-error) can be ignored at occurrence removal phase, the daily plan process uses a field automatically set by the scheduler, corresponding to the *Recovered by COND* output field in the browsing operation flow.

Note: As soon as a recovery job becomes ready, the scheduler checks the predecessors in error status at that time. Any predecessor that ends in error after the recovery job runs cannot be flagged as Recovered by COND.

The daily plan process removes the occurrence in the following cases:

- The occurrence status is C (Completed).

- The occurrence status is E (Ended-in-error), and includes only operations in one of the following statuses:
  - C
  - X (Suppressed by condition)
  - E, with the Recovered by COND field set to Y.

For example, suppose that either JOBR1 or JOBR2 must run when JOBB ends with an error. You can specify JOBB as their conditional predecessor, according to Figure 175:

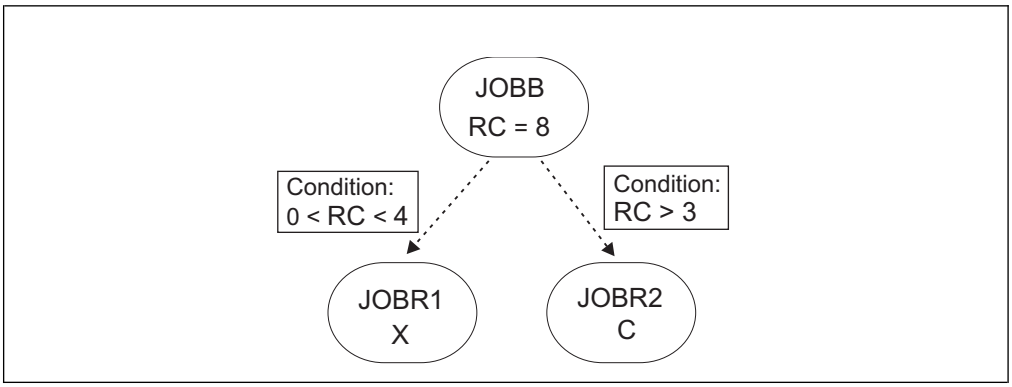


Figure 175. Basic example of condition dependencies for recovery jobs

When defining JOBR1 and JOBR2 and specifying JOBB as conditional predecessor, you can also set the COND RECOVERY JOB option to Y in the AUTOMATIC OPTIONS of JOBR1 and JOBR2, so that the daily plan process removes the occurrence containing JOBB, because it ended with an error code matching one of the defined condition dependencies.

An example of using recovery jobs to implement workflow

This section describes how you can implement the scenario described in "Examples of job conditional dependencies evaluation" on page 425 by using recovery jobs instead of the NOERROR function.

These are the requirements that the workflow must satisfy:

- JOB1 ends successfully only when RC=0, RC=4, or RC=8 is returned. Any different result causes the job to end in error.
- JOB2 must run if JOB1 ends successfully with RC=4.
- J0B3 must run if JOB1 ends successfully with RC=8.
- JOB2 and JOB3 are skipped if JOB1 ends successfully with RC=0.
- JOB53 runs unconditionally when JOB1 completes successfully and the two jobs, JOB2 and JOB3, are either completed or skipped.

Figure 176 on page 442 shows how you can customize the workflow to implement its requirements using recovery jobs. In the figure dotted lines represent conditional dependencies.

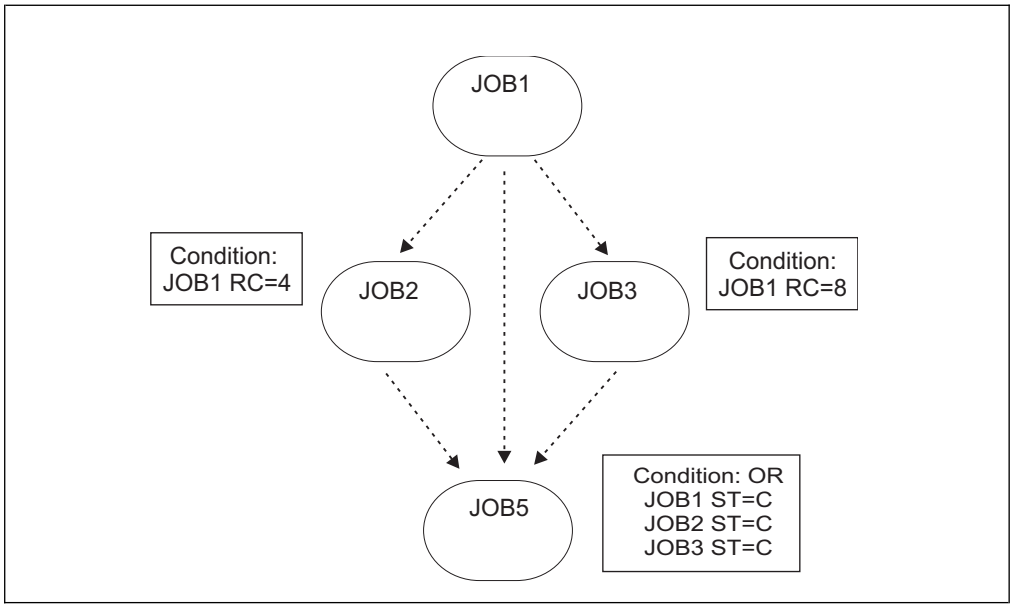


Figure 176. Example of conditioning operations using recovery jobs

Define the workflow in the following way:

- Set JOB2 as recovery job for JOB1, specifying that JOB2 must run if JOB1 RC=4.
- Set JOB3 as recovery job for JOB1, specifying that JOB3 must run if JOB1 RC=8.
- Define a condition on JOB5 specifying that JOB5 must run if the status of one among JOB1, JOB2, and JOB3 is C.

An example of handling recovery in an end-to-end environment

If an operation has a conditional predecessor to be run on a fault-tolerant workstation, the scheduler takes into account any RECOVERY statement defined in the SCRPTLIB member related to this predecessor. If there is a RECOVERY statement defined, the scheduler postpones the evaluation of the condition according to the following logic:

- If the conditional dependency check is based on the status value C (Completed) or E (Ended-in-error):
  - If the recovery option is STOP or CONTINUE, the scheduler evaluates the condition when the recovery job, specified through the JOBCMD or JOBSCR parameter, ends. If there is no recovery job specified, the scheduler evaluates the condition after the reply to the prompt.
  - If the recovery option is RERUN, the scheduler evaluates the condition only if the rerun succeeds.
- If the conditional dependency check is based on the status value S (Started), the scheduler evaluates the condition immediately. If the recovery option is RERUN, the condition status is not reset after the rerun.

For details about the RECOVERY statement, see *Scheduling End-to-end with Fault Tolerance Capabilities*, Chapter 3 *Customizing*, section *Defining centralized and non-centralized scripts*, topic *Configuring the SCRPTLIB*.

Interactions with other functions

This section contains useful information if you use any of the following functions:

Automatic Recovery
If an operation has conditional successors defined, check that the related JCL does not contain automatic recovery statements that cause the job to be restarted.

Restart and cleanup
The same restrictions apply as for changing the operation status to ready by selecting option 6 (GENERAL) from the MODIFYING AN OPERATION IN THE CURRENT PLAN panel. See also "MCP consistency rules."

In particular, a step or job restart request might result in a request to change to ready the status of an operation with conditional successors already started, completed, suppressed by condition, or ended in error. In this case the scheduler issues message EQQM208E. Only when rerunning an occurrence might you indirectly have this kind of change.

NOERROR or highest return code
If you use the NOERROR or highest return code capabilities, the scheduler saves the original return code when setting an operation to complete. It then uses the original return code to evaluate a condition dependency.

You can display the original return code when listing operations interactively, by using the ISPF dialog or Dynamic Workload Console, or through batch programs, by using a PIF application or BCIT.

Critical path handling
When processing a critical path, the scheduler considers that a job, with any conditional predecessor defined, breaks the critical path. Therefore avoid using critical jobs with conditional predecessors.

However, given a critical job, the scheduler updates the related hot list with any critical job predecessor ended in status X (Suppressed by condition).

MCP consistency rules

When you add work to the plan on request, the scheduler typically handles operation conditions as external objects. Some checks and restrictions, that are valid for external predecessors, are valid also for conditions. In particular, this applies for:

Status change consistency:

- You cannot directly change the status of an operation with undefined or false conditions (the scheduler applies the same checks as it does for not completed external predecessors). Only when rerunning an occurrence might you indirectly have this kind of change.
- You cannot directly change the status of an operation with external or conditional successors that are already S (Started), C (Completed), X (Suppressed by condition), or E (Ended in error). Only when rerunning an occurrence might you indirectly have this kind of change.

Dependency resolution:
When adding an occurrence to the current plan, you must require the dependency resolution if you want to add also the related conditions, even for conditions that specify only internal predecessors. For details, see "Including dependencies defined in the database" on page 594.

The following sections highlight other impacts of condition definitions on some main MCP functions.

Rerunning an occurrence

By rerunning an occurrence, you can reset conditional successors that have already completed.

If you selected an operation as restart point, the scheduler automatically perform the following actions:

- Modifies the status of conditional successors to W (Wait). Their conditions, if any, are forced to U (Undefined). The condition extended status is set to *Forced by rerun*.
- Modifies the status of conditional predecessors to C (Completed) until a conditional predecessor with status C is found. Their conditions, if any, are forced to T (True). The condition extended status is set to Forced by rerun.
- Because the X (Suppressed by condition) status is a final status equivalent to C status, the modification of conditional predecessors status stops also when a conditional predecessor with status X is found. In this case, the condition is left as F (False) and the extended status of the condition is set to Forced by rerun.

For more details, see "Rerunning an occurrence in the current plan from a specific operation" on page 603.

Setting an occurrence to waiting

The same rules apply as described in "MCP consistency rules" on page 443.

If the selected occurrence has conditional successors, the scheduler might reset the related conditions to undefined.

For more details, see "Restarting an occurrence from the beginning" on page 602.

Setting an occurrence to complete

Setting an occurrence to C (Completed) is equivalent to setting to C each single operation in the occurrence. All possible incongruences in both normal and conditional dependencies are adjusted.

The successors conditions that are already evaluated are not evaluated again to avoid running alternative branches out of rerun path. The conditions that must be evaluated again are marked with extended status *Frozen by Complete*.

For example, suppose that you have the following two occurrences, A and B , each containing only one operation, A-001 and B-002. You define a condition on B-002 saying that B-002 runs if A-001 ends in error. If A-001 ends in error: the condition is evaluated as true and the B-002 status is set to ready.

Then, if you decide to manually set to complete the job occurrence A-001 the condition on B-002 remains true, but its extended status is set to *Frozen by Complete*.

For more details, see "Completing an application occurrence" on page 606.

Deleting an operation or an occurrence

Unlike the behavior for normal dependencies, when you delete an operation or an occurrence containing operations referenced in a condition as conditional predecessor or conditional successor jobs, the scheduler does not redefine the rule criteria to avoid workflow propagation tree from breaking.

This is how the scheduler manages condition dependencies for which the deleted operation is the conditional predecessor:

If the condition status has already been evaluated T (True) or F (False)
All condition dependencies are kept and the condition dependencies whose predecessor is the deleted job are marked as removed.

If the condition status is undefined (some condition dependencies have not been evaluated yet)

- Evaluated condition dependencies whose predecessor is the deleted job are marked as removed.
- Non-evaluated condition dependencies whose predecessor is the deleted job are deleted from the condition.

If the deleted job is the conditional successor job the condition is deleted.

Monitoring conditions in the current plan

Condition dependencies introduce a different logic in how job processing is run across the plan. For example, it allows you to start an operation even if its conditional predecessor has just started or ended in error.

The following sections provide you with some examples of how to use ISPF panels both to check if job processing is blocked and to see if a job that ended in error is preventing job processing from continuing.

How to look for operations that ended in error

The ERROR LIST panel (EQQMEP1L / EQQMEP2L) lists jobs that ended in error and provides you with other important information to understand if that error is preventing job processing from proceeding.

Figure 177 shows you how the information about the jobs that ended in error is displayed if you use the default layout TWSZOS:

```
Cmd Jobname  no. Ia date  Ia time Errc xRC CoRj RbyCo CPR£ PR£  CSU£ SU£  SR£
------------------------------------------------------------------------------
''' ROXJOB1    1 00/03/22 00.00   2134 Y   N    N        0    0    2    0   0
''' ROXJOB2    3 02/03/19 12.02   S806 N   N    N        0    0    1    1   0
''' ROXJOB3    1 03/03/22 01.00   5134 N   N    N        0    0    0    1   0
****************************** Bottom of data ********************************
```

Figure 177. EQQMEP1L - Left side of the Error List panel

The error code is displayed in the ERRC column.

The right side of the panel, accessible by typing RIGHT, provides you with additional information such as the occurrence the job belongs to, the workstation, and the execution destination. By typing LEFT you see again the left side of the panel.

How to see if an operation that ended in error prevents job processing from proceeding

In the ERROR LIST panel you can see if the job listed in the JOBNAME column might prevent successor jobs from running by looking at the values in the CSU£ and SU£ columns.

How to check if conditional successors are prevented from running

In the CSU£ column you see the number of conditional successors for the job displayed in the JOBNAME column. If this number is 0, then that job has no conditional successors. If the number is greater than 0, then the job has conditional successors and their status depends on how the rule is set in the condition.

The Unexpected RC field XRC indicates if something unexpected occurred and leaves some conditions in Undefined status preventing conditional successors from running.

The job processing is blocked if CSU£ is greater than 0 and the value listed under the XRC column is set to Y.

You can filter by XRC (Unexpected RC) both on ERROR LIST (ISPF 5.4 or 6.4) and OPERATION LIST (ISPF 5.3 or 6.3) panels. For each operation listed, you can check conditional successors and their conditions by using the row command I from error list or B from operation list. The OPERATION DETAILS panel `EQQSOPSP` is displayed and gives you additional information about what was incorrect or unexpected in the path.

To investigate in more detail you can also look for warning messages EQQE141W and EQQE142W issued in `EQQMLOG` and in the console log.

Note: When messages EQQE127W and EQQE141W are issued a manual intervention is required to allow job processing to proceed.

If you find, the message EQQE142W in the log, it means that, when the step-end event, identified in the message text by STEPNAME PROCSTEP, was received, the scheduler evaluated that existing conditional and normal successors would never have run due to conditions definitions. For example, see the example in “Examples of step-level conditional dependencies evaluation” on page 434.

If you find the message EQQE141W in the log, one of the following events occurred:

- When the status of the job indicated in the message became ST, the scheduler evaluated that existing conditional and normal successors would never have run due to conditions definitions. For example, see the example in “Examples of job conditional dependencies evaluation” on page 425.
- You defined a step dependency for a step that does not exist in the referenced job. The scheduler recognizes that there is a missing step and issues the warning message EQQE127W, when the job ends, it evaluates that successors will never run and issues the warning message EQQE141W, even if the origin of the problem is in the step definition. For example, see the example in “Examples of step-level conditional dependencies evaluation” on page 434.

How to check if conditional successors are not prevented from running

A conditional predecessor job that ended in error does not block job processing from proceeding when at least one of the following occurs:

- Its entry under the JOBNAME has the value listed under the XRC (Unexpected RC) column set to N.
- Its entry under the JOBNAME column has the value listed under the RBYCO (Recovered by Condition) column set to Y.

A job that ended in error and flagged as Recovered by Condition has the recovery action already activated by its conditional successor, the conditional recovery job, and so it does not prevent any other job from processing. Therefore, it does not stop processing and is removed by the daily plan batch if it belongs to an occurrence with all operations in X, C, or Error Recovered by Condition status. For more information, see "Handling recovery using conditional dependencies" on page 440.

You can filter by XRC and RBYCO both on the ERROR LIST and OPERATION LIST panels.

How to check if normal successors are prevented from running

The SU£ column shows if the job displayed under the JOBNAME column has a normal successor. If the number displayed in the SU£ column is 0 then that job has no normal successor, and, even if the operation ended in error, no successor job is prevented from running. If the number displayed under SU£ is greater than 0, then the job has a normal successor that is prevented from running because its status can be set to Ready (R) only if the predecessor job status is Complete (C) or Suppressed by condition (X).

How to check if an operation is waiting due to conditions

An operation is in W (Wait) status due to condition when its condition is in U (Undefined) status.

You can list these operations by filtering on Status=W and Undefined Cond=Y in the SELECTING OPERATIONS filter panel as displayed in Figure 178.

```
EQQSOPFP ------------------- SELECTING OPERATIONS ----------------------------
Command ===>

Specify selection criteria below and press ENTER to create an operation list.

JOBNAME           ==> ________           WORK STATION NAME ==> ____
APPLICATION ID    ==> ________________   OWNER ID          ==> ________________
AUTHORITY GROUP   ==> ________           PRIORITY          ==> _
GROUP DEFINITION  ==> ________________   STATUS            ==> W_______________
CLEAN UP TYPE     ==> ____               CLEAN UP RESULT   ==> __
OP. EXTENDED NAME ==> ____________________________________________________________
OP. SE NAME       ==> ________________   SUBMIT DEST       ==> ________
Input arrival in format YY/MM/DD  HH.MM
 FROM             ==> ________  _____
 TO               ==> ________  _____
Additional Options:
FAST PATH         ==> N                Valid only along with jobname
Set Y, N, or leave blank to select all:
MANUALLY HELD      => _   WAITING FOR SE     => _   STARTED ON WAIT WS => _
CRITICAL PATH      => _   COND RECOVERY JOB  => _   RECOVERED BY COND  => _
UNEXPECTED RC      => _   UNDEFINED COND     => _   SHADOW JOB         => _
STARTED AT STARTUP => _
Set P, M, B, E, or leave blank to select all:
WAITING PEND.PRED. ==> _
```

Figure 178. EQQSOPFP - Selecting operations

How to search for skipped operations in a conditional flow

The operations in status X (Suppressed by condition) are skipped in the current plan, meaning that they are not run, but, like NOPED operations, their normal successors can run if free from other constraints. To list skipped operations you can filter on status X in the operation list filter panel.

When you define an application you can decide to allow the X status to propagate through a branch using conditional dependencies as described in "How to propagate the X status in a branch" on page 438.

How to display information about conditions

You can monitor the conditions defined in the current plan by selecting option 4 (Dependencies) from the SELECTING APPLICATION OCCURRENCE AND OPERATION INFORMATION panel and then entering the COND command. The panel in Figure 179 is displayed.

```
EQQSCONL -------------------- BROWSING CONDITION ------------- Row 1 to 1 of 1
Command ===>                                                  Scroll ===> PAGE

Enter the row command S to show Condition details.

Application     : APPL2
Operation       : CPU1 4
Jobname         : JOBKAT1

Row  Cond Text                     Cond     Rule              Status  Ext.
cmd  no.                           Deps                               Status
'''  001  COND TO APPL1            5        all               U
```

Figure 179. EQQSCONL - Browsing condition

For a list of possible values in the `Status` field, see "How the scheduler evaluates the status of a condition" on page 424.

The possible values of the `Ext. Status` field are:

C Frozen by complete, meaning that one of the operations included in the conditional dependencies belongs to an occurrence that was set to complete, after an MCP request.

F Forced by rerun, meaning that the condition status was forced by a rerun action. For more information see "Rerunning an occurrence" on page 444.

After selecting a row, the panel shown in Figure 180 is displayed:

```
EQQSOCCP -------------- BROWSING CONDITION DEPENDENCIES------- Row 1 to 5 of 5
Command ===>                                                  Scroll ===> PAGE

Application     : APPL2
Operation       : CPU1 4           JOBKAT1
Condition       : 1
Rule            : All condition dependencies in this list must be true
Status          : Undefined
Extended Status :

Scroll right to see further condition dependency details.

Oper     Application Id   Input     Jobname  Cond Cond Status Ret Code  S R S M
ws.  no.                  arrival            Type OP   Value  Val1 Val2     D I
CPU1 001 APPL1             21 00.10 JOBKAT1  RC   EQ          0000      U N N N
CPU1 001 APPL1             21 00.10 JOBKAT1  RC   RG          S000 SFFF U N N N
CPU1 001 APPL1             21 00.10 JOBKAT1  RC   EQ          0000      U N Y N
CPU1 002 APPL1             21 00.10 JOBKAT2  RC   NE          0008      U N N N
CPU1 002 APPL1             21 00.10 JOBKAT2  RC   RG          0000 0008 U N Y N
```

Figure 180. EQQSOCCP - Browsing condition dependencies

The R (Removed) column set to Y indicates that the corresponding operation was either removed by daily planning or manually deleted from the current plan.

The last two columns, SD and MI, provide information about step-level dependencies. In particular:

- The SD (Step Dependency) flag indicates if the dependency is at step level.
- The MI (Missing step completion Information) flag indicates if the dependency is undefined because of missing step-end information.

  For such operations, the event writer issues message EQQE127W in the message log (EQQMLOG), unless the operation did not actually run (status manually set).

If the dependency is undefined because of missing step-end information and DP or MCP processes removed the corresponding operation, the last three columns, R, SD and MI, are set to Y.

You can check any step name definition by scrolling the list to the right, to display the panel shown in Figure 181:

```
EQQSOCCR -------------- BROWSING CONDITION DEPENDENCIES------- Row 1 to 5 of 5
Command ===>                                                  Scroll ===> PAGE

Application     : APPL2
Operation       : CPU1 4           JOBKAT1
Condition       : 1
Rule            : All condition dependencies in this list must be true
Status          : Undefined
Extended Status :

Scroll left to see further condition dependency details.

Application Id   Input     JobName  StepName ProcStep Cond Cond St  Ret Code
                 arrival                             Type OP   Val Val1 Val2
APPL1             21 00.10 JOBKAT1                     RC   EQ       0000
APPL1             21 00.10 JOBKAT1                     RC   RG       S000 SFFF
APPL1             21 00.10 JOBKAT1  STEP0    PROC0     RC   EQ       0000
APPL1             21 00.10 JOBKAT2                     RC   NE       0008
APPL1             21 00.10 JOBKAT2  STEPRG00 PROCRG09  RC   RG       0000 0008
```

Figure 181. EQQSOCCR - Browsing condition dependencies

Daily plan batch handling of conditional dependencies

The daily plan batch removes the following entries from the new plan:

- All the occurrences that are completed
- All the conditions that were evaluated (with status True or False)
- All the conditions defined on operations in X status

This behavior can lead, in some particular scenarios, to the setting of the Unexpected RC flag after a daily plan batch run. An example of one of these scenarios is when a true path (Condition and conditional successors) is removed and the conditional predecessor has another conditional successor still in the plan in waiting status due to an undefined condition caused by a missing step event.

If the daily plan batch needs to reconsider the undefined conditions referring to predecessor operations that have been removed from the plan, then the condition dependencies are:

- Left in the Condition with flag Removed set to on if they were already evaluated (True or False)
- Dropped from the Condition if they were still Undefined. In this case the Condition rule is readjusted if needed.

If all operations mentioned in a condition are removed from the plan, the condition is removed from the plan too.

Automatic conditional dependencies resolution

When you add new occurrences to the current plan, the scheduler applies some criteria to identify potential conditional successors:

1. Searches, among all the potential conditional successors defined in the database, for those existing in the plan.
2. Selects the closest following conditional predecessor.
3. Determines whether to add a new condition dependency to the existing condition or to create a new condition ad hoc as follows:
   - If the condition dependency referring to the new predecessor occurrence is not present in the plan for the conditional successor, a new COND ID is created.
   - If the condition dependency referring to the new predecessor occurrence is already present in the plan for the conditional successor, then:
     – If that condition dependency has not yet been filled in the plan, the condition dependency is added to the existing COND ID.
     – If the condition dependency has already been filled in the plan, then a new condition containing that condition dependency is created and marked as a *clone*. A different COND ID is generated, but the original one is also saved and displayed in the description of the cloned condition. The new COND ID is the first available number in the range from 1 to 999.

Chapter 23. Defining and managing cross dependencies

IBM Workload Scheduler for z/OS cross dependencies help you to integrate and automate job processing when:

- The workload is spread across different scheduling environments, because some of the activities run at different sites or involve different organizational units or require different skills to be run.
- Even if most of the batch workload is managed locally, none of these environments is completely isolated from the others because they frequently interoperate to exchange or synchronize data and activities.

More specifically, the cross dependency feature is key when you need to synchronize activities between different scheduling environments in an easy way so that you can:

- Define in one scheduling environment dependencies on batch activities that are managed by another scheduling environment.
- Monitor the status of the remote predecessor jobs as if they were running in your local environment.

Additionally, you can control the status of these dependencies by navigating from a unique user interface across the different scheduling environments.

This chapter describes how you define and use cross dependencies.

It contains the following sections:

- "An introduction to cross dependencies"
- "Defining a cross dependency in the database" on page 452
- "Daily plan consistency checks on shadow jobs and remote engine workstations" on page 455
- "Monitoring a cross dependency resolution in the current plan" on page 456
- "Contacting the remote engine in a failover scenario" on page 469

An introduction to cross dependencies

A cross dependency is, from a logical point of view, a dependency for a local job on a job instance that is scheduled to run on a remote engine plan.

Use cross dependencies to integrate the workload running on different engines, which can be IBM Workload Scheduler for z/OS engines (controller) or IBM Workload Scheduler engines (master domain manager and backup master domain manager).

The following objects and terms are used to describe and implement cross dependencies:

Remote engine workstation
A type of workstation that represents locally a remote IBM Workload Scheduler engine, either distributed or z/OS. This type of workstation uses a connection based on HTTP or HTTPS protocol to allow the local environment to communicate with the remote environment.

Remote job
A job scheduled to run on a remote IBM Workload Scheduler engine.

Shadow job
A job defined locally, on a remote engine workstation, which is used to map a remote job. The shadow job definition contains all the information necessary to correctly match, in the remote engine plan, the remote job instance.

Bind The process to associate, in the remote engine plan, a shadow job with a remote job instance.

From a logical point of view in the local environment:

- The remote engine workstation is used to map the remote IBM Workload Scheduler engine.
- The shadow job, defined on that remote engine workstation, is used to map a remote job instance scheduled to run on that remote IBM Workload Scheduler engine.

To implement a cross dependency, you must define a normal dependency for your local job on a shadow job that:

- Points to the remote job on which you want to create the cross dependency.
- Is defined locally on the remote engine workstation that points to the engine where the remote job is scheduled to run.

Figure 182 shows the logical flow implementing cross dependencies:

1. In the bind process, the shadow job is associated to the remote job instance.
2. After the bind is established, the shadow job status is updated according to the remote job status transition.
3. When the shadow job status becomes COMPLETE (C) the normal dependency of the local job is released, and so also the cross dependency of that local job on the remote job is also released.

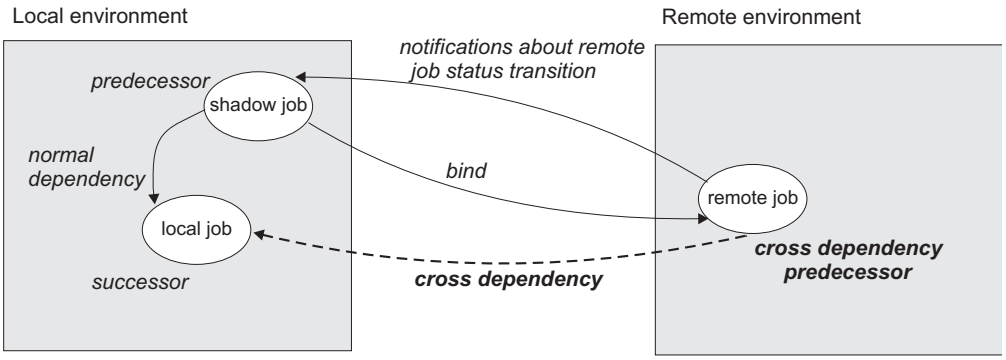


Figure 182. Cross dependency logic

Defining a cross dependency in the database

The following sections describe the steps to define a cross dependency between a job defined in your environment and another job defined on a different IBM Workload Scheduler engine:

- "Step 1. Set up destinations" on page 453
- "Step 2. Create a remote engine workstation" on page 454

- "Step 3. Define a shadow job on the remote engine workstation" on page 454
- "Step 4. Add a dependency on the shadow job" on page 455

Step 1. Set up destinations

An existing HTTP or HTTPS destination to communicate with the remote engine is a prerequisite:

- When you want to define a remote engine workstation to send bind requests to the remote engine referenced in the destination. The name of the destination must be specified in the remote engine workstation definition, as the DESTINATION field.
- When you expect to receive incoming bind requests from the remote engine referenced in the destination.

Depending on whether the remote engine communicates using a secure or non-secure HTTP protocol, you define the destination using either ROUTOPTS HTTPS or ROUTOPTS HTTP.

The ROUTOPTS statement is defined in the member of the EQQPARM library that is specified by the PARM parameter in the JCL EXEC statement of the controller. The syntax for defining an HTTP or HTTPS destination is the following:

```
ROUTOPTS HTTP|HTTPS(dest name:'IP address or hostname'/port/remote engine type)
```

Where:

dest name
: Name of the destination, up to 8 alphanumeric characters.

IP address or hostname
: Fully qualified IP address or hostname used to communicate with the remote engine. For more information about how to set this value, see "How to get the correct values to specify in the destination" on page 454.

port
: Port number used to communicate with the remote engine. For more information about how to set this value, see "How to get the correct values to specify in the destination" on page 454.

type
: Type of the remote engine:

  D Distributed remote engine

  Z z/OS remote engine

  Destinations for which a remote engine type has been specified are named *remote engine destinations*.

To ensure connection availability, the remote engine destinations are checked on a timely basis, even if there is no HTTP pending request for that destination. As a best practice, avoid defining unnecessary remote engine destinations, to prevent unnecessary connection checks. If a remote engine destination is unreachable the following occurs:

- The error message EQQHT15E with a specific TCP/IP error is issued in the MLOG.
- The remote engine workstation that uses an unreachable destination is set to OFFLINE. The status of the workstation is set to ACTIVE as soon as the connection check to the remote engine succeeds.

For more information about the ROUTOPTS statement, see *Customization and Tuning*.

How to get the correct values to specify in the destination

When defining the destination to communicate to the remote engine make sure that the values specified for *IP address* or *hostname* and *port* are the same as those set locally on the remote engine.

To verify which values are set on the remote engine:

If the remote engine is z/OS based
The settings are optional. If specified, they are set in the HTTPOPTS options HOSTNAME and HTTPPORTNUMBER. If not specified their default values are displayed in the MLOG in the EQQHT19I message.

If the remote engine is distributed
The settings are mandatory and are specified at installation time. First add a destination using the information specified in the file `JobDispatcherConfig.properties`, then add destinations using the values specified in the output of the following command:

On Windows:
TWA_home`\TDWB\bin\exportserverdata.bat`

On UNIX:
TWA_home`/TDWB/bin/exportserverdata.sh`

Step 2. Create a remote engine workstation

Create a remote engine workstation for a specific remote engine when you need to define dependencies on job instances defined on that remote engine. You can run only shadow jobs on a remote engine workstation.

Optionally, you can specify when the remote engine workstation is available.

You can create a remote engine workstation from the CREATING GENERAL INFORMATION ABOUT A WORKSTATION panel, as shown in Figure 35 on page 57.

To create a remote engine workstation from the Dynamic Workload Console navigation toolbar, click **Administration** > **Workload Environment Design** > **Create Workstations**. Then after specifying an engine name, in the Create Workstation window, you can create and edit any type of workstation, including remote engine workstations.

For more information about the settings that define a remote engine workstation, see "Specifying remote engine workstations" on page 66.

Step 3. Define a shadow job on the remote engine workstation

Create a shadow job pointing to a specific job instance defined on a remote engine when you want to track in your local environment the status of that remote job and define cross dependencies on that remote job.

The closest preceding matching criteria is used to map the shadow job to a job instance in the remote engine plan.

The input arrival (IA) of the shadow job is used to find the matching with the job instance to bind in the remote engine plan.

The shadow job status transition is derived from the remote job instance status transition.

You can create a shadow job from the OPERATIONS panel, as shown in Figure 72 on page 148. Choose a remote engine workstation as the workstation for the operation, and select option 13 (REMOTE JOB INFO) in the OPERATION DETAILS panel to specify the information to identify the job instance in the remote engine plan.

To create a shadow job from the Dynamic Workload Console navigation toolbar, click **Administration** > **Workload Design** > **Manage Workload Definitions**. Then after specifying an engine name, in the Workload Designer window, you can create and edit any type of job, including shadow jobs.

On IBM Workload Scheduler distributed environments, you can use alias for job stream names and job names. If you are defining in your IBM Workload Scheduler for z/OS environment a distributed shadow job, make sure that:

- The remote job stream name specified, contains the job stream name as it is defined in the database.
- The remote job name specified, contains the alias, if defined, of the remote job to bind.

If you do not follow these guidelines, the bind fails and the status of the shadow job becomes ERROR.

For more details about the settings that define a shadow job, see "Specifying remote job information in shadow jobs" on page 174.

Step 4. Add a dependency on the shadow job

After defining the shadow job you can add the cross dependency.

Add a cross dependency on a job instance scheduled in a remote engine plan, by defining a normal dependency on the shadow job that:

- Points to the remote job on which you want to create the cross dependency.
- Is defined on a local remote engine workstation that points to the engine where the remote job is defined.

Because the remote job instance status transition is mapped into the shadow job status transition, the status of the cross dependency is represented by the status of the normal dependency.

Daily plan consistency checks on shadow jobs and remote engine workstations

Depending on the type of workstation selected, some fields in the job definition become mandatory. To avoid incongruences, the daily plan batch program, at plan creation or extension, performs consistency checks to ensure that no mismatch has occurred in between the definition of jobs and workstations in the database and their inclusion in the current plan.

Based on the results of the checks, the daily plan batch program can:

- Complete successfully.
- Generate the plan, providing a return code and a warning message.

- Fail to generate the plan, issuing an error message documenting the exception that occurred.

The possible results of the checks run by the daily plan batch against shadow jobs and remote engine workstations are defined in the following sections.

The daily plan batch program generates the plan providing a return code 4 and logging a warning message in the report, *if the workstation involved was not yet present in the plan* and one of the following situations occurred:

A job, defined on a non-remote engine workstation, contains remote job information.
This situation might occur, for example, if the type of workstation changed from remote engine into another type after the job was defined. In this case the job is no longer considered as a shadow job, but its definition still includes the information that applies to a shadow job.

The daily plan completes with return code 4, message EQQ0396W is logged in the DP batch report, the job is added to the plan, and its remote engine information settings are ignored.

A job, defined on a remote engine workstation, does not contain remote job information.
This situation might occur, for example, if the type of workstation changed to remote engine type after the job was defined. In this case, the jobs defined on that workstation are automatically considered as shadow jobs and so they lack the remote job information.

The daily plan completes with return code 4, message EQQ0391W is logged in the DP batch report, and the occurrence is not added to the plan.

The remote engine type of a workstation was changed causing an inconsistency in the remote job information set in the shadow job.
Because the remote engine type determines the set of information that is necessary to map a shadow job to a remote job instance, if you change the remote engine type you cause an inconsistency in the shadow job definition.

In this case, the daily plan completes with return code 4, message EQQ0392W is logged in the DP batch report, and the occurrence is not added to the plan.

The daily plan batch program fails, at plan extension or replan time, *if the workstation is already present in the plan* and one of the following situations occurs:

The remote engine type of a workstation existing in the plan was changed.
The daily plan fails and message EQQ0397E is logged in the DP batch report.

The type of a workstation existing in the plan was changed.
The daily plan fails and message EQQ0316E is logged in the DP batch report.

Monitoring a cross dependency resolution in the current plan

Shadow jobs are added to the plan in the same way as any other job:

- At run time, if a shadow job is added to an occurrence existing in the current plan or if a new occurrence containing the shadow job is added to the current plan.

- When the plan is extended or created again and its time frame includes the shadow job input arrival time.

As soon as a shadow job instance is added to the plan, you can start monitoring its status.

How the shadow job status changes until the bind is established

Figure 183 summarizes how the shadow job status changes until the bind is established. The bind status of the shadow job is represented as *STATUS - Extended status*. You can see the extended status of a job shown in the SELECTING APPLICATION OCCURRENCE AND OPERATION INFORMATION panel.

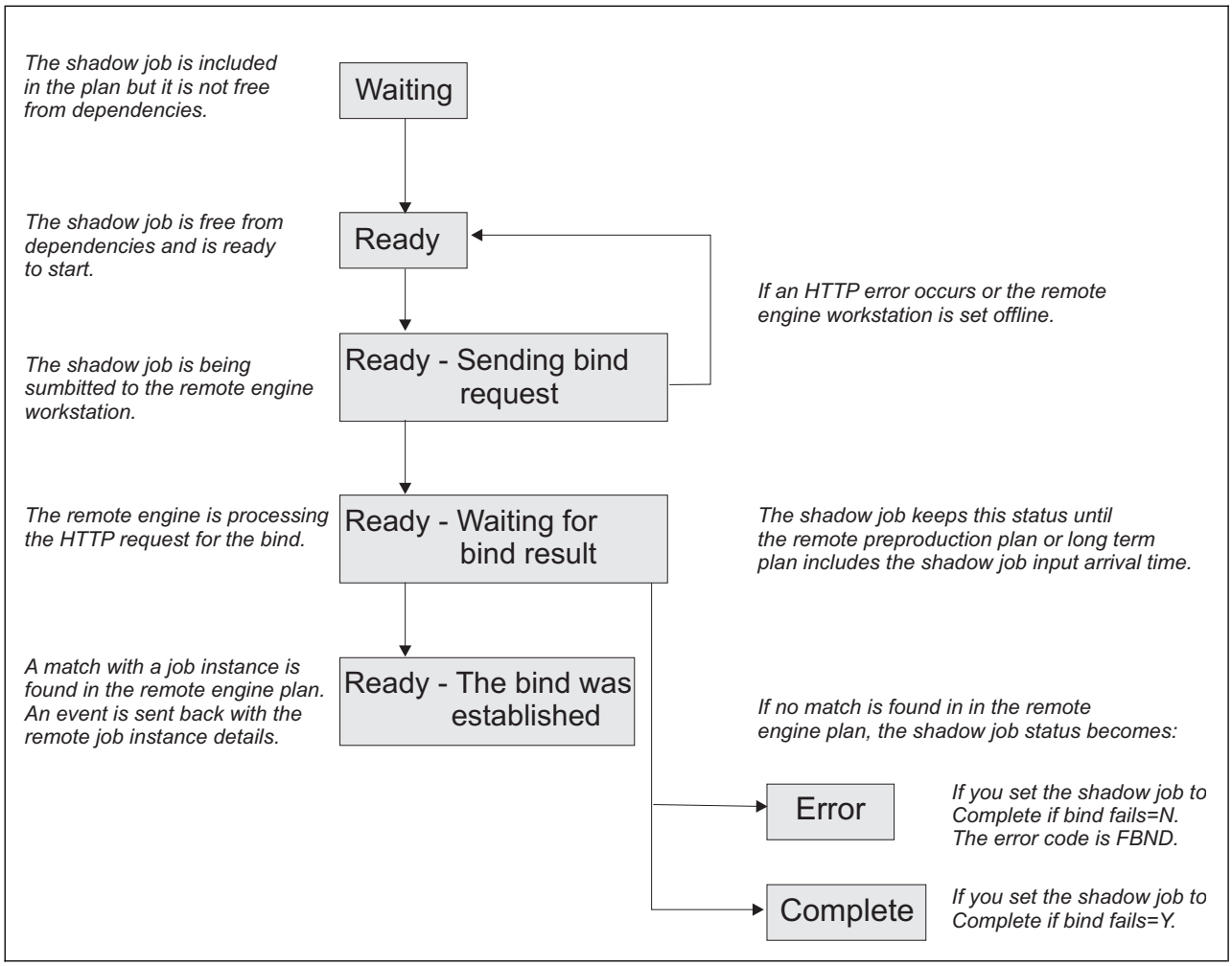


Figure 183. Shadow job status transition chain while establishing the bind

The initial status of the shadow job is WAITING (W). It changes to READY (R) as soon as the shadow job becomes free from dependencies and is ready to start.

The scheduler then sends an HTTP request to the remote engine asking to bind that shadow job instance with the instance of the remote job that closest precedes the shadow job input arrival in the remote engine plan. The HTTP request contains both the information to identify the shadow job in the current plan and the

information to uniquely identify the remote job instance in the remote engine plan. The scheduler requires, as well, to be notified about the status of the remote job instance bound.

As soon as the remote engine receives the HTTP request it tries to identify in its plan the job stream instance to bind. The definition of that job stream must contain the definition of the remote job to bind.

Note: On a distributed remote engine it can be specified which job can be bound by assigning specific authorization to the user ID that runs the bind in the plan. If that user ID has not the needed authorization to run the bind, the bind fails. For more information, see the *IBM Workload Scheduler: User's Guide and Reference*.

Depending on whether the shadow job is a z/OS or a distributed job, the way to associate it with a remote job instance is slightly different. The following sections describe how the job instance is matched in the remote engine plan.

How a distributed shadow job is bound with a remote job instance

On an IBM Workload Scheduler distributed remote engine, the bind is established in the preproduction plan. Distributed remote job instances belonging to the JOBS job stream and submitted at run time are not written into the preproduction plan and so they are not involved in the bind process.

If the preproduction plan does not exist on the remote engine when the bind request is received, the distributed shadow job status remains WAIT until the preproduction plan generation is completed and the bind request is processed. This might happen, for example, when the preproduction plan is created again from scratch on the remote engine.

The preproduction plan does not contain the instances of the jobs belonging to the job streams. The job instances are added later on to the production plan when the plan is extended or created.

This means that the bind is established with the job stream instance included in the preproduction plan and that is scheduled to run on the specified workstation. The definition of that job stream must contain the definition of the remote job to bind.

The following sections describe the scenarios that can occur when binding a distributed shadow job having:

- Input arrival (IA): 18:00
- Remote job information:
  - Job stream name: JS2
  - Job name: JOB2
  - Job stream workstation: WKST2

In the figures:

- The white box indicates the time interval covered by the preproduction plan.
- The light grey box indicates the time interval covered by the production plan.
- The dark grey box indicates the interval in the remote engine plan during which the job instance to bind must be searched.
- The JS2 instances shown are scheduled to run on workstation WKST2.
- The JS2 occurrence highlighted in bold is the instance selected for the bind.

Scenario 1: The production plan contains the instance of job stream JS2 that closest precedes the shadow job input arrival.

Both, in the case where the shadow job input arrival is included in the production plan interval, as shown in Figure 184:

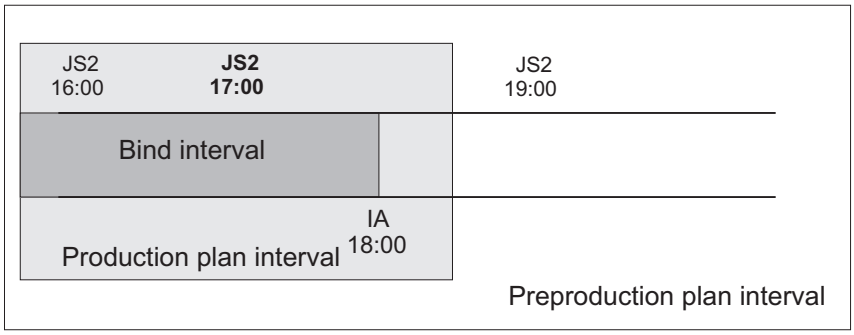


Figure 184. Instance to be bound if the shadow job input arrival is included in the production plan interval

and in the case where the bind interval extends outside the production plan interval, as shown in Figure 185:

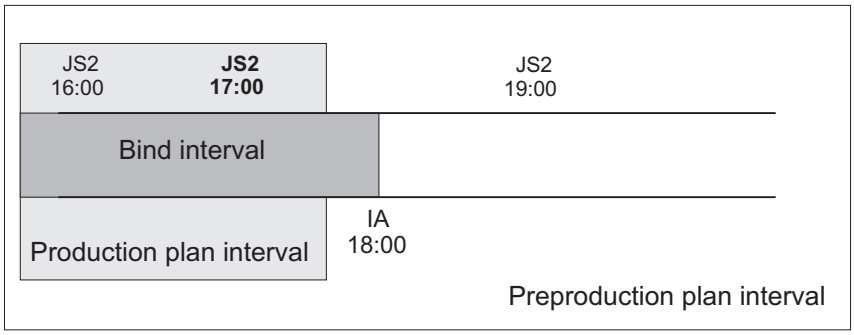


Figure 185. Instance to be bound if the bind interval extends outside the production plan interval

the JS2 instance that closest precedes the shadow job input arrival is selected for the bind. This means that the shadow job and the remote job stream instance are now associated. If, at a later time, a new instance of JS2 that more closely precedes the shadow job input arrival is submitted ad hoc in the remote engine plan, the match with the JS2 instance selected for the bind is *not* modified.

One of the following situations can now occur:

The selected JS2 instance contains JOB2

The bind is established and a notification containing:

- The remote job information identifying the JOB2 instance in the remote engine plan
- The current status of that JOB2 instance in the remote engine plan

is sent back to the IBM Workload Scheduler for z/OS controller, the shadow job instance is updated with the remote job information, and its status is updated accordingly.

The selected JS2 instance no longer contains JOB2 because it was either canceled or completed, and was removed from the production plan.
The bind is established and a notification informing about the successful execution status is sent back to the IBM Workload Scheduler for z/OS controller. The shadow job instance is marked as completed. Its successors can start.

The selected JS2 instance contains JOB2, but JOB2 is in canceled status
The bind is established and a notification informing about the successful execution status is sent back to the IBM Workload Scheduler for z/OS controller. The shadow job instance is marked as completed. Its successors can start.

Scenario 2: The production plan interval contains the input arrival of the shadow job, but no instances of job stream JS2 exist.

Figure 186 shows the case where a JS2 instance that closest precedes the

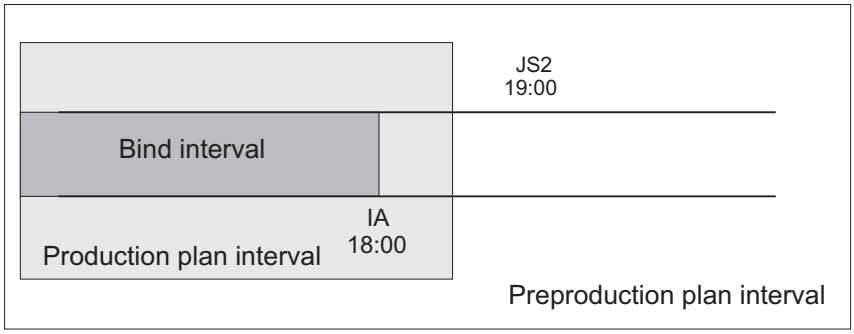


Figure 186. The input arrival of the shadow job is included in the production plan but no instance to bind exists

shadow job input arrival does not exist.

In this case, the bind with JOB2 fails. A notification informing that the bind failed is sent back to the IBM Workload Scheduler for z/OS controller, and the shadow job status is updated according to what you set in the Complete if bind fails field.

Scenario 3: The preproduction plan interval contains the input arrival of the shadow job and the production plan does not yet include the closest preceding JS2 instance.

Figure 187 shows the JS2 instance that can be associated to the shadow job,

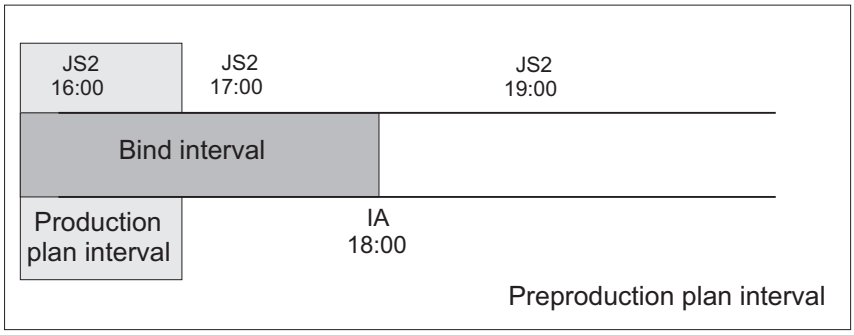


Figure 187. The instance to be bound exists but it is not yet included in the production plan

even though the job JOB2 is not yet in the production plan.

A notification informing that the bind is established is sent back to the IBM Workload Scheduler for z/OS controller and the status of the shadow job is set to "READY-The bind was established".

Scenario 4: The preproduction plan interval still does not contain the input arrival of the shadow job.

Figure 188 shows that no JS2 instance can be associated with the shadow

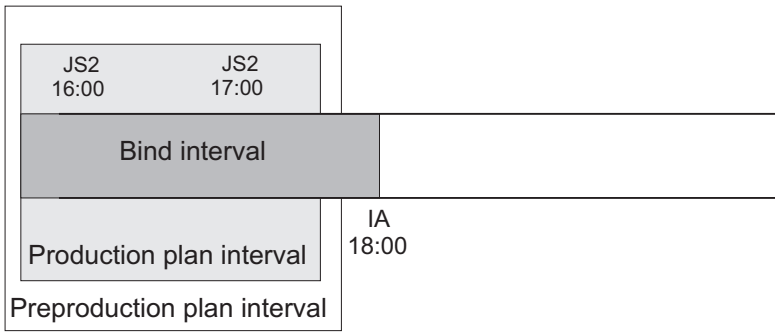


Figure 188. The preproduction plan interval still does not contain the input arrival of the shadow job

job, because, until the preproduction plan includes the shadow job input arrival, closer preceding JS2 instances can still be added.

In this case, the bind request is put on hold until the preproduction plan is extended to include the shadow job input arrival. Until then the status of the shadow job remains "READY-Waiting for bind result".

How a z/OS shadow job is bound with a remote job instance

If the remote engine is an IBM Workload Scheduler for z/OS controller, the search for the remote instance to bind is done as follows:

- First, the instance is searched in the Long Term Plan (LTP) in the part of the bind interval that follows the Current Plan (CP) end time and precedes the shadow job input arrival.
- If no instance is found, the instance is searched in the CP in the part of the bind interval that precedes the current plan end.

Note: If the remote controller receives a bind request with a client notify URI that is not defined among the HTTP destinations, the bind request is discarded and the message EQQHT62E is logged in the MLOG.

The following sections describe the scenarios that can occur when binding a z/OS shadow job having:

- Input arrival (IA): 18:00
- Remote job information:
  - Application ID: JS2
  - Operation number: OP2

In the figures:

- The white box indicates the time interval covered by the LTP.
- The light grey box indicates the time interval covered by the CP.
- The dark grey box indicates the interval in the remote engine plan during which the job instance to bind must be searched.
- The JS2 occurrence highlighted in bold is the instance selected for the bind.

Scenario 1: The CP interval contains the input arrival of the shadow job and JS2 occurrences exist.

Figure 189 shows, highlighted in bold, the JS2 instance that more closely

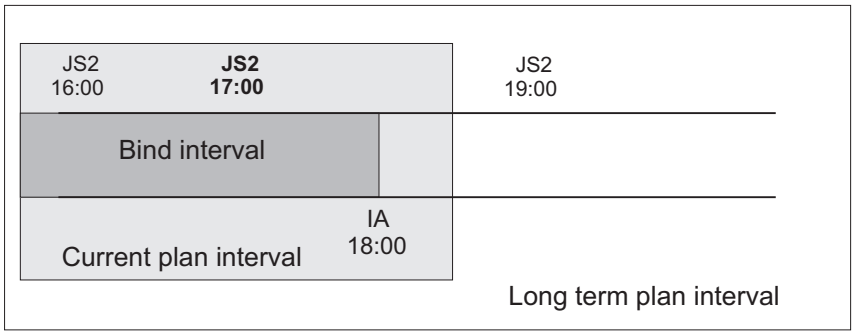


Figure 189. Instance to be bound if the shadow job input arrival is included in the CP interval

precedes the shadow job input arrival. This instance is selected for the bind because the input arrival is contained in the CP. The shadow job and the remote job instance are associated. If, at a later time, a new instance of JS2 that closest precedes the shadow job input arrival is submitted ad hoc in the remote engine plan, the match with the JS2 instance selected for the bind is *not* modified.

At this point, one of the following situations can occur:

The selected JS2 instance contains OP2

The bind with OP2 belonging to JS2 is established and a notification containing:

- The information necessary to identify the OP2 instance in the remote engine plan
- The current status of that OP2 instance

is sent back to the IBM Workload Scheduler for z/OS controller, the shadow job instance is updated with the remote job information, and its status is updated accordingly.

The selected JS2 instance no longer contains OP2 because either it was deleted and a daily plan removed it from the CP, or it was never contained in JS2.

The bind fails. A notification informing that the bind failed is sent back to the IBM Workload Scheduler for z/OS controller, and the shadow job status is updated according to what you set in the Complete if bind fails field.

The selected JS2 instance contains OP2 that was deleted but not yet removed from the CP

The bind is established and a notification informing about the successful execution status is sent back to the IBM Workload Scheduler for z/OS controller. The shadow job instance is marked as completed. Its successors can start.

Scenario 2: The current plan interval contains the shadow job input arrival, the JS2 instance that most closely precedes the shadow job input arrival exist in the LTP but it was canceled from the CP.

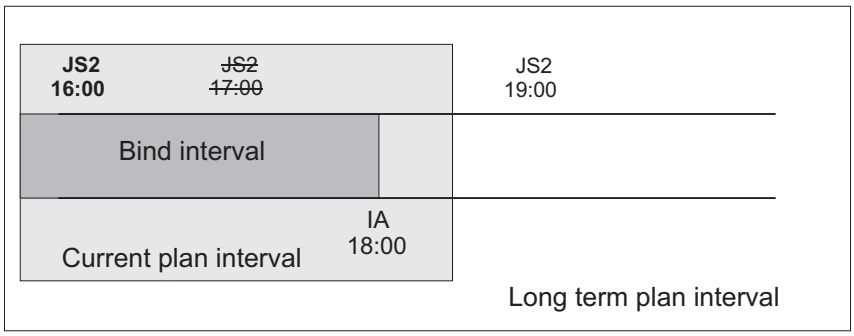


Figure 190. Instance to be bound if the instance that most closely precedes the shadow job input arrival exist in the LTP but it was canceled from the CP

Figure 190 shows, highlighted in bold, the JS2 instance that is selected for the bind, because the occurrence that better matched was deleted.

The bind with OP2 is established and a notification containing:

- The information necessary to identify the OP2 instance in the remote engine plan
- The current status of that OP2 instance

is sent back to the IBM Workload Scheduler for z/OS controller, the shadow job instance is updated with the remote job information, and its status is updated accordingly.

Scenario 3: The CP interval contains the input arrival of the shadow job but no JS2 instance exists

Figure 191 shows that a JS2 instance that closely precedes the shadow job

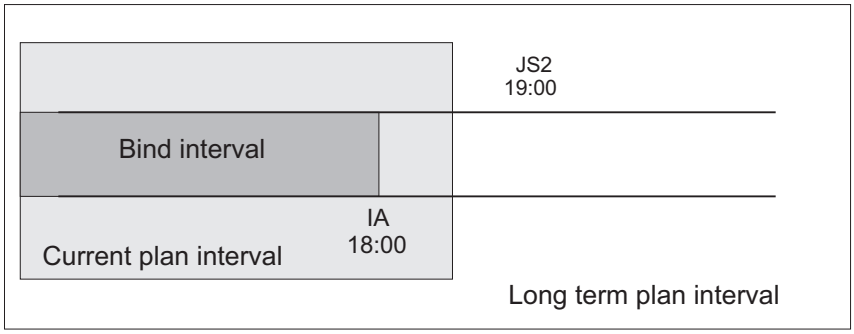


Figure 191. The input arrival of the shadow job is included in the CP but no instance to bind exists

input arrival does not exist.

The bind fails. A notification informing that the bind failed is sent back to the IBM Workload Scheduler for z/OS controller, and the shadow job status is updated according to what you set in the Complete if bind fails field.

Scenario 4: The LTP interval contains the input arrival of the shadow job and the CP does not yet include the closest preceding JS2 instance.

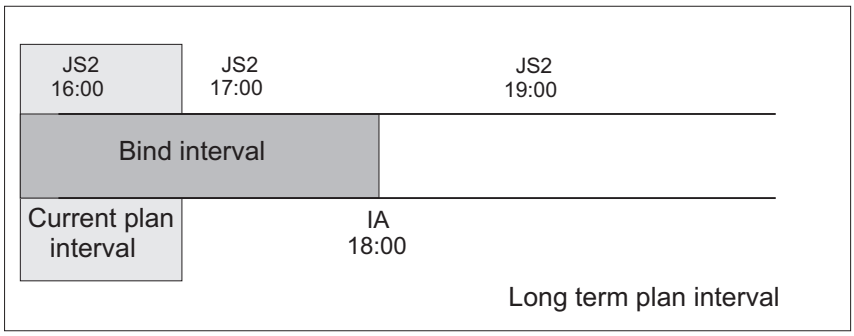


Figure 192. The instance to be bound exists but it is not yet included in the CP

Figure 187 on page 460 shows the JS2 instance that can be associated with the shadow job, even though the job JOB2 is not yet in the CP.

A notification informing that the bind is established is sent back to the IBM Workload Scheduler for z/OS controller and the status of the shadow job is set to READY-The bind was established.

Scenario 5: The LTP interval still does not contain the input arrival of the shadow job.

Figure 193 shows that no JS2 instance can be associated with the shadow

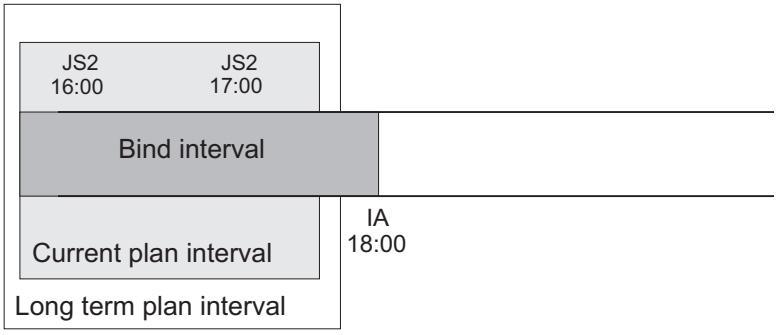


Figure 193. The LTP interval still does not contain the input arrival of the shadow job

job because, until the LTP includes the shadow job input arrival, closer preceding JS2 instances can still be added.

In this case, the bind request is put on hold on the remote engine until the LTP is extended to include the shadow job input arrival. Until then the status of the shadow job remains "READY-Waiting for bind result".

Monitoring the shadow job status changes after the bind is established

As soon as the bind is established, the remote engine sends back an HTTP notification containing the status of the bind and, if the bind was successful, the information to identify the remote job instance bound. This information is saved in the shadow job instance details.

To see these details, choose option 14 (REMOTE JOB INFO) in the SELECTING APPLICATION OCCURRENCE AND OPERATION INFORMATION panel. A panel containing the following information is displayed:

Shadow job data:

- Application name
- Input arrival
- Operation
- Job name

Complete if bind fails
It determines if the operation must be forced to COMPLETE status when the bind process fails.

Bind status
It can be one of the following values:

- Sending bind request
- Waiting for bind result
- The bind was established
- The bind failed

Depending on the type of remote engine, the following information about the remote job instance is shown:

The remote engine type is z/OS

- Application ID
- Input arrival
- Operation number
- Workstation
- Job name

The remote engine type is distributed

- Job stream name
- Input arrival
- Job stream workstation
- Job name

Notifications about job status changes are sent asynchronously from the remote engine. These notifications are used to map remote job status transition into shadow job status transition. Store and forward mechanism ensures the delivery of the messages and the recovery in case of failures. Figure 194 on page 466 shows how the status of a distributed shadow job changes, from when the bind is established until the shadow job status becomes COMPLETE (C).

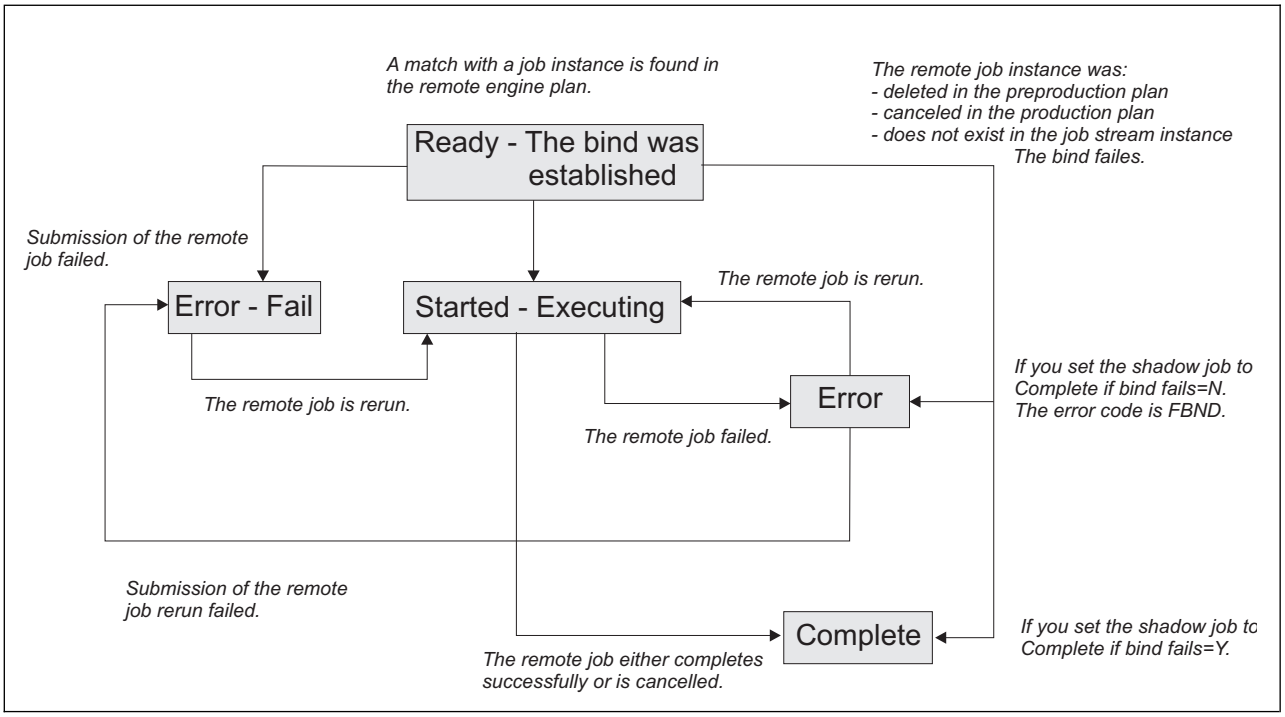


Figure 194. Distributed shadow job status transition chain after the bind was established

Figure 195 on page 467 shows how the status of the z/OS shadow job changes, from when the bind is established until the shadow job status becomes COMPLETE (C).

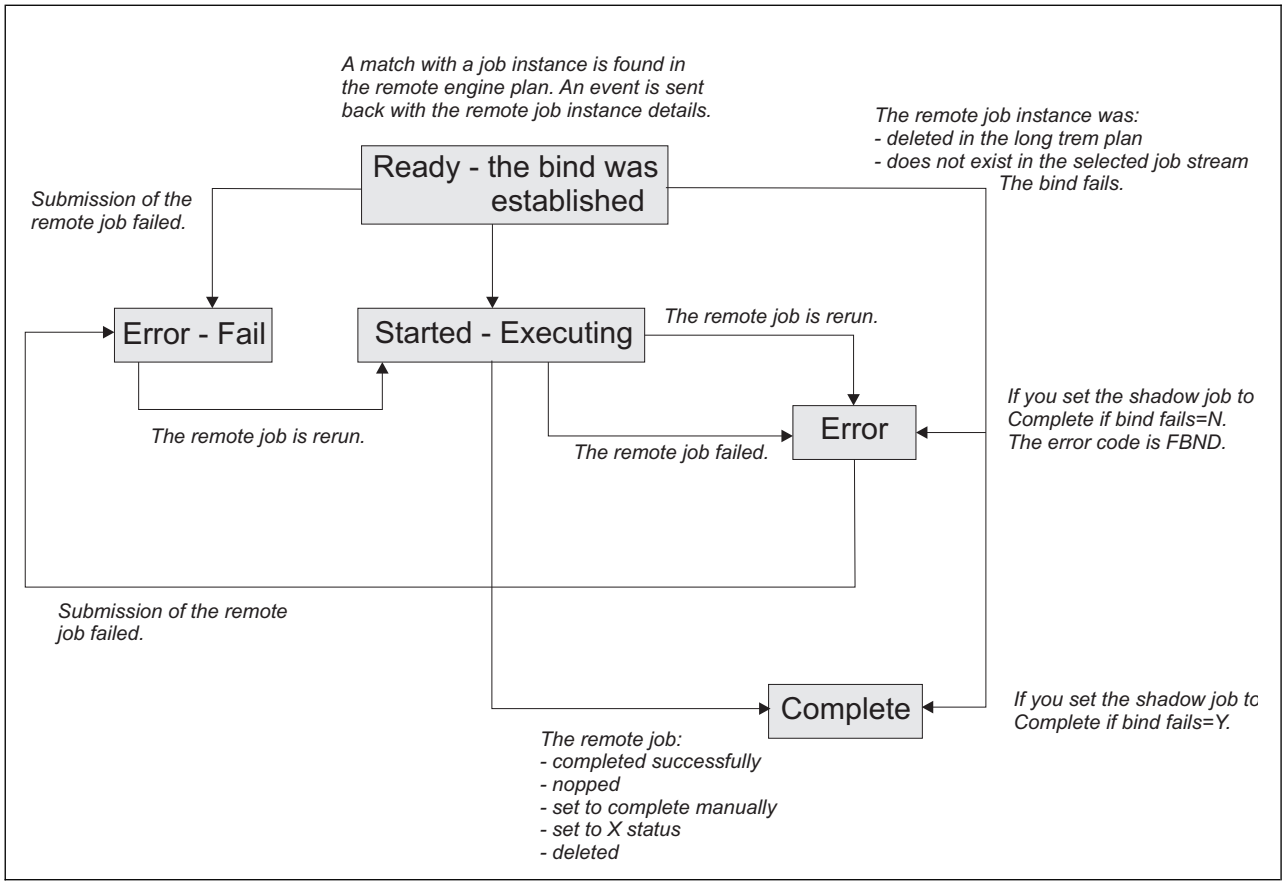


Figure 195. z/OS shadow job status transition chain after the bind was established

If the remote job instance has already completed successfully when the match is done, the shadow job status becomes C immediately.

If the shadow job ends in ERROR, an error code explains why the job failed. For example, if the job failed because the bind failed then the error code is FBND.

ERROR status is *not* considered a final status for the shadow job, because the remote job instance bound can be rerun at a later time. Only status C is considered as the final status for a shadow job.

As soon as the shadow job status satisfies the dependency rule, the dependency of the local job from the shadow job is resolved, and the cross dependency for the local job on the remote job is also resolved.

Modifying shadow job instances in the current plan

In a shadow job instance you can modify the following settings:

The remote job data that is used to bind the shadow job to a job instance in the remote engine plan

To modify the remote job data, select option 11 - Remote job info in the MODIFYING AN OPERATION IN THE CURRENT PLAN (EQQMMODP) panel. Depending on whether the shadow job is distributed or z/OS, one the following panels opens:

MODIFY DISTRIBUTED JOB INFORMATION IN THE CURRENT PLAN (EQQMMRDP)

In this panel you can modify any of the following values:

- Job stream name
- Job stream workstation
- Job name

MODIFY Z/OS JOB INFORMATION IN THE CURRENT PLAN (EQQMMRZP)

In this panel you can modify any of the following values:

- Application ID
- Operation number

Changes applied to these settings affect bind requests not yet triggered or shadow job reruns, they neither affect bind requests already in progress or established, nor update the shadow job definition in the database.

The workstation name

To modify the workstation name, select the job instance in the MODIFYING OPERATIONS IN THE CURRENT PLAN (EQQMOPRL) panel and update the workstation name field. Depending on the type of the workstations, both the original and the new one, the following situations can occur:

If you change from a non remote engine workstation to a remote engine workstation:

Because only shadow jobs are supported on remote engine workstations, you are requested to add remote job data to the job instance definition before saving the change.

If you change from a remote engine workstation to a non remote engine workstation:

Because shadow jobs are not supported on non remote engine workstations, when you save the changes the following situations occur:

- All information contained in the remote job data fields are deleted.
- If a bind request was in progress, notifications are discarded.
- If a remote job instance was already bound the asynchronous notifications about remote job status are discarded.

If you change from a remote engine workstation to another remote engine workstation:

When you save the changes the following occurs:

- If a bind request was in progress, notifications are discarded.
- If a remote job instance was already bound, the information about the job instance matched in the remote engine plan are deleted and the asynchronous notifications about remote job status are discarded.

If the types of the remote engine workstations are different, the information necessary to bind the remote job are deleted and you are requested to add new remote job data before saving the change.

Shadow job status transition during the remote job recovery or rerun

If the shadow job is used to map locally the status transition of a remote job with recovery job, prompt or options defined, the following behavior occurs:

- The shadow job status remains STARTED with extended status RECOVERY_IN_PROGRESS while the remote job recovery is in progress.
- The shadow job status is updated only when the remote job reaches a final state. The shadow job status will become:

  ERROR
  When the remote job final status notified is FAILED_EXECUTION or FAILED_SUBMISSION..

  COMPLETE
  When the remote job final status notified is SUCCEDED_EXECUTION.

It might happen that the remote job is rerun, either manually or as result of an automatic recovery. If the remote job was already completed successfully then the rerun has no impact on the shadow job status because it was already SUCC. If the remote job rerun requires the change of the shadow job status from ERROR to STARTED, IBM Workload Scheduler for z/OS applies the change if:

- The shadow job has no conditional successors.
- The shadow job is a conditional predecessor and its status change does not cause inconsistencies in the condition evaluation.

If the shadow job status change from ERROR to STARTED causes inconsistencies in evaluating conditions where the shadow job is a conditional predecessor, IBM Workload Scheduler for z/OS automatically sets the status of the shadow job to ERROR with error code OSEQ.

You can see the information about the remote job status:

- In the extended status of the shadow job displayed on the SELECTING APPLICATION OCCURRENCE AN OPERATION INFORMATION panel.
- In the Extra Information fields in the shadow job properties panel on the Dynamic Workload Console.

Modifying remote engine workstations in the current plan

You can modify the status of remote engine workstation instances in the current plan from the MODIFYING A WORKSTATION IN THE CURRENT PLAN (EQQMWSRP) panel.

If you set this type of workstation to OFFLINE, the outgoing bind requests to the remote engine referenced in the remote engine workstation are queued until the workstation status becomes ACTIVE. The status of a remote engine workstation does not affect the outgoing bind requests already triggered or the incoming bind requests.

After the bind is established, you cannot modify the destination of a workstation (with the RFRDEST command), since the information used to identify the bound remote job instance is already stored within the shadow job instance.

Contacting the remote engine in a failover scenario

On the IBM Workload Scheduler distributed system, the management can be switched from the current master domain manager to a backup master domain manager. In this case, when your distributed remote engine workstation tries to contact the master domain manager its status becomes OFFLINE. To prevent the bind process from failing:

1. Define a distributed remote engine workstation for the master domain manager and for each backup master domain manager.

2. Define each remote engine workstation as the alternate workstation for the previous one.

For example, in your z/OS scheduling environment you have defined a distributed remote engine workstation RENG that points to the master domain manager MDM on the distributed IBM Workload Scheduler. You have also defined the remote engine workstations REW1 and REW2, respectively pointing to the backup master domain managers BMDM1 and BMDM2. If the master domain manager is switched to a backup master domain manager, to prevent the bind process from failing, define REW1 as the alternative workstation for RENG, and REW2 as the alternative workstation for REW1.

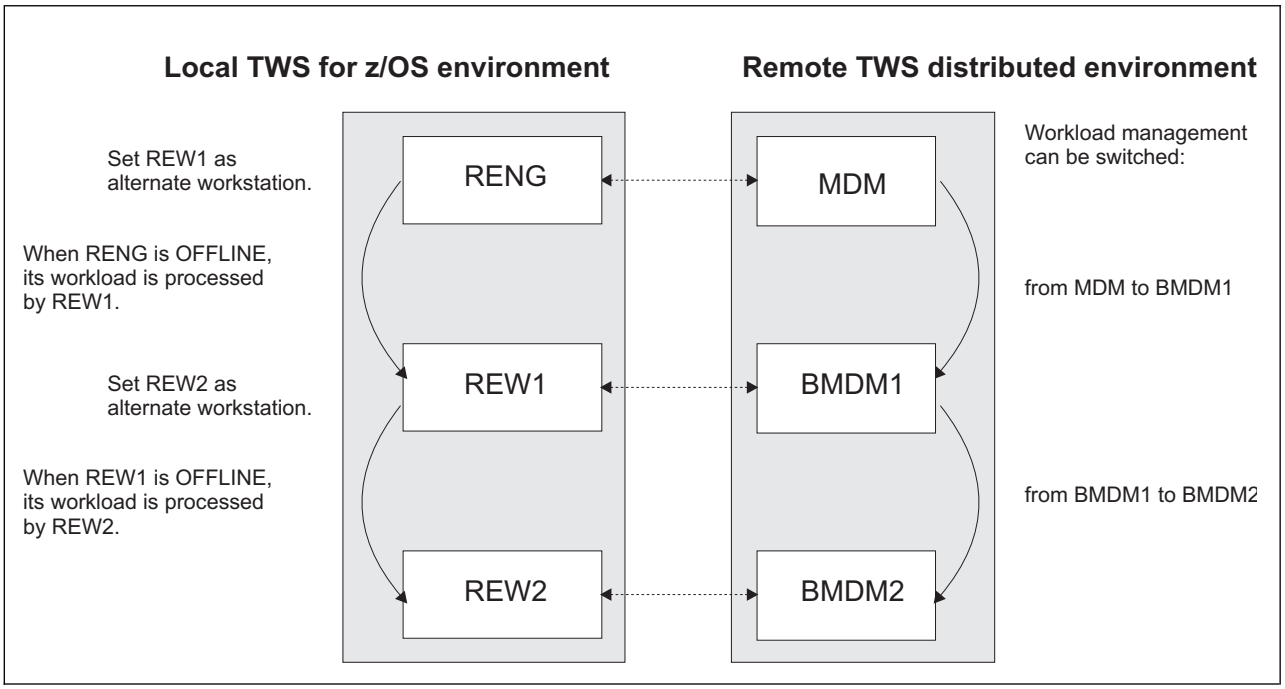


Figure 196. Cascading remote engine workstation definitions for the switch management scenario

The routing of workload between primary and alternate remote engine workstations works also when the IBM Workload Scheduler engine on the remote master domain manager that you powered off remains active.

If all the primary and alternate remote engine workstations are OFFLINE, the requests are queued and will be managed by the first of these workstations that will become ACTIVE again. If more than one of these workstations becomes ACTIVE simultaneously, the requests will be managed by the highest remote engine workstation in the cascade.

When the remote engine is a z/OS controller the failover scenario is managed automatically by the SYSPLEX so you do not need to define any alternate remote engine workstation. In fact, a single HTTP address is sufficient to manage in a transparent way failover scenarios because the configuration with a hot standby controller is supported through Dynamic Virtual Internet Protocol Addressing - VIPA and controller and standby controller listen on the same hostname and port.

Chapter 24. Running event-driven workload automation

Event-driven workload automation (EDWA) addresses on-demand workload automation in addition to plan-based job scheduling.

Using event-driven workload automation you can carry out a predefined set of actions in response to events that occur in environments where the scheduler runs.

This process is based on the following concepts:

Event The event that the scheduler can detect for action triggering. It can be:

- Activity impacting a data set, when SMF writes a record that traces the closure of one of the following types of file:
  - Data set
  - GDG file
  - VSAM cluster
- HFS or ZFS file changes.
- Job submission outside IBM Workload Scheduler for z/OS.
- Special resource status change, requested by an operator command.

Action

The action that the scheduler runs when the defined condition is satisfied. It can be:

- Add a special resource to the current plan or modify an existing resource, after the tracker generated an event of special resource status change.
- Releasing a dependency on an operation that runs file watching.
- Add an occurrence to the current plan.

Condition

The event condition that is to be monitored, based on specified filtering criteria.

Business scenario

The business analyst of a Bank Information Center requires that IBM Workload Scheduler for z/OS produces periodic reports on daily data, provided by a bank employee using FTP to update a data set located on a tracker system.

To automate this process, the scheduling administrator creates an application where the job producing the report depends on a special resource that corresponds to the data set to be updated by FTP.

When the update process ends, the scheduler submits the job to produce a formatted report.

The event-driven process

Event-driven workload automation is an ongoing process and can be reduced to the following steps:

1. The administrator defines the event rule, that is the criteria to correlate event conditions and actions.
2. The administrator builds and activates triggering selection data based on the previous criteria, starting the event-driven process: on each system where the scheduler runs, specific components act as event or action provider. The action provider access the data correlating event conditions and actions, according to the following schema:

	Event Provider	Action Provider	Correlation data
Data set triggering	SMF	Tracker, requesting to change special resource availability	EQQJCLIB member in the system where the tracker runs
HFS or ZFS file triggering	Tracker, handling jobs that run file watching	Controller, releasing dependencies on operations that run file watching	• Dependencies defined on operations that run file watching • file watching utility parameters
Event-triggered tracking (ETT)	• JES • user request to change special resource availability	Controller, adding an occurrence to the current plan	Database ETT record in the system where the controller runs

The following sections describe how you can set up this process. In particular:
- To trigger an action on a special resource, refer to "Data set triggering."
- To trigger an action based on HFS or ZFS file changes, refer to "HFS or ZFS file triggering" on page 475.
- To trigger workload submission (adding an occurrence), define the correlation as described in "Adding occurrences by event-triggered tracking" on page 478.

Data set triggering

To build the EQQJCLIB member, you can:

- Write a series of EQQLSENT macros as described in "Invoking the EQQLSENT macro" on page 854, compile them using the EQQLSJCL member of the SEQQSAMP library, name the output file EQQDSLST and place it in the partitioned data set specified by the EQQJCLIB DD statement in the tracker start process. You have to manually populate the EQQJCLIB data set for each system where data set monitoring must be active.
- Using a single job, that you can submit from the product dialog, customize the triggering criteria for all your trackers, build configuration files based on that criteria and deploy them at tracker side. These configuration files are automatically placed as EQQEVLST members in the EQQJCLIB data set. For a description of these tasks, refer to the following sections:
  - "Defining event rules" on page 473

– "Producing the configuration files"
– "Deploying configuration files" on page 474

They require preliminary steps for the system where the controller runs, as described in *Planning and Installation*, section *Activating support for the Java™ utilities*.

Your EQQJCLIB data set can contain EQQEVLST data only, EQQDSLST data only, or both EQQEVLST and EQQDSLST data.

To decide which kind of selection table is best for your purpose, consider that customizing EQQEVLST provides the following capabilities:

– Centralized deploy process.
– The process that monitors data set closure can distinguish if a data set is closed after it was opened in read or write mode (by checking the `ReadCompleted` or `ModificationCompleted` values specified in the rule as `eventType` parameter, described in Appendix G, "Defining event rules and invoking EQQLSENT macro," on page 847).

Defining event rules

A scheduling event rule defines a set of actions that are to run upon the occurrence of specific event conditions. The definition of an event rule correlates events and triggers actions. An event rule definition is identified by a rule name and by a set of attributes. It includes information related to the specific events (`eventCondition`) that the rule must detect and the specific actions it is to trigger upon their detection (`action`).

The SEQQSAMP library contains EQQXML01 member as sample of event rule definition. For details about the XML syntax, refer to Appendix G, "Defining event rules and invoking EQQLSENT macro," on page 847.

Producing the configuration files

About this task

Based on the current routing options (ROUTOPTS initialization statement), the controller creates your configuration files in the EQQEVLIB data set, that is a partitioned data set where each member name corresponds to a tracker destination.

When the controller starts, it updates the EQQEVLIB data set by creating a member for each active destination. The controller leaves unchanged any existing member with the same name as an active destination, and empties any member that does not correspond to an active destination.

To populate the configuration files for all the defined tracker destinations, perform the following steps:

1. Select option 1.7.3 from the main menu.
2. Press Enter to submit or edit a JCL to run the EQQRXTRG program, that performs the following actions:
   a. Reads and parses the defined event rules.
   b. Updates EQQEVLIB data set, according to the following criteria:
      - If the controller is not active when you run the JCL, EQQRXTRG updates the EQQEVLIB data set based on the defined event rules, producing one member for each `Destination` value.

        Existing members, with the same name as a specified `Destination` value, are replaced.

Existing members, with names that do not correspond to any specified `Destination` value, remain unchanged.

- If the controller is active when you run the JCL, EQQRXTRG updates the EQQEVLIB data set based on the defined event rules, replacing any existing member corresponding to a specified `Destination` value.

  Existing members, with names that do not correspond to any `Destination` value, remain unchanged.

  When detecting a `Destination` value that does not correspond to any member in the EQQEVLIB data set, EQQRXTRG returns an error message without creating a new member.

The process formats each EQQEVLIB member data according to a trigger table layout mapped by the TRG data area. It includes a header with a Cyclic Redundancy Check (CRC) number, to univocally identify the configuration file: changing the input to the EQQRXTRG program produces a different CRC number.

Any comment inserted in the XML source file is not stored in the formatted output.

For details about the TRG data area, refer to *Diagnosis Guide and Reference*.

c. Optionally, issues a modify command with the DEPLOYCF option, to immediately start the deploy process for the configuration files. You can add the modify command in the JCL source before submitting it, or manually issue the same command later. For details about the deploy process, refer to "Deploying configuration files."

Deploying configuration files

When starting the deploy process, the controller loads the CRC numbers and uses them to check whether or not any connected tracker needs a new copy of the configuration file.

As result of the deploy process, each tracker that:

- Is connected to the controller
- Is at the same level as the controller
- Has its destination associated with a workstation present in the current plan

receives an event configuration file updated according to the current content of the controller EQQEVLIB data set. The refreshed configuration file is stored in the EQQEVLST member of the tracker EQQJCLIB data set.

Note: If EQQJCLIB contains also the EQQDSLST member, the resulting triggering selection table is the union of EQQEVLST and EQQDSLST.

Then, each tracker monitors for the events that match the refreshed data, based on an in-storage copy of the configuration file.

The deploy process starts in the following cases:

- At tracker connection time.
- Periodically, depending on the frequency of handshakes initiated by the trackers, specified by the PULSE parameter of the ROUTOPTS initialization statement.
- When processing a modify command with the DEPLOYCF option.

If a tracker destination is referenced in the ROUTOPTS initialization statement, but it is not currently connected, the tracker acquires the configuration file data when the connection is restored.

Effects on special resource availability

When the deploy process is completed, an automatic special resource availability handling starts and goes on, as follows:

1. Whenever any file is affected by an action that corresponds to a possible triggering event type, the proper SMF write exit is called to examine the generated SMF record.
2. The exit invokes the tracker subsystem, which compares the file name and other specifics from the SMF record against the entries in the configuration file.
3. If a match is made, the tracker subsystem creates a special resource status change event record and places it on the writer queue (WTRQ) in the extended common service area (ECSA). Following rules apply:
   - For a partitioned data set, the member name is not part of the resource name in the event that the tracker generates.
   - Generation Data Group data sets are specified by the group name. For example, when a GDG data set with the name 'DSN.OPCSUBS.GDG.G0001V00' is closed the special resource event contains resource name 'DSN.OPCSUBS.GDG'.
   - For VSAM data sets the resource name in the generated event is the cluster name (without the DATA or INDEX suffix).
   - If you used wildcards in the `FileName` parameter values of your event rule definition, the resource name in the generated event is the full name of the matching data set.

   Note: This record is an EXS event. It begins with the characters `SYY`. When browsing the tracker event data set, `SYY` appears in columns 21-23. The data set name from the SMF record begins in column 53 (x'20'). For more information about the EXS event, see *Diagnosis Guide and Reference*.
4. The tracker event WRITER task removes the record from the writer queue, writes it to the event data set, and passes it to the controller.

HFS or ZFS file triggering

The product package includes a file watching utility. After installing the product, you find this utility as load-module EQQFLWAT in the SEQQLMD0 library. You can use it to check for file system changes of HFS or ZFS files and directories, for example when you want to make sure that a file exists before running a job that processes that file. By defining a job that runs this utility, you can implement file dependency, that is a relationship between a file and an operation in which specific activity on the file determines the starting of the operation. For example, you can define the job that runs EQQFLWAT as predecessor of the operation depending on the file.

The user running EQQFLWAT must have execute (x) access to the directory path that contains files to be monitored.

The SEQQSAMP library contains EQQFLWAT member as sample JCL to call the file watching utility.

On IBM Workload Scheduler for z/OS Agents and on fault-tolerant agents in end-to-end configurations the utility uses a file named `filwatchdb` to save its file monitoring data. You can use the `-database` argument to specify an extension for

file `filwatchdb` that is different from the default. In this way, you can use a particular database file for every application of the file watching utility that you make.

Syntax

As shown in the EQQFLWAT member of the SEQQSAMP library, the following format is supported for the parameter of the EXEC statement that specifies PGM=EQQFLWAT:

```
//FLWATCH  EXEC PGM=EQQFLWAT,PARM='ENVAR()/-c condval  -dea deadline
//   -fi file_path -i interval -r rc -t trace_level -dat database_extension'
```

Consider that:

- No continuation character is used. To continue the PARM field, interrupt it at column 72 and continue in column 16 of the next card.
- Separate arguments and values by using a blank character.
- Use `ENVAR()` to pass environment variables to EQQFLWAT.
- EQQFLWAT returns messages and trace information (if required) in the log of the job used to run the utility. If you use the job log retrieval function, set to Y the User Sysout field in the cleanup options at operation level, both in the database and in the current plan.
- The arguments are not positional.
- You can use an abbreviated format for all the arguments. Generally you can truncate the arguments to any position following the first character, except for `deadline` that requires at least three characters.

Arguments

-condition | -c
The condition to be checked. Valid values are:

wcr | waitCreated
Waits until the file exists. If the file already exists, **filewatch** exits immediately. If `-filename` argument specifies a directory, the process waits until the directory exists and contains a new file.

wmr | waitModificationRunning
Waits until the file size or modification time changes. If `-filename` argument specifies a directory, the process waits until the size or earlier file modification time changes, when a file is created, modified, or deleted.

wmc | waitModificationCompleted
Checks that the file size or modification time stopped changing, meaning that **filewatch** waits for three search intervals without any change. If `-filename` argument specifies a directory, the process checks the size or the earlier file modification time change, for example if the number of directory files and the earlier file modification time does not change within three search intervals.

wmrc | waitModificationRunningCompleted
Waits until the file size or modification time changes and stops changing, meaning that, after the first change, **filewatch** waits for three search intervals without any further change. If `-filename` argument specifies a directory, the process checks the size or the earlier file modification time change, for example if the number of

directory files and the earlier file modification time does not change within three search intervals.

wdl | waitDelete
Stops running when the file is deleted. If `-filename` argument specifies a directory, the process waits until a file is deleted from the directory.

-database | -dat
Applies only to IBM Workload Scheduler for z/OS Agents or to fault-tolerant agents in end-to-end configurations. It is a file extension to be added to filename `filwatchdb`, where the utility saves its file monitoring data. This provides the possibility to have more than one file watch database files.

The extension cannot be longer than 4 characters. If you specify a longer value, the following message is issued:

```
-WARNING: value XXXXXXX for keyword '-database' is too long.
```

The value is truncated to XXXX and used as such.

-deadline | -dea
The deadline period, expressed in seconds. The allowed formats are:

- An integer in the range 0 to 31536000 (the upper value corresponds to one year). To have **filewatch** performing an indefinite loop, specify 0.
- *hh:mm:ss*, in the range 00:00:01 to 24:00:00, to select a time within the same day when **filewatch** started.

  It corresponds to the GMT value. To specify a value different from the GMT, use the `ENVAR` parameter as shown in "Example" on page 478. For details about setting the TZ environment variable, refer to the *UNIX System Services Command Reference*.

-filename | -fi
The file path to be processed. You can embed blank or special characters, by using double quotation marks. Wildcard characters are not supported. To include more files in the monitoring process, you can store those files in a specific directory and use a file path specifying that directory.

-interval | -i
The file search interval, expressed in seconds. Specify an integer in the range:

- 5–3600 when specifying **wcr** or **wdl** as condition value.
- 30–3600 otherwise.

The default is 60.

-returncode | -rc
The exit return code, if the file is not found by the deadline. Specify an integer in the range 0 to 255. The returncode value is ignored if you specify 0 as deadline value. The default is 4.

-trace | -t
Trace level for internal logging and traces. Possible values are:

0 To receive error messages only.

1 Indicates the *fine* level, to receive the most important messages with the lowest volume.

2 Indicates the *finer* level, to activate entry and exit traces.

3 Indicates the *finest* level, to receive the most detailed tracing output.

The default value is 0.

You find the trace output in the log of the job that run **filewatch**.

Example

```
//FLWATCH  EXEC PGM=EQQFLWAT,PARM='ENVAR(TZ=GMT-1CET)/-co wcr  -dead 30
//             -fi /u/falsi/prova -int 30 -t 2'
```

In the previous example `ENVAR(GMT-1CET)` is used to change the time zone to Central Europe Time. GMT-1 is the time zone value and CET is the selected daylight saving time.

Adding occurrences by event-triggered tracking

Event-triggered tracking adds occurrences to the current plan based on a triggering event. You can use ETT to track work that has been submitted outside IBM Workload Scheduler for z/OS control, or simply to respond to an on-demand request for processing.

The following sections follow:

- "Triggering event types"
- "Activating ETT" on page 479
- "Defining your ETT criteria" on page 479
- "Automatically adding an occurrence to the current plan" on page 481
- "How you can use ETT to automate tasks" on page 483
- "Using ETT occurrence-related variables" on page 483

Triggering event types

IBM Workload Scheduler for z/OS generates events when certain incidents occur on the system. The events generated when a resource is set available, or when a job or started task arrives in JES, can be used to communicate to ETT that a particular occurrence should be added to the current plan.

When you define ETT criteria, you specify which event type is triggering IBM Workload Scheduler for z/OS to add an occurrence of an application to the current plan.

J-type

These occur when a job or started task arrives in JES which cannot be matched with an operation in the current plan. The job that has entered the reader can be the actual job that you want IBM Workload Scheduler for z/OS to track, or an IEFBR14 that is being used only as a trigger for additional processing. J-events can also be generated when a STATUS(Q) is requested using the OPSTAT command issued either in native TSO, or in a CLIST or REXX EXEC, the EQQEVPGM using OPSTAT as input, or by using the EQQUSIN subroutine.

The first operation of the added application must be defined on the same type of computer workstation as the triggering event. In other words, if the triggering event is a batch job, the first operation of the added application must be defined on a job computer workstation. If the triggering event is a started task, the first operation of the added application must be defined on a started-task (STC) computer workstation. If the workstation types do not match, no application will be added.

R-type

These occur when the availability status of a resource is set to YES. The availability of a resource can be set to YES by the SRSTAT command issued either in native TSO, or in a CLIST or REXX EXEC, the EQQEVPGM batch program using SRSTAT as input, or by the EQQUSIN subroutine. The availability of a resource can also be set automatically when a data set is closed if your installation implements the data set triggering support.

The resource might be one that is also used by operations in the current plan, or it can be a resource dedicated as an ETT trigger.

Note: If you change the availability of a resource on the MODIFYING RESOURCES panel, an R-event is not created. IBM Workload Scheduler for z/OS does not recognize this as an ETT-triggering action. This also applies to resources that are created dynamically either from the Dynamic Workload Console or the PIF. For more information about creating and using resources, see Chapter 5, "Creating special resources," on page 75.

Activating ETT

To activate ETT automatically when IBM Workload Scheduler for z/OS is started, specify ETT(YES) on the JTOPTS statement (see *Customization and Tuning*).

To activate or deactivate ETT while IBM Workload Scheduler for z/OS is active, use the SERVICE FUNCTIONS panel. See Chapter 14, "Using service and optional functions," on page 327.

Defining your ETT criteria

About this task

Follow these steps to specify ETT criteria:

1. Specify option 1 (DATABASE) on the main menu.
2. Specify option 7 (EDWA) on the MAINTAINING IWSz DATA BASES menu.
3. Specify option 2 (MODIFY) on the MAINTAINING EVENT TRIGGERED TRACKING menu.

```
EQQJMTCL -------------- MODIFYING ETT TRACKING CRITERIA ----------  ROW 1 OF 3
Command ===>                                                  Scroll ===> PAGE

Change data in the rows, and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat,  D(nn),DD - Delete

Row  Name of triggering event                      Id of associated  E  J  D  A
cmd                                                application       T  R  R  S

'' DAP*_____________________________________  SAMPLEA_________  J  N  Y  N
'' TESTJOBB_________________________________  SAMPLEB_________  J  Y  N  N
'' SPECIAL RESOURCE 1_______________________  SAMPLE0_________  R  N  Y  Y
****************************** BOTTOM OF DATA ********************************
```

Figure 197. EQQJMTCL - Modifying ETT tracking criteria

4. Specify these fields for the criteria:

   Name of triggering event

   This is:

   - For a J-event, the name of the job that will act as the trigger
   - For an R-event, the name of the resource whose availability will act as the trigger

You can specify the triggering-event name generically by using the generic search characters * (asterisk) or % (percent). If there is more than one match for generic filters, the most specific match is selected. For a J-event, for example, you could specify a job name of DAP* as the name of the triggering event. Whenever a job that is outside IBM Workload Scheduler for z/OS control with a job name beginning with DAP enters the system, IBM Workload Scheduler for z/OS adds an occurrence of SAMPLEA to the current plan.

ID of associated application
Specify the ID of the application to be triggered.

ET The type of event (J or R). See "Triggering event types" on page 478.

JR This specifies job-name replace tracking. Specify Y if IBM Workload Scheduler for z/OS will track the job that is being used as the trigger. If you specify N, IBM Workload Scheduler for z/OS will not track the trigger, and the job serves only as the means for automatically adding an occurrence to the current plan. Use of job-name replace can give you a single point for monitoring all tasks. Tracking the actual job also means that powerful error detection capabilities and dependency control will be available to you for that operation.

For example, the JCL for IMS recoveries can be built by DBRC. If you want to track the recoveries and use IBM Workload Scheduler for z/OS to detect errors and establish dependencies, define the tasks to ETT with job-name replace tracking. You would need only a single application description in the AD for all DBRC-generated recoveries. When the occurrence is added to the current plan, the job name of the first operation, which must be defined on a z/OS computer workstation, is changed to match the actual name of the triggering job.

Note: You can specify Y only for J-type triggering events.

DR Specify dependency resolution for the occurrence to be added. As with the MCP panel and the program interface, you can choose:
Y Resolve both predecessor and successor dependencies.
N Ignore all dependencies.
P Resolve only predecessor dependencies.
S Resolve only successor dependencies.

AS If this is N, ETT adds an occurrence each time the availability status is set to YES on a R-event. If you want an occurrence added only in the case of a true availability status switch for a resource from available=no to available=yes, set the availability status switch to Y. The availability status switch is valid only if the event type is R. If the event type is J, this field should have the value N, or blank.

Note: Be aware that if an SRSTAT command (or equivalent) is issued for a resource that does not exist in either the resource definition database (panel option 1.6) or in the special resource monitor (panel option 5.7), IBM Workload Scheduler for z/OS reacts differently depending on whether the SRSTAT create option is set to YES or NO:

- If you issue an SRSTAT command with CREATE(NO) AVAIL(YES), no resource is created in the plan and the resource status changes from NO to YES, then immediately back to NO. Each time the SRSTAT command is repeated, another availability switch to YES occurs, and ETT processing adds another occurrence, even if the ETT criteria has AS set to Y.

- If you issue an SRSTAT command with CREATE(YES) AVAIL(YES), the resource is created in the special resource monitor, but IBM Workload Scheduler for z/OS does not count this creation as a real status change, and if AS in the ETT definition is set to Y, then no ETT triggering occurs.

Thus for predictable processing, if you want to use the ETT ACTUAL STATUS option, all special resources, for which this option is to be set, should be predefined in the MAINTAINING SPECIAL RESOURCES panel (option 1.6)

Automatically adding an occurrence to the current plan

You use a J-event or an R-event to trigger the addition of an application occurrence to the current plan. This is equivalent to adding an occurrence using the MODIFYING CURRENT PLAN panel.

When the J or R triggering event occurs, the application occurrence is added to the current plan. If possible, its input arrival time is set to the time of the triggering event. If this is not possible, because an occurrence of the application already exists with that input arrival time, the next closest time available is used. If IBM Workload Scheduler for z/OS cannot allocate an input arrival time before the end of the current plan, the occurrence will not be added.

The application description of the occurrence to be added must exist in the AD database. If the application has run cycles specified in the AD database, the deadline date and time of the occurrence are calculated based on the first run cycle that is found. Otherwise, they are set to the input arrival time of the triggering event, plus 8 hours. The input arrival time of operations within the occurrence is calculated using the operation IATs in the AD database.

To control the calculation of the deadline date and time plan, you can define a special period, ETTRCY2, and create a run cycle in the application description that refers to that period. The period must be called ETTRCY2. Define the period as noncyclic, with an origin date of 71/12/31, 31 December 2071, which is the IBM Workload Scheduler for z/OS high date. Such a date satisfies requirements for noncyclic period definitions but ensures that applications that refer to the period definition are not accidentally included in the long-term plan. Set the run cycle input arrival time as 00.00, and the deadline day and time as the offset you want to add to the actual input arrival time. If an ETT-added occurrence contains a run cycle that uses the period ETTRCY2, IBM Workload Scheduler for z/OS uses the deadline day and time defined on that run cycle to calculate the deadline from the actual input arrival time, which by default is the triggering-event time.

If the application has external dependencies, you can specify if these dependencies should be automatically resolved when the occurrence is added to the current plan. An occurrence that has been added to the current plan by ETT will not become the predecessor to an occurrence that is added later by daily planning, even if normal dependency criteria are met.

If the ETT criteria specifies job-name replace, the job name of the first operation is changed to that of the triggering job name. If the first operation has a successor print operation, the job name of the print operation is also changed. The first operation is the one with the lowest operation number. The operation cannot have internal predecessors and must be defined on a computer workstation. IBM Workload Scheduler for z/OS ignores the TRACK keyword of the JTOPTS statement for jobname replace. The operation's SUBMIT option is set to NO.

Regardless of whether you use job-name replace, the application occurrence added to the plan can contain up to 255 operations. If you need to trigger the addition of multiple applications from a single triggering event, define the ETT trigger for the first application. The first application can then contain a job to set the availability of a resource to YES, which in turn matches another ETT definition, and the second application is added to the current plan.

If you use ETT to trigger a job when a resource becomes available, you might get into an occurrence-add loop under certain situations. For example, if you want IBM Workload Scheduler for z/OS to submit job A when ETT detects the availability of resource X, and X originally has an availability of NO, the following can occur:

1. Special resource X becomes available (that is, its availability status changes to YES), and ETT detects the change.
2. In response to the R-event, ETT causes job A to be submitted.
3. Job A uses resource X, changes its availability status back to YES, and then terminates.
4. ETT detects the changed availability of X to YES and submits job A again.

In this situation, job A is continually submitted.

Note: When you set the availability of a resource to YES, IBM Workload Scheduler for z/OS generates an R-event regardless of the initial status of the resource. If a resource is currently available and you issue an SRSTAT specifying AVAIL(YES), an R-event is generated.

Normally, when an occurrence is added to the plan and resolution of successor dependencies is requested, the input arrival time of the occurrence is used to identify the best candidate operations. ETT-added occurrences are, by their nature, not very predictable. The input arrival time of the occurrence is equally unpredictable.

To control the input arrival time that should be used when establishing predecessor dependencies in the current plan, you can specify an explicit start time on the operation level of the application that is to be added by ETT.

To control the time used when establishing successor dependencies in the current plan, you can define a special period, ETTRCY1 and create a run cycle in the application description that refers to that period. The period must be called ETTRCY1. Define the period as noncyclic, with an origin date of 71/12/31, 31 December 2071, which is the IBM Workload Scheduler for z/OS high date. Such a date satisfies requirements for non-cyclic period definitions but ensures that applications that refer to the period definition are not accidentally included in the long-term plan.

If an ETT-added occurrence contains a run cycle that uses the period ETTRCY1, IBM Workload Scheduler for z/OS adds the occurrence to the current plan with an input arrival time that corresponds to the current time. As a consequence, to establish successor dependencies IBM Workload Scheduler for z/OS uses the time supplied by ETTRCY1, *not* the occurrence input arrival time.Use the JTOPTS ETTNEWDEP parameter to customize the criteria used by the scheduler when selecting candidate successors. For details, refer to *Customization and Tuning*.

Attention:

- If you define an application that both uses the period ETTRCY1 and has a dependency on itself (with the same input arrival day), you can add it only twice. A further attempted addition will result in a message being displayed describing the ETT failure.
- Because the successor intervals are created before the predecessor occurrence is added, the ETTNEWDEP parameter does not apply to the resolution of mandatory successors.
- ETT supports only applications of type A (Applications). If an application of type G (Group) is specified, the application is not added by ETT and message EQQE011E is issued.

How you can use ETT to automate tasks

ETT provides a method for automating some tasks currently performed manually. Using ETT, you can reduce processing-request telephone calls or run-request sheets from your operations department.

You can also use the ETT to trigger batch processing from online systems, particularly from on-demand transaction programs. These are ways you might use ETT in your environment:

- Start batch processing after the receipt of unsolicited file transfer.
- Request some processing via SRSTAT, which triggers an occurrence to be added to the plan.
- Start a batch process when NetView intercepts a particular message.
- Provide IF-THEN logic in your batch streams: if a step returns CC4, execute a step to trigger APPLA; if the step returns CC8, execute a different step to trigger APPLB.
- Dynamically add the next occurrence in a sequence, for processing that cannot be determined in advance (database backups that are run only when the database has been changed, for example).
- Start batch processing initiated by an online transaction.

ETT can be used in many different situations to streamline your operation.

Using ETT occurrence-related variables

About this task

To determine the type of event that has caused the automatic addition of a new occurrence to the plan, use the variables provided by ETT. For example, consider that a company is asked to produce customer-oriented reports according to an external demand. The on-demand request is created by a job name that identifies the customer and is contained in a new generation of an input GDG data set. You can resolve the on-demand process by using the ETT definition and ETT variables in a single job, as follows:

1. In the CREATING A SPECIAL RESOURCE panel (option 1.6.2 on the main menu), define the special resource that identifies the input GDG data set root.

```
EQQQDCRP ---------------- CREATING A SPECIAL RESOURCE -----------------------

 Select one of the following:

 1 INTERVALS  - Specify intervals
 2 WS         - Modify default connected work stations

 SPECIAL RESOURCE   ===> TWS.REQUESTS.GDG_____________________________
 TEXT               ===> ____________________________________________
 SPECRES GROUP ID   ===> ________
 Hiperbatch         ===> N       DLF object Y or N
 USED FOR           ===> B       Planning and control C , P , B or N
 ON ERROR           ===> _       On error action F , FS , FX , K or blank
 ON COMPLETE        ===> _       On complete action Y , N , R or blank
 MAX USAGE LIMIT    ===> _____   Max number of allocations before usage reset
 MAX USAGE TYPE     ===> N       Status change type Y, N or R


 Defaults
   QUANTITY         ===> 1_____  Number available 1-999999
   AVAILABLE        ===> Y       Available Y or N
```

Figure 198. EQQQDCRP - Creating a special resource

2. In the MODIFYING ETT TRACKING CRITERIA panel, specify the ETT criteria for the GDG data set root.

```
EQQJMTCL --------------- MODIFYING ETT TRACKING CRITERIA -------- Row 1 to 4 of 4
Command ===>                                                    Scroll ===> PAGE

Change data in the rows, and/or enter any of the following row commands:

I(nn) - Insert,  R(nn), RR(nn) - repeat,  D(nn), DD - Delete


Row  Name of triggering event                        ID of associated E  J  D  A
cmd                                                  application      T  R  R  S
'''' SETT*_____________________________________ ETTAPPL1________ J  N  Y  N
'''' TWS.CWSA.CLIST____________________________ ETTAPPL2________ R  N  Y  N
'''' TWS.CWSA.JCL*_____________________________ ETTAPPL3________ R  N  Y  N
'''' TWS.REQUESTS.GDG__________________________ ETTAPPL4________ R  N  Y  N

******************************** Bottom of Data ********************************
```

Figure 199. EQQJMTCL - Modifying ETT tracking criteria

3. Update the selection table for the tracker to identify the ETT criteria for the GDG data set root. The file to be edited depends on which kind of selection table the tracker uses:
   - If the tracker uses EQQDSLST as selection table, update the EQQLSJCL member of the sample job JCL library as follows:

```
EDIT      TWS.CWSA.JOBLIB(EQQLSJCL) - 01.08                Columns 00001 000072
Command ===>                                                   Scroll ===> CSR

****** *************************** Top of Data ***********************************

000001 //ASMH      EXEC PGM=ASMA90,PERM='NODECK,OBJECT,XREF,(SHORT),LIST'
000002 //SYSPRINT  DD SYSOUT=*
000003 //SYSLIB    DD DISP=SHR,DSN=TWS.SEQQMAC0
000004 //SYSLIN    DD DISP=SHR,DSN=TWS.JCLIB(EQQDSLST)
000005 //SYSUT1    DD UNIT=SYSDA,SPACE=(CYL,(2,1))
000020 //SYSIN     DD *
000021 EQQLSENT    STRING='TWS.CWSA.CLIST ',POS=1
000022 EQQLSENT    STRING='TWS.REQUESTS.GDG ',POS=1
000023 EQQLSENT    STRING=LASTENTRY
000024 END
000025 /*

****** ************************ Bottom of Data ***********************************
```

Figure 200. Updating EQQDSLST list

If the tracker uses EQQEVLST as selection table, updated it as described in "Data set triggering" on page 472.

4. Write a sample JCL that includes the ETT occurrence-related variables.

```
EDIT      TWS.CWSA.JOBLIB(TESTJCL) - 01.00                 Columns 00001 000072
Command ===>                                                   Scroll ===> CSR

****** *************************** Top of Data ***********************************

000100 //TESTJCL   JOB  (876903,D07),'AAAAAAA',MSGLEVEL=(1,1),
000200 //        MSGCLASS=A,CLASS=A
000210 //*
000211 //*%OPC SCAN
000220 //*************************************************************
000221 //* - READ AND ELABORATE THE NEW REQUEST
000222 //* - CREATE THE OUTPUT REPORT FOR CUSTOMER
000223 //*************************************************************
000224 //STEP1    EXEC PGM=READREQ
000225 //REQUEST  DD DISP=SHR,DSN=&OETEVNM
000227 //REPORT   DD DISP=(,CATLG),DSN=REPORT.&OETJOBN,
000228 //        SPACE=(TRK,(1,1)),UNIT=SYSDA,
000229 //        DCB=(RECFM=VBA,BLKSIZE=136,LRECL=1360)
000230 //*

****** ************************ Bottom of Data ***********************************
```

Figure 201. JCL written to use ETT occurrence-related variables

5. When you create a request, a new generation of TWS.REQUESTS.GDG is created. The ETT criteria schedule a new occurrence and the variable is resolved.

```
//TESTJCL  JOB  (876903,D07), 'AAAAAAA',MSGLEVEL=(1,1),
//     MSGCLASS=A,CLASS=A
//*
//*%OPC SCAN
//*********************************************************************
//* - READ AND ELABORATE THE NEW REQUEST
//* - CREATE THE OUTPUT REPORT FOR CUSTOMER
//*********************************************************************
//STEP1    EXEC PGM=READREQ
//REQUEST  DD DISP=SHR,DSN=TWS.REQUEST.GDG.G0002V00
//REPORT   DD DISP=(,CATLG),DSN=REPORT.USER1,
//         SPACE=(TRK,(1,1)),UNIT=SYSDA,
//         DCB=(RECFM=VBA,BLKSIZE=136,LRECL=1360)
//*
```

Figure 202. JCL with variables resolved

For a detailed description of the ETT occurrence-related variables, see Table 24 on page 494.

Combining data set triggering and ETT

After deploying configuration files, you can combine event-triggered resource handling and event-triggered tracking by specifying the `FileName` data, that you defined in the event rule, as the special resource name in the MODIFYING ETT TRACKING CRITERIA panel.

Note: The MODIFYING ETT TRACKING CRITERIA panel does not support ? as generic search character.

Here is a summary of the overall process:

1. Produce the configuration files. Same steps as in “Deploying configuration files” on page 474 and “Producing the configuration files” on page 473 are valid.
2. Deploy your configuration files. Then, same automatic process as in “Effects on special resource availability” on page 475 starts.
3. After the tracker passed the special resource event to the controller, the controller processes the event exactly the same as it would one created by means of an SRSTAT batch job. The resource name is compared to the ETT trigger definitions, and if a match is made, an occurrence of the specified application is added to the current plan.

Chapter 25. Job tailoring

This chapter describes the job tailoring, which enable jobs to be automatically edited using information that is known only at job setup or submit. This can reduce your dependency on time-consuming and error-prone manual editing of jobs. Job tailoring provides:

- Automatic variable substitution
- Dynamic inclusion or exclusion of inline job statements
- Dynamic inclusion of job statements from the EQQJBLIB data set or from an exit

For jobs to be submitted on a z/OS system, these job statements will be z/OS JCL, but IBM Workload Scheduler for z/OS JCL tailoring directives can be included in jobs to be submitted on other supported operating systems. The directives have the same format for all supported operating systems.

An alternative method of substituting variables is to use the IBM Workload Scheduler for z/OS program interface (PIF) . The PIF lets user-programs issue requests to the IBM Workload Scheduler for z/OS subsystem, thereby automating actions that you would otherwise perform with the panels. The PIF resource, JCLPREPA, can simulate variable substitution; in other words, you can perform *trial substitution* of your variables without actually updating the job.

Note: You must specify values when using a JCLPREPA-call to PIF, otherwise the variable will not be substituted, leaving `&`, `?`, and `%` signs in the job.

For more information about PIF, see *Developer's Guide: Driving IBM Workload Scheduler for z/OS*.

Variable substitution

IBM Workload Scheduler for z/OS supports automatic substitution of variables during job setup and at job submit. IBM Workload Scheduler for z/OS also supplies several standard variables, which you can use in your job. You can create your own variables using the OPC JCL VARIABLE TABLES panel; these variables are stored in variable tables in the IBM Workload Scheduler for z/OS database. By using the same variable name in different variable tables and associating the tables with different applications, you can make the value the variable takes dependent on the application that it is being used in.

IBM Workload Scheduler for z/OS lets you create variables in job statements, in comment statements, and in any in-stream data within the job. You cannot use IBM Workload Scheduler for z/OS variables within cataloged or in-stream procedures. Variables occurring in comments are substituted (including comments to the right of job statements). When you create a variable using the JCL VARIABLE DEFINITION panel, you specify whether IBM Workload Scheduler for z/OS should substitute it at job setup, at job (or started task) submission, or both.

You can specify that the variable values be supplied in any of these ways:

- Manually
- By a user-written exit
- Automatically from information in the IBM Workload Scheduler for z/OS database

A variable that must be supplied by the operator is called a *promptable* variable.

The same variables can be used by several applications. The default value of a variable is stored in a variable table. If you have the same variable in different variable tables, make sure that the correct concatenation is in effect when substitution occurs. The order of concatenation can change the value assigned to the variable at substitution (see the example). The variable table contains the default value for a variable and the rules for evaluating the variable.

Note: If a variable is given a value of blank, the variable is not substituted if the variable definition states that no value is required. This lets these variables undergo normal operating system substitution after IBM Workload Scheduler for z/OS tailoring. If a variable is set to ¬ (logical not) or has this as a default setting, the variable is deleted from the line.

Associating variable tables with applications

IBM Workload Scheduler for z/OS searches for values to variables in this sequence:

1. In tables specified for the operation:

   This varies depending on whether or not you are using JCL or a centralized script.

   - When using JCL or a centralized script:
     a. In the variable table identified in the TABLE directive in the job. See "TABLE directive" on page 520.
     b. In the variable tables identified in the SEARCH directive in the job. See "SEARCH directive" on page 513.
   - When *not* using JCL or a centralized script, use the VARSUB statement in the script definition in the SCRPTLIB. "Variable substitution for jobs running on fault-tolerant workstations" on page 529 provides information.

2. In tables specified for the application:
   a. Specified using the MODIFYING CURRENT PLAN (MCP) panel.
   b. Specified using the LONG TERM PLAN panel.
   c. In the variable table associated with the run cycle, if any, for the application occurrence. See "Creating run cycles with rules" on page 133.
   d. In the variable table associated with the period, if any, for the application occurrence (for offset-based run cycles only). See "Creating periods" on page 100.
3. In the global variable table. See "Global variable table" on page 508.

Figure 203 on page 489 shows how user-defined variables are matched to individual units of work. User-defined variables are specified in the JCL VARIABLE TABLES panel (A) and are stored in the IBM Workload Scheduler for z/OS database.

In the PERIOD panel (B), you can associate a variable table name with a period, and this table is then used if the period is used in an offset-based run cycle.

When creating an application in the APPLICATION DESCRIPTION panel (C), you can specify run cycles to be used when creating occurrences of the application in the plan. You can associate a table with a run cycle. If you use offset-based run cycles, you can associate a table with a period.

JCL variable table names for individual occurrences can be modified or added using the LONG TERM PLAN panel (D) or the MODIFYING CURRENT PLAN panel (E).

A JCL variable table name (F) can be referenced by statements within the job by using table directives (see "JCL tailoring directives" on page 511).

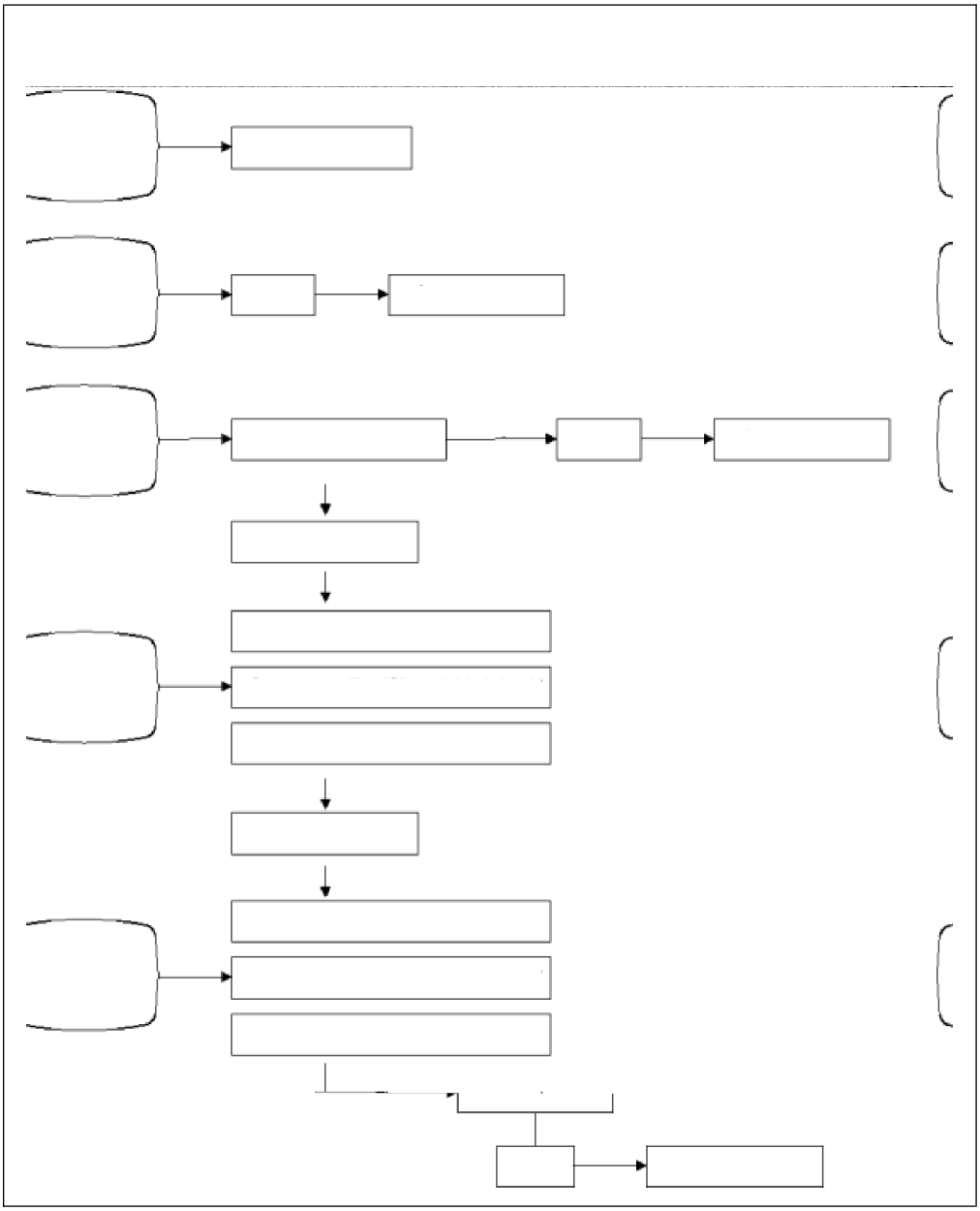


Figure 203. JCL variable handling

Invoking and avoiding variable substitution

To invoke variable substitution, take one of the following actions:

- Set the VARSUB keyword of the OPCOPTS statement to YES. This means that variable substitution occurs from the beginning of the job for all operations defined on setup or computer workstations.

- Set the VARSUB keyword of the OPCOPTS statement to SCAN (this is the default) and specify the directive `//*%OPC SCAN` in your job. Substitution in the job starts where the SCAN directive is found. See "SCAN directive" on page 513 for more information.

In the JCL VARIABLE TABLES panel, specify whether variables will be substituted during the setup of the job or when the job is submitted. This is called the *phase* of the substitution.

If you want to avoid having IBM Workload Scheduler for z/OS scan the job for variables, you must set the VARSUB parameter on the OPCOPTS initialization statement to NO. If you do this, job setup is bypassed on the READY LIST panel-setting next logical status sets the status of a job setup operation to Complete.

If you want to bypass variable substitution errors, then set the VARFAIL keyword. If you want to apply variable substitution also to inline procedures, then use the VARPROC statement, as described.

See Chapter 1 of the *Customization and Tuning* manual for details.

Coding variables in JCL

A variable, either user-defined or supplied by IBM Workload Scheduler for z/OS, consists of up to 8 alphanumeric characters, the first of which must be alphabetic. When using a variable in a job, precede it with an ampersand (&), a percent sign (%), or a question mark (?). The symbol preceding the variable determines how IBM Workload Scheduler for z/OS carries out the variable substitution. A period can denote the end of a variable name. You can use a variable repeatedly within the job using different prefix symbols.

Table 23. Symbols that mark the end of variables

Symbol	Description
,	Comma
/	Forward slash
'	Single quotation mark
(	Left parenthesis
)	Right parenthesis
*	Asterisk
&	Ampersand
&&	Double ampersand
%	Percent sign
+	Plus sign
-	Dash
=	Equals sign
	Blank (␣)
Blank	
?	Question mark

To maintain compatibility with variable substitution within z/OS JCL procedures, IBM Workload Scheduler for z/OS will assume that a variable has ended (even if

the completing period is missing) if the variable is followed by one of the symbols listed in Table 23 on page 490. An ampersand or percent variable can be assigned a value that is itself a variable.

For example, if LIBRARY is given the value LINKLIB for the following statement:

```
//STEPLIB DD DSN=MY.&LIBRARY.(IEFBR14),DISP=SHR
```

or the following statement (without the completing period):

```
//STEPLIB DD DSN=MY.&LIBRARY(IEFBR14),DISP=SHR
```

The JCL line becomes as follows:

```
//STEPLIB DD DSN=MY.LINKLIB(IEFBR14),DISP=SHR
```

The product assumes that the variable LIBRARY ends when it detects the left parenthesis '('.

Note: The completing period is discarded when a variable is substituted. Other termination symbols are left in place.

Note: When coding JCL, do not insert all the messages that IBM Workload Scheduler for z/OS uses during the variable substitution process (that is, VARIABLE SUBSTITUTION FAILED with OPCSMSG at column 73).

Ampersand, percent, compound, and question mark variables

The three variable types, ampersand (&), percent sign (%), and question mark (?), cause IBM Workload Scheduler for z/OS to perform variable substitution in different ways. You can use a variable multiple times with a different prefix symbol within the same job.

Note: If JCL variable substitution is on, the ampersand (&), percent sign (%), and question mark (?) are considered by IBM Workload Scheduler for z/OS as symbols that precede a JCL variable. Therefore, if you want to use these variables as comment characters within a JCL procedure, specify ACTION=NOSCAN to prevent the JCL from ending with errors.

Ampersand variables

These variables are substituted from left to right within the line. Ampersand variables correspond to the standard variables in z/OS JCL procedures and behave accordingly.

If an &-variable is immediately followed by a % variable (that is, there is no intervening termination character), a compound variable is formed. See "Compound variables" on page 493. A compound variable is also formed if an &-variable immediately follows a ?-variable.

Any string that begins with && is not substituted. This is because the double ampersand within JCL is usually used to denote a temporary data set. Any such strings are unaffected by the variable substitution.

Note: Also, strings beginning with %% or ?? are not substituted, in order to keep consistency with the behavior of && and to avoid the incorrect use of delimiters.

If the JCL member contains symbolic parameters in the format &SYMBOLIC and you do not want IBM Workload Scheduler for z/OS to attempt resolution, define the variable in an IBM Workload Scheduler for z/OS JCL variable table. Define the

variable with a blank default value, and specify that a value is not required. See "User-defined variables and variable tables" on page 499 for more information.

Percent variables

Percent variables can be used to form compound variables and simple variables. Using JCL substitution, you can form *compound variables*. See "Compound variables" on page 493.

The values of the percent variables making up a compound variable are not substituted directly. Instead, these values are used to form new variables, which have their own values assigned. IBM Workload Scheduler for z/OS attempts to resolve such variables in a series of passes. The individual variables making up the compound variable are resolved, moving from right to left.

For example, consider the following line of JCL from a job:

```
//STEPLIB DD DSN=MY.&DATA%SET,DISP=OLD
```

Assume that SET has been given a value of LIB. After the first pass, the variable DATA%SET becomes variable DATALIB because the right-most percent variable is resolved on the first pass. This first pass has now formed a new variable, DATALIB, which IBM Workload Scheduler for z/OS will try to resolve on its next pass across this line of JCL.

The new variable DATALIB is treated the same as any other JCL variable. That is, it must be predefined in a variable table and have a value assigned to it. The value can be assigned automatically by IBM Workload Scheduler for z/OS, a substitution exit, or manually, using the panels.

Compound variables can be made up of a sequence of many %-variables. Consider the following line:

```
//DDNAME1 DD DSN=MY.%VAR1%VAR2%VAR3....DATA,DISP=OLD
```

Assume that VAR3 has value SIX and VAR2SIX has value JUNE. On the first pass over this line of JCL, the variable %VAR1%VAR2%VAR3....DATA becomes %VAR1%VAR2SIX...DATA. On the second pass, the variable %VAR1%VAR2SIX. becomes %VAR1JUNE..DATA. The value assigned to %VAR1JUNE. determines the final value that is substituted.

At every substitution, a period was discarded when the variable was substituted. You must specify the correct number of periods to ensure that the substitution is performed correctly. In the preceding example, an extra period was required to denote the beginning of the second-level data set qualifier.

In the next example, you need only one parenthesis to complete the compound variable. This is because the parenthesis is not discarded at substitution.

```
//DDNAME1 DD DSN=MY.%VAR1%VAR2%VAR3(MEMBER),DISP=OLD
```

If you specify a compound variable %VAR1%VAR2...DATA, where VAR1 is a promptable variable and VAR2 is a (not promptable) setup variable, the substitution fails, because IBM Workload Scheduler for z/OS resolves the compound variable right-to-left.

Simple variables: If the variable is preceded by a % and ended by a period or any termination character other than %, a value is assigned to the variable, and substitution, for this variable, completes. This is called a *simple variable*.

Compound variables

A compound variable is made up of a concatenation of:

- A variable (of any type) followed by a percent variable with no intervening periods or other termination symbols
- A question mark variable followed by an ampersand variable with no intervening periods or other termination symbols

Question mark variables

Question mark variables are *tabular*; that is, you can specify in which column on the line the variable value should begin when the variable is substituted. The position at which the value is placed can be defined in the IBM Workload Scheduler for z/OS database when the variable is defined, or can be specified in the job where the variable is used. You will probably use these variables primarily within in-stream data, although they can be used anywhere within your job. For example:

```
?VAR1.
```

will cause the value of `VAR1` to be placed on the line that the variable appears on, starting at the column number defined in the IBM Workload Scheduler for z/OS database.

```
?nnVAR1.
```

will cause the value of `VAR1` to be placed on the line that the variable appears on, starting at the column number specified by *nn*. Any column value specified for this variable in the IBM Workload Scheduler for z/OS database is overridden.

More than one ?-variable can appear on a JCL line. The positions of the variables themselves have no influence on the positions of the variable values. These positions are decided by the column number specified for the variable. For example:

```
//SYSIN DD *
....+....1....+....2....+....3....+....4....+....5....+....6....+....7..
         ?20VAR1.?9VAR2.
```

where `VAR1` is APRIL and `VAR2` is MAY (the scale line has been included only for example purposes), the result after variable substitution would be:

```
//SYSIN DD *
....+....1....+....2....+....3....+....4....+....5....+....6....+....7..
        MAY        APRIL
```

The value of ?-variables is evaluated in the same way as for &- and %-variables, and in the same sequence (see "Making one variable dependent on another" on page 502). However, ?-variables are substituted only after all percent and ampersand variables have been substituted. This is because the value of the ?-variable can be placed only in areas of the line that are blank. IBM Workload Scheduler for z/OS can only know which areas of a line will be blank after ampersand and percent substitution has occurred.

Tabular variables cannot overlap. That is, the values of two different variables cannot be defined to occupy the same space on a line. The space that the variables themselves originally take up is ignored when substitution occurs. For example:

```
//SYSIN DD *
....+....1....+....2....+....3....+....4....+....5....+....6....+....7..
        ?20VAR1.?21VAR2.
/*
```

where VAR1 is APRIL and VAR2 is MAY, the substitution would be invalid because the two variables are attempting to use columns 21, 22, and 23.

IBM Workload Scheduler for z/OS changes the space occupied by the variable to spaces, if it is not covered by the substituted value. For example:

```
//SYSIN DD *
....+....1....+....2....+....3....+....4....+....5....+....6....+....7..
THIS IS?40VAR1. THE STANDARD DATA.           IS A WET MONTH.
```

VAR1 is APRIL. After substitution, the line becomes:

```
//SYSIN DD *
....+....1....+....2....+....3....+....4....+....5....+....6....+....7..
THIS IS         THE STANDARD DATA.     APRIL IS A WET MONTH.
```

IBM Workload Scheduler for z/OS has changed the space occupied by the variable to spaces. The other data in the line does not move.

Note: Variables supplied by IBM Workload Scheduler for z/OS do not have an implied position. When these variables are specified as tabular variables, you must include the column number. For example, ?OADID will not be accepted; however, ?20OADID is valid: the application ID is substituted at column 20.

Supplied variables

IBM Workload Scheduler for z/OS supplies variables that you can use in your business. These variables are reserved, in the sense that IBM Workload Scheduler for z/OS will never try to read variable definitions for these variables from a variable table. The variables are split into four groups:

- Occurrence-related variables
- Operation-related variables
- Date-related variables
- Dynamic-format variables

Occurrence-related supplied variables

The first group of variables, described in Table 24, are related to information about the occurrence. Occurrence-related variables can be used as setup or submit variables.

Table 24. Occurrence-related supplied variables

Variable name	Length (in bytes)	Description
OADID	16	Application ID.
OADOWNER	16	Occurrence owner.
OAUGROUP	8	Authority group.
OCALID	16	Calendar name.
ODAY	1	Occurrence input arrival day of the week (1-7); 1 represents Mon., 7 represents Sun.
ODD	2	Occurrence input arrival day of month, in DD format.
ODDD	3	Occurrence input arrival day of the year, in DDD format.

Table 24. Occurrence-related supplied variables (continued)

Variable name	Length (in bytes)	Description
ODMY1	6	Occurrence input arrival date in DDMMYY format.
ODMY2	8	Occurrence input arrival date in DD/MM/YY format.
OETCRIT	44	Event triggering policy name from the ETT table. **Note:** This variable can be used only by the ETT added occurrence.
OETEVNM	44	Complete ETT event name: **Event type J** Contains the same value of OETJOBN. **Event type R** Contains the complete resource name that triggered the event. **Note:** This variable can be used only by the ETT added occurrence.
OETGGEN	8	GDG data set generation number (G*nnnn*V*nn*). For the ETT event type R, generated by a data set triggering for GDG. **Note:** This variable can be used only by the ETT added occurrence.
OETGROOT	35	GDG data set root. For the ETT event type R, generated by a data set triggering for GDG. **Note:** This variable can be used only by the ETT added occurrence.
OETJNUM	8	Job number associated with the OETJOBN. It is set only for the event type J. **Note:** This variable can be used only by the ETT added occurrence.
OETJOBN	8	The complete job name that triggered the ETT event: **Event type J** Contains the job name of the triggering job **Event type R** Contains the job name or TSO user ID that closed the ETT data set triggered **Note:** This variable can be used only by the ETT added occurrence.
OETTYPE	1	Event type of the ETT table entry (J=Job, R=Resource). **Note:** This variable can be used only by the ETT added occurrence.
OFREEDAY	1	Denotes whether the occurrence input arrival date is a free day (F) or a workday (W).
OHH	2	Occurrence input arrival hour in HH format.
OHHMM	4	Occurrence input arrival hour and minute in HHMM format.
OMM	2	Occurrence input arrival month in MM format.
OMMYY	4	Occurrence input arrival month and year in MMYY format.
OWW	2	Occurrence input arrival week of the year in WW format.
OWWD	3	Occurrence input arrival week, and day within week, in WWD format, where WW is the week number within the year, and D is the day within the week.

Table 24. Occurrence-related supplied variables (continued)

Variable name	Length (in bytes)	Description
OWWLAST	1	A value, Y (yes) or N (no), that indicates whether the occurrence input arrival date is in the last week of the month.
OWWMONTH	1	A value between 1 and 6 that indicates the occurrence input arrival week-in-month, where each new week begins on a Monday. For example, consider these occurrence input arrival dates for the month of March in 1997: **Date OWWMONTH** **Saturday 1st** 1 **Monday 3rd** 2 **Monday 31** 6
OYMD	8	Occurrence input arrival date in YYYYMMDD format.
OYM	6	Occurrence input arrival month within year in YYYYMM format.
OYMD1	6	Occurrence input arrival date in YYMMDD format.
OYMD2	8	Occurrence input arrival date in YY/MM/DD format.
OYMD3	10	Occurrence input arrival date in YYYY/MM/DD format.
OYY	2	Occurrence input arrival year in YY format.
OYYDDD	5	Occurrence input arrival date as a Julian date in YYDDD format.
OYYMM	4	Occurrence input arrival month within year in YYMM format.
OYYYY	4	Occurrence input arrival year in YYYY format, for example, 1997.

Operation-related supplied variables

The second group of variables are related to information about the operation that is to be submitted. Operation-related variables can be used only as submit variables. Table 25 describes these variables.

Table 25. Operation-related supplied variables

Variable name	Length (in bytes)	Description
OJOBNAME	8	Operation job name.
OLDAY	1	Operation latest start day (1-7); 1 represents Monday, 7 represents Sunday.
OLDD	2	Operation latest start day (day in the month).
OLHH	2	Operation latest start hour.
OLHHMM	4	Operation latest start in hours and minutes.
OLMD	4	Operation latest start time (month and day), in MMDD format.
OLMM	2	Operation latest start month, in MM format.

Table 25. Operation-related supplied variables (continued)

Variable name	Length (in bytes)	Description
OLWK	2	Operation latest start week (week in the year) in WW format.
OLYMD	6	Operation latest start date in YYMMDD format.
OLYYDDD	5	Operation latest start in Julian date format (YYDDD).
OOPNO	3	Operation number within the occurrence, right-justified and padded with zeros.
OWSID	4	Workstation ID for current operation.
OXJOBNAM	54	Extended job name set in the current plan at the operation level. If you enter blanks in the Extended Job Name field, the OXJOBNAM value is truncated at the first blank.

Date-related supplied variables

The third group of variables are related to the current date and time; that is, the time and date on which the job or started task was submitted. Because they relate to the submission time of the operation, these variables can be used only at submit time. They cannot be used during job or started-task setup. Table 26 describes these variables.

Table 26. Date-related supplied variables

Variable name	Length (in bytes)	Description
CDAY	1	Current day of the week; 1 represents Monday, 7 represents Sunday.
CDD	2	Current day of month in DD format.
CDDD	3	Day number in the current year.
CDDMMYY	6	Current date in DDMMYY format.
CFREEDAY	1	Denotes whether the job actual run date and time is a free day (F) or workday (W).
CHH	2	Current time in HH format.
CHHMM	4	Current hour and minute in HHMM format.
CHHMMSS	6	Current hour, minute, and second in HHMMSS format.
CHHMMSSX	8	Current hour, minute, second, and hundredths of seconds in HHMMSSXX format.
CMM	2	Current month in MM format.
CMMYY	4	Current month within year in MMYY format.
CWW	2	Week number in the current year.
CWWD	3	Current day within week in WWD format, where WW is the week number within the year, and D is the day within the week.
CYMD	8	Current date in YYYYMMDD format.
CYY	2	Current year in YY format.
CYYDDD	5	Current Julian date in YYDDD format.
CYYMM	4	Current month within year in YYMM format.

Table 26. Date-related supplied variables (continued)

Variable name	Length (in bytes)	Description
CYYMMDD	6	Current date in YYMMDD format.
CYYYY	4	Current year in YYYY format, for example, 1997.
CYYYYMM	6	Current month within year in YYYYMM format.

Dynamic-format supplied variables

The fourth group are time-and-date-related supplied variables. You define the format you require for these variables using the SETFORM directive described in "SETFORM directive" on page 515. For example, if you want to substitute the occurrence input arrival date with the format MM:DD:YY, you define the dynamic variable OCDATE:

Example

```
//*%OPC SETFORM OCDATE=(MM:DD:YY)
```

Table 27 describes these variables.

Table 27. Dynamic-format date-related supplied variables

Variable name	Description
CDATE	Current date.
CTIME	Current time.
OCDATE	Occurrence input arrival date.
OCFRSTC	First calendar day in month of the occurrence input arrival date.
OCFRSTW	First work day in the month of the occurrence input arrival date.
OCFRSTWY	First work day in the year of the occurrence input arrival date.
OCLASTC	Last calendar day in the month of the occurrence input arrival date.
OCLASTW	Last work day in the month of the occurrence input arrival date.
OCLASTWY	Last work day in the year of the occurrence input arrival date.
OCTIME	Occurrence input arrival time (hours and minutes).
OPIADATE	Operation input arrival date (if blank, this takes the value of the occurrence input arrival date).
OPIATIME	Operation input arrival time (if blank, this takes the value of the occurrence input arrival time).
OPLSDATE	Operation latest start date.
OPLSTIME	Operation latest start time.

You can use the variables in Table 24 on page 494, Table 25 on page 496, Table 26 on page 497, and Table 27 in the same way as any other variables. Note that dynamic-format variables are treated as the supplied, predefined variables rather than user-defined variables.

When you have defined the format of a dynamic-format variable by using the SETFORM directive, you can use a different format later in the job by redefining the same variable with another SETFORM directive.

Variables beginning with C are substituted only at submit phase. Variables beginning with O are substituted at setup phase, if present, and otherwise at submit. An exception to this is when a C variable is used in a SETVAR expression; it is substituted at setup phase if the SETVAR directive specifies this.

Temporary variables

You can create temporary variable by using one of the following values:

- An arithmetic expression on the date-related or time-related variables.
- A substring of another variable.
- The result of an arithmetic addition or subtraction.
- Concatenated strings or variables set to an alphanumeric value.

For example, you might want to refer to the first workday after the occurrence input arrival date in the format YY/MM/DD. You do this by creating a temporary variable from the supplied variable, OYMD2, using the SETVAR directive. The temporary variable is assigned the value (date) of the first workday after the occurrence input arrival date, as in the following example:

Example

```
//*%OPC SCAN
//*%OPC SETVAR TVAR=(OYMD2+1WD)
```

If the occurrence input arrival date is 97/02/07 (Friday), and the next working day is Monday 97/02/10, TVAR will be assigned the value 97/02/10. You can now refer to TVAR as a normal variable through the rest of the job: you can also give it a new value later in the job.

For details, see "SETVAR directive" on page 516.

User-defined variables and variable tables

About this task

Beside the supplied variables, you can define variables in a variable table by using the JCL VARIABLE panel.

1. Select option 9 (JCLVAR) from the MAINTAINING IWSz DATABASES panel, or enter the fast path `1.9` from the main menu. You see the MAINTAINING IWSz JCL VARIABLE TABLES panel, shown in Figure 204.

```
EQQJVMAP --------- MAINTAINING IWSz JCL VARIABLE TABLES --------------------
Option ===>

Select one of the following:


1 BROWSE          - Browse variable tables

2 MODIFY          - Create a new JCL variable table or modify,
                    copy, browse or delete an existing variable table

3 PRINT           - Print variable tables
```

Figure 204. EQQJVMAP - Maintaining IWSz JCL Variable Tables

2. (MODIFY). You then see a filter panel that lets you select which JCL variable tables you want to look at. If you leave all the fields blank when you press Enter, you see a list of all the JCL variable tables defined to your IBM Workload

Scheduler for z/OS system. See Figure 205.

```
EQQJVTML ------------- LIST OF JCL VARIABLE TABLES -----------------ROW 1 OF 5
Command ===>

Enter the CREATE command above to create a new JCL variable table
or enter any of the following row commands:
M - Modify, C - Copy, D - Delete, B - Browse


Row Variable         Owner            Table                    Last updated
cmd Table            Id               Description              by

 _  T3112            ACCSSOFF         END OF YEAR PROCESSING   XCALLIN
 _  ACCOUNTS         SYSPROG          ACCOUNTING VARIABLES     XPULL
 _  DEPARTMENT       SYSPROG          DEPARTMENTAL COSTS       MAGNUSZ
 _  INVOICE1         OPSMGR           INVOICES REGION NORTH    XCALLIN
 _  INVOICE2         OPSMGR           INVOICES REGION EAST     XCALLIN
 ****************************** BOTTOM OF DATA ******************************
```

Figure 205. EQQJVTML - List of JCL variable tables

3. From this panel, you can copy, modify, browse, delete, and create a variable table. Enter the CREATE command to display the CREATING A JCL VARIABLE TABLE panel, where you are prompted for a table name, the names of the variables you want to create, and other details. See Figure 206 for an example of variable creation.

```
EQQJVVCL ----------- CREATING A JCL VARIABLE TABLE ----------------- ROW 1 OF 1
Command ===>                                                Scroll ===> PAGE

Enter/change data below and in the rows,
and/or enter any of the row commands below :
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete, S - Select
variable details.

VARIABLE TABLE     ===> WEEKLY_____________
OWNER ID           ===> XCALLIN_____________
DESCRIPTION        ===> TESTTABELL_____________

Row Variable Subst.   Setup  Val  Default
cmd Name     Exit             req  Value
 _  PXM0001_ ________ _      _    ________________________________________

****************************** BOTTOM OF DATA  ********************************
```

Figure 206. EQQJVVCL - Creating a JCL variable table

The SETUP option specifies when the variable is substituted. See "When variables are substituted" on page 501 for more information.

You can specify a variable-substitution exit, rather than IBM Workload Scheduler for z/OS should substitute the variable. For more details about a variable-substitution exit, see *Customization and Tuning*.

When you select a variable from panel EQQJVVCL, you can make detailed modifications to it using this panel:

```
EQQJVVMP ---------------- MODIFYING A JCL VARIABLE ----------------------------
Command ===>

Enter/Change data below, or DEP command to create/modify dependency,
Enter VER command to define verification rules.

Variable table        :MONTHLY          Monthly variables
Variable name         :PXM0001

DESCRIPTION        ===> ____________________
                                        Descriptive text
DEFAULT VALUE      ===> ________________________________________________
UPPER CASE         ===> _             Y - Yes, N - No
SETUP              ===> _             Y - Yes, N - No, P - Prompt
SUBSTITUTION EXIT  ===> ________      A load module name
VALUE REQUIRED     ===> _             Y - Yes, N - No
DEFAULT POSITION   ===> __            01 - 80  A position in a JCL
                                                instream data line
DIALOG TEXT        ===> ____________________________________________________
                        ____________________________________________________
                        ____________________________________________________
                        ____________________________________________________
```

Figure 207. EQQJVVMP - Modifying a JCL variable

Set the UPPER CASE field to `Y`, if you want lower case characters of the DEFAULT VALUE field to be translated to upper case.

The VALUE REQUIRED option specifies whether the variable can be blank. If you set this field to `Y`, the value cannot be assigned a blank value.

4. When you have selected and defined a variable, you can specify:
   - Dependencies on the variable (see "Making one variable dependent on another" on page 502)
   - Validation criteria for the variable (see "Variable validation" on page 506)

   by entering the DEP or VER primary command.

When variables are substituted

Table 28 shows how to specify the SETUP option in the panel shown in Figure 207.

Table 28. Specifying the SETUP option

SETUP	IBM Workload Scheduler for z/OS substitutes the variable ...
Y	Automatically at job setup, or at submission if there is no setup operation.
N	Automatically at job submission. The variable is stored with the job in the JCL repository (JS) data set, and is then substituted automatically before the job is routed to the required destination.
P	After substituting any `SETUP=Y` variables and prompting the operator. IBM Workload Scheduler for z/OS first substitutes `SETUP=Y` variables. Then it scans the job for promptable variables and displays them. The operator enters values for each variable. If there is no setup phase, the job fails with error code `OJCV`.

The operator initiates setup by setting the operation to next logical status using the workstation READY LIST panel. Variables can also be substituted by a user-supplied exit rather than by IBM Workload Scheduler for z/OS.

Customizing System Automation commands

About this task

The System Automation command tailoring function automatically edits System Automation commands through predefined information. This will help you to save time and reduce the possibility of editing errors. System Automation command tailoring provides automatic variable substitution before the command text is submitted to System Automation for processing. Note that:

- No support for directives is provided. Variables in the command text are searched in the table specified for the application, if any. If no table is defined for the application, variables are searched in the global variable table.
- Variable substitution is enabled only by setting the VARSUB parameter of the OPCOPTS statement.
- Only the variable types ampersand (&) and percent sign (%) are supported. The question mark (?) is not valid.
- The SAVARFAIL parameter in the OPCOPTS statement supports any combination of the variable types (& and %), but at least one type must be specified. Note that by setting the SAVARFAIL parameter you prevent the System Automation command operation from failing, in case of unresolved variables. Unresolved variables are left unchanged. If you do not set SAVARFAIL and a variable is not resolved, an error message is issued.
- If errors occur during variable substitution, messages are issued in EQQMLOG. The maximum length supported for command text is 255 bytes. Any text exceeding this length after variable substitution, produces a truncation error and the operation failure (OJCV). Text truncation is not allowed.
- The variables supplied by IBM Workload Scheduler for z/OS are the same as those supplied for JCL. For details, refer to "Supplied variables" on page 494.
- Variable substitution exits are supported.

To use variable substitution in System Automation commands, the load module EQQZVGSU must have been successfully loaded at controller startup. Any variable contained in a System Automation command text is resolved when the operation starts, before it is submitted to System Automation. After the variables in System Automation commands are successfully resolved, the corresponding CP33 record in current plan (CPLREC33) is updated with the resulting values. If there are no variables to resolve or the variable substitution is not successful, the record in the current plan is left unchanged. The System Automation command text supports mixed case, but the string that identifies a variable must be uppercase, otherwise an error message about variable substitution is issued.

Making one variable dependent on another

You can have variables that depend on other variables or on a substring of other variables. For example, the message class and print destination might both depend on the z/OS system that a job runs on. If you make the message class (MSGC) and destination (DEST) variables dependent on the system (SYSTEM) variable, you need only change the value of the system variable, and the others are given the correct value.

Follow these steps to specify a *dependent* variable (MSGC in this example) based on the value of another variable (SYSTEM in this example):

1. Enter the DEP command from the MODIFYING A JCL VARIABLE panel. You see the JCL VARIABLE DEPENDENCY VALUE LIST panel, shown in

Figure 208.

```
EQQJVDVL ------------ JCL VARIABLE DEPENDENCY VALUE LIST ----  ROW 1 TO 2 OF 2
Command ===>                                                  Scroll ===> PAGE

Enter any of the row commands below:
I(nn) - Insert, R(nn), RR(nn) - Repeat, D(nn) - Delete
Enter DEL   command to delete this dependency.

Dependent variable    : MSGC              message class
Variable table        : PAY               test jcl variables
Default value         :

INDEPENDENT               SUBSTRING           SUBSTRING
VARIABLE ===> SYSTEM      START ===>          LENGTH ===>
Row
cmd
'' VALUE OF INDEPENDENT ===> ANY
   VALUE OF DEPENDENT   ===> Q

'' VALUE OF INDEPENDENT ===> *
   VALUE OF DEPENDENT   ===> H
```

Figure 208. EQQJVDVL - JCL variable dependency value list

2. Specify the system as the *independent* variable.
3. For each value of the independent variable (SYSTEM), specify the associated value of the dependent variable (MSGC). Make sure that you specify the independent variable in the correct case, it is case-sensitive, and `any` in Figure 208 does not give the same result as `ANY`.

   If there are many values of SYSTEM with the same value of MSGC, make that value of MSGC the default, and do not specify those values of SYSTEM: if there is no match, MSGC takes its default value.
4. When you create the JCL, make sure that the independent variable occurs first, or the result is unpredictable.

   ```
   //*%OPC SCAN
   //JOB6     JOB  (&ACCT.,NOBO),'SAMPLE',
   //      MSGCLASS=&MSGC.,NOTIFY=XRAYNER,CLASS=A
   /*JOBPARM SYSAFF=&SYSTEM.
   //*MAIN SYSTEM=&SYSTEM.
   //OUTPUT1 OUTPUT DEST=&DEST,DEFAULT=NO
   ```

   In this example, the job will fail if MSGC depends on SYSTEM, because the MSGC variable occurs first.

   Change the JCL by inserting a comment card before the first dependent variable:

   ```
   //*%OPC SCAN
   //* THE VALUE OF SYSTEM IS &SYSTEM.
   //JOB6     JOB  (&ACCT.,NOBO),'SAMPLE',
   //      MSGCLASS=&MSGC.,NOTIFY=XRAYNER,CLASS=A
   /*JOBPARM SYSAFF=&SYSTEM.
   //*MAIN SYSTEM=&SYSTEM.
   //OUTPUT1 OUTPUT DEST=&DEST,DEFAULT=NO
   ```

To specify a dependent variable based on a substring of the independent variable, use the SUBSTRING fields. For example, suppose that:

- The SYSTEM variable is set to ZOS18P1 or ZOS18T1, depending on your JCL runs in a production or a test system.
- The input for your JCL must be TWSZ.PROD.IN or TWSZ.TEST.IN, depending on your JCL runs in a production or a test system.

You can define DSNQL as dependent variable as follows:

```
EQQJVDVL ------------ JCL VARIABLE DEPENDENCY VALUE LIST ----  ROW 1 TO 2 OF 2
Command ===>                                                  Scroll ===> PAGE

Enter any of the row commands below:
I(nn) - Insert, R(nn), RR(nn) - Repeat, D(nn) - Delete
Enter DEL   command to delete this dependency.

Dependent variable    : DSNQL
Variable table        : TESTVAR
Default value         : Y

INDEPENDENT                SUBSTRING           SUBSTRING
VARIABLE ===> SYSTEM       START ===> 6        LENGTH ===>1

Row
cmd
'' VALUE OF INDEPENDENT ===> P
   VALUE OF DEPENDENT   ===> PROD

'' VALUE OF INDEPENDENT ===> T
   VALUE OF DEPENDENT   ===> TEST
```

Figure 209. EQQJVDVL - JCL variable dependency on a substring

Then you can reference `TWSZ.&DSNQL..IN` in your JCL and run it in both your systems.

Restrictions

Do not:

- Specify both dependent and independent variables as setup variables, if the independent variable is part of a compound variable that cannot be resolved at the setup phase.
- Specify a setup or promptable dependent variable if the independent variable is resolved at submit.
- Cause a loop by making a variable directly or indirectly dependent on itself.
- Give a dependent variable a blank value, if `VALUE REQUIRED=Y` is specified for that variable.
- Use a variable substitution exit to set the value of the independent variable.

The dependent variable is given its value on the first pass of variable substitution, and you should be careful if the independent variable needs several passes to resolve. For example, if you gave SYSTEM a value &OWSID. (which is substituted further, because it is a scheduler-defined variable), MSGC will not be substituted correctly, unless you specify the literal `&OWSID.` as the value for the independent variable, which is probably not what you want. If you need to make MSGC dependent on the workstation name, the correct method is to make OWSID the independent variable. See “Using supplied variables” on page 505 for a description of this method.

Using dependent variables for migration

Dependent variables can be useful when you are changing the release of some software. One way is to have two copies of each job, but in many cases it is just data set qualifiers that change (for example, from `CICS320.LOADLIB` to `CICS330.LOADLIB`. Making the data set qualifier a variable lets you have just one set of jobs, which is important if you make other changes unconnected to the change in release. Your effort in coding variables is rewarded when you next upgrade the software, because the variables are already in the jobs.

Another advantage is that fallback is easier, because you do not have to remember what happened to the old jobs, and what changes must be retroactively made to them.

Using supplied variables

The example using SYSTEM needs some manual intervention when the value of the SYSTEM variable must be changed (either at a setup workstation or using the variable table panel). But you can use dependent variables even in a fully automatic system, if the independent variable is a supplied variable.

This example shows how to change variables automatically, depending on the input arrival day of the occurrence. The supplied variable is ODAY, which has values from 1 (Monday) to 7.

This is how the dependent variable (HLQ1) is defined:

```
EQQJVVMP ----------------- MODIFYING A JCL VARIABLE ---------------------
Command ===>

Enter/Change data below, or DEP command to create/modify dependency,
enter VER command to define verification rules.

Variable table        : SPECIALONMONDAY
Variable name         : HLQ1

DESCRIPTION        ===> high-level-qualifier
                                Descriptive text
DEFAULT VALUE      ===> OTHER.DAYS_____________________________________
UPPER CASE         ===> Y            Y - Yes, N - No
SETUP              ===> Y            Y - Yes, N - No, P - Prompt
SUBSTITUTION EXIT  ===> ________     A load module name
VALUE REQUIRED     ===> Y            Y - Yes, N - No
```

Figure 210. Specifying the variable HLQ1

The default value, OTHER.DAYS, is used when there is no match on the independent variable values.

```
EQQJVDVL ------------ JCL VARIABLE DEPENDENCY VALUE LIST ----  ROW 1 TO 1 OF 1
Command ===>                                                  Scroll ===> PAGE

Enter any of the row commands below:
I(nn) - Insert, R(nn), RR(nn) - Repeat, D(nn) - Delete
Enter DEL   command to delete this dependency.

Dependent variable    : HLQ1              high-level-qualifier
Variable table        : SPECIALONMONDAY
Default value         : OTHER.DAYS

INDEPENDENT
VARIABLE           ===> ODAY

Row
cmd
'' VALUE OF INDEPENDENT ===> 1
    VALUE OF DEPENDENT   ===> DAY1
```

Figure 211. Specifying a special value for Monday (ODAY=1)

IBM Workload Scheduler for z/OS substitutes DAY1 for the HLQ1 variable when ODAY=1. On other days, it uses the default value OTHER.DAYS. ODAY is a setup or submit variable, so HLQ1 can also be specified as a setup or submit variable.

Variable validation

IBM Workload Scheduler for z/OS can check input entered by the operator at job setup or by a substitution exit. You can specify, for example, whether the input will be numeric or alphabetic, or whether it should match a predefined picture. You can also specify whether the entry should be within a range of values or be one of the values in a given list. Logical comparisons can also be performed; for instance, you can specify that the entered value will be less than, equal to, or not greater than a given value. Define your validation criteria on the SPECIFYING VERIFICATION CRITERIA panel (see Figure 212). This panel is displayed when you enter the VER command from the MODIFYING A JCL VARIABLE panel (see Figure 207 on page 501).

```
EQQJVVEP ------------- SPECIFYING VERIFICATION CRITERIA -----------------
Command ===>

Enter data below, or enter the DEL command to delete the verification.

Variable name         : FRED             varfred
Variable table        : SIMON            test jcl variables

VERIFICATION TYPE  ===> RANGE__      ALPHA/NUM/ENUM/HEX/BIT/PICT/NAME/
                                     DSNAME/RANGE/LIST

LENGTH COMPARISON  ===> __           EQ/LT/GT/LE/GE/NE/NL/NG
LENGTH VALUE       ===> __           1 to 44

For type PICT only - use characters C A N 9 X
PICT VALIDATION    ===> ____________________________________________

LIST/RANGE NUMERIC ===> Y            Y or N  (if Y, specify the values below)
Separate each value (or pair of ranges) in the list with commas
LIST/RANGE VALUES  ===> 23,26_____________________________________________
                        _____________________________________________
```

Figure 212. EQQJVVEP - Specifying verification criteria

You can specify these values in the fields on the SPECIFYING VERIFICATION CRITERIA panel:

VERIFICATION TYPE

ALPHA
The input must be alphabetic.

NUM The input must be numeric, in the range -2^{31} to $2^{31}-1$.

ENUM
The input must be numeric but can also contain the plus sign (+), negative number indicator, delimiter symbols, decimal symbol (.), or certain national character decimal symbols, such as a comma (,).

HEX The input must be valid hexadecimal characters.

BIT The input can have only the digits 0 and 1.

PICT The input must match a certain pattern.

NAME
The input must be a valid partitioned data set member name.

DSNAME
The input must be a valid data set name. (Lowercase letters are not allowed.)

RANGE
The input must be within the range specified in the *Valid values/ranges* field.

LIST The input variable must be a member of the list given in the *Valid values/ranges* field.

LENGTH COMPARISON and VALUE
These fields are for validating the length of the entered value. The possible comparisons are:

= or EQ
Equal to

< or LT
Less than

> or GT
Greater than

<= or LE
Less than or equal to

>= or GE
Greater than or equal to

!= Not equal to

!< Not less than

!> Not greater than.

For example, to specify that the value of the variable must be less than 6 characters, specify `LT 6`.

PICT VALIDATION
Specify this only for validation type PICT. The variable must contain characters that match the corresponding characters in the validation pattern. The pattern can have these characters:

C Any character

A Any alphabetic character (A–Z, a–z, ?, $, @)

N Any numeric character (0–9)

9 Any numeric character (same as N)

X Any hexadecimal character (0–9, A–F, a–f).

For example, if a six-byte field must have its first three characters in the range 0-9, and the last three characters can have any value, specify `999CCC`.

LIST/RANGE NUMERIC
This option applies only for types **RANGE** or **LIST**. If you specify `Y` (Yes), IBM Workload Scheduler for z/OS performs a numeric comparison with the **LIST/RANGE VALUES**. If you specify `N` (No), a character-by-character comparison is performed.

LIST/RANGE VALUES
This field is used for validation types LIST and RANGE. For type LIST, specify the values separated by commas (,) or spaces. For type RANGE, each pair of values in the range is separated by commas, and each range is separated by commas or spaces.

Variable	TYPE	NUMERIC	VALUES
DAYS-IN-MONTH	LIST	Y	28,29,30,31
DAYS-IN-MONTH	RANGE	Y	28,31
DATA-CENTERS	LIST	N	LONDON,NEW YORK
CREDIT-RATING	RANGE	N	A1,A9,B1,B9

Note:

1. Embedded blanks are allowed in character values (`NEW YORK`).
2. IBM Workload Scheduler for z/OS checks that the value for CREDIT-RATING is in the range A1-A9 or B1-B9. Because this is a character comparison, a value A12 is allowed, unless you also specify a length of 2.

Global variable table

You can define a global variable table. The name of this variable table is specified in the GTABLE keyword of the initialization statement OPCOPTS (see *Customization and Tuning*). If IBM Workload Scheduler for z/OS cannot find a variable in the variable tables specified for the operation or in the operation job, it searches the global variable table.

Where variables can be used

IBM Workload Scheduler for z/OS variables can be used anywhere in your job and as many times as you want. Variables used in comment and in-stream data will also be substituted.

Substitution takes place depending on the setting of the VARSUB initialization statement. If VARSUB(YES) is specified, variable scanning is performed for all operations. If VARSUB(SCAN) is specified, IBM Workload Scheduler for z/OS searches for variables only if the `//*%OPC SCAN` directive has been encountered in the job.

IBM Workload Scheduler for z/OS does not substitute variables within procedures, with the exception of inline procedures when VARPROC(YES) has been specified in the OPCOPTS statement. However, variables are substituted in the calling EXEC statement. See "Variable substitution in z/OS JCL procedures" on page 509.

Errors in variable substitution

If an error occurs in variable substitution, the operation is put on the error list with the error code OJCV.

For more information about a variable substitution error:

- Examine the message log, EQQMLOG.
- Look at the job for the operation that ended in error. Use the `J` row command from the error list.

Variable substitution error messages are inserted into the job in the lines immediately preceding the erring variable. These messages are displayed in the form of ISPF note lines:

Examples of notes lines

```
000001 //XCALLINN JOB (885002,J09),'BOC',MSGLEVEL=(1,1).
000002 //   NOTIFY=XCALLIN,MSGCLASS=Q,CLASS=B
000003 //STEP001  EXEC PGM=IEFBR14
000004 //DD       DD  DSN=&DS1..DATASET,DISP=SHR
NOTE=> //*>EQQJ535E 03/17 08.57.00
NOTE=> //*>         UNDEFINED VARIABLE DS2 LINE 00005 OF ORIG JCL
000005 //DD       DD  DSN=&DS2..DATASET,DISP=SHR
000006 //* More JCL
```

To find variable substitution error message note lines in the job, enter the primary command LOCATE SPECIAL. To save the messages in the job, convert these temporary note lines into *data lines*, by entering the row command MD (make data).

You can avoid the variable substitution errors by using the VARFAIL keyword. Refer to *Customization and Tuning* for details.

Note: IBM Workload Scheduler for z/OS scans the job only up to the first detected error.

Suppressing variable substitution

You can specify that variable substitution should be suppressed in jobs that would normally be eligible for variable substitution, using the statement `//*%OPC BEGIN ACTION=NOSCAN` in your job. Any lines after this statement will not be eligible for variable substitution. If you want to turn variable substitution on again, you can do so using the `//*%OPC END ACTION=NOSCAN` statement. For example, in the following job, IBM Workload Scheduler for z/OS would substitute `DS1`, would leave `DS2` and `DS3` as they were, and would substitute `DS4`.

```
//DD1     DD DSN=MY.&DS1,DISP=SHR
//*%OPC BEGIN ACTION=NOSCAN
//DD2     DD DSN=MY.&DS2,DISP=SHR
//DD3     DD DSN=MY.%DS3,DISP=SHR
//*%OPC END ACTION=NOSCAN
//DD4     DD DSN=MY.&DS4,DISP=SHR
```

```
//DD1     DD DSN=MY.&DS1,DISP=SHR
//*%OPC BEGIN ACTION=NOSCAN
//DD2     DD DSN=MY.&DS2,DISP=SHR
//DD3     DD DSN=MY.%DS3,DISP=SHR
//*%OPC END ACTION=NOSCAN
//DD4     DD DSN=MY.&DS4,DISP=SHR
```

A `//*%OPC BEGIN ACTION=NOSCAN` statement must have an associated `//*%OPC END ACTION=NOSCAN` statement, or an error will result. See "JCL tailoring directives" on page 511 for a complete explanation of the directives.

Variable substitution in z/OS JCL procedures

Variable substitution does not take place within JCL procedures. If you have z/OS JCL variables within such procedures, their substitution is independent of any substitution made by IBM Workload Scheduler for z/OS. Even if the z/OS JCL variable name is the same as an IBM Workload Scheduler for z/OS variable name, the values assigned to the two variables will be unrelated. However, if you want the variable reference outside the procedure to be substituted by z/OS, you can define the IBM Workload Scheduler for z/OS-variable with the attribute DEF=⌂ (value not required). with the attribute DEF=blank (value not required).

If a variable is given a value of ⌂ (blank), the If a variable is given a value of blank, the variable will not be substituted if the variable definition states that no value is required. This lets these variables undergo normal JCL substitution after the tailoring performed by IBM Workload Scheduler for z/OS. If a variable is given a default value of ¬ (logical not), the variable is deleted from the line.

This means that z/OS substitutes the variables that have a ⌂, or not-required, value. IBM Workload Scheduler for z/OS substitutes the variables that have values that are not blanks, as well as variables that require values.

This means that MVS substitutes the variables that have a blank, or not-required, value. IBM Workload Scheduler for z/OS substitutes the variables that have values that are not blanks, as well as variables that require values.

Because procedures are called after IBM Workload Scheduler for z/OS substitution has taken place, a situation in which a *procedure* variable is assigned an IBM Workload Scheduler for z/OS variable value can occur. Consider the JCL in Figure 213 and the procedure in Figure 214.

```
//EXEC    PROC=MYPROC
//DD2     DD DSN=MY.&DS2,DISP=SHR
//EXEC    PROC=MYPROC
//DD2     DD DSN=MY.&DS2,DISP=SHR
```

Figure 213. Substituting a variable in a procedure: job JCL

If DS2 is defined as an IBM Workload Scheduler for z/OS variable, it is substituted in the usual way.

```
//MYPROC   EXEC PGM=IKJEFT01,DYNAMNBR=50,REGION=4096K
//DD2      DD DSN=MY.&DS2,DISP=SHR
//MYPROC   EXEC PGM=IKJEFT01,DYNAMNBR=50,REGION=4096K
//DD2      DD DSN=MY.&DS2,DISP=SHR
```

Figure 214. Substituting a variable in a procedure: procedure JCL

If, as in this example, the ddname DD2 occurs in the procedure MYPROC, the entire JCL line will be substituted in the procedure, including the IBM Workload Scheduler for z/OS substituted value of DS2:

```
//DD2     DD DSN=MY.&DS2,DISP=SHR
```

Any value that the variable DS2 is assigned within the procedure is not substituted in this line because, as far as z/OS is concerned, the variable DS2 does not occur. If you want the variable to take the value assigned by the procedure rather than the IBM Workload Scheduler for z/OS value, you can give the variable a default value of ⌂ (blank) and set the VALUE REQUIRED attribute to 'N' in the IBM Workload Scheduler for z/OS database using the JCL VARIABLE DEFINITION panel. This causes IBM Workload Scheduler for z/OS to ignore the variable when performing variable substitution.

Note: For inline procedures it is possible to apply variable substitution when VARPROC(YES) has been specified in the OPCOPTS statement.

Substituting variables with embedded blanks

IBM Workload Scheduler for z/OS allows embedded blanks and trailing blanks in variables. For example, the string 25 Dec 1997 can be specified as a variable value. If you specify variable verification, the type of variable must be LIST or blank. When you define a default value with embedded or trailing blanks, a warning message is issued to ensure that these blanks are intentional.

Leading blanks, however, are not supported. If you enter leading blanks, the string is left-justified (the blanks are removed) with no warning or error message.

To get trailing blanks, you must specify a length for the variable—this is the only way IBM Workload Scheduler for z/OS can tell if there should be trailing blanks.

Use the LENGTH VALUE field on the SPECIFYING VERIFICATION CRITERIA panel (Figure 212 on page 506). If you do not specify a length, trailing blanks are not included in the substitution.

JCL tailoring directives

IBM Workload Scheduler for z/OS can dynamically include or exclude job statements during job setup and job submit. IBM Workload Scheduler for z/OS excludes lines in the job by skipping them at job setup or at job submit. You can include the job statements from a member in the EQQJBLIB library or supply them through a user-defined JCL-embed exit.

IBM Workload Scheduler for z/OS uses special comment statements, called *directives*, to manage the inclusion and exclusion of lines and to control aspects of variable substitution. The directives are:

- NOP
- SCAN
- SEARCH
- SETFORM
- SETVAR
- TABLE
- BEGIN and END
- FETCH

The general syntax of the directives is:

- Each directive must begin on a new 80-byte line.
- All directives begin with `//*%OPC` in columns 1 to 7 followed by at least one space. The only exception is the NOP directive, for which only one space is allowed.
- Directive parameters can be coded in any order.
- Directive parameters can occur more than once in the same directive.
- Directive parameters are separated by commas with no embedded blanks between parameters on the same line.
- If more than one parameter value is specified, parentheses are required. For example, this is correct:

  ```
  NAME=TABLE1
  ```

  But this is incorrect:

  ```
  NAME=TABLE1,TABLE2
  ```

  It should be defined:

  ```
  NAME=(TABLE1,TABLE2)
  ```
- A directive specification cannot exceed 71 characters. It can be continued on a new line if the directive is split by a comma after a complete or partial parameter.
- Positions 72 to 80 are ignored.
- Each continuation line must begin with `//*%OPC` in columns 1 to 7 followed by a least one space.
- Except for the NOP directive, if the directive is executed successfully, the `//*%OPC` is changed to `//*>OPC`.

If a line begins with //*%OPC and none of the known directives is found, the IBM Workload Scheduler for z/OS job substitution routines treat any other directives that it finds as "unknown," and will take no action.

Note:

1. When a variable has been substituted with a value from the current variable table concatenation, that value remains valid for the entire substitution phase. It will not be changed when a different table is declared by a subsequent SEARCH or TABLE directive (see "JCL tailoring directives" on page 511), even if the same variable name is found later. Therefore avoid using several variable tables for the same job, especially if they contain variables with the same name.
2. If you set VARSUB(SCAN) in the OPCOPTS statement, the SCAN directive must be present in the JCL, in order to process all the subsequent directives.

Note:

A description of the directives follows. If you are unfamiliar with syntax diagrams, see "How to read syntax diagrams" on page xx.

Table 29. Date formats allowed in the SETVAR directive

ODMY1	ODMY2	OYMD	OYMD1	OYMD2	OYMD3
OLYMD	OLMD	CDDMMYY	CYMD	CYYMMDD	OCDATE
OCFRSTW	OCFRSTWY	OCFRSTC	OCLASTW	OCLASTWY	OCLASTC
CDATE	OPIADATE	OPLSDATE			

Table 30. Day-in-year formats allowed in the SETVAR directive

ODDD	OYYDDD	OLYYDDD	CDDD	CYYDDD	

Table 31. Month formats allowed in the SETVAR directive

OMM	OMMYY	OYM	OYYMM	CMM	CMMYY
CYYMM	CYYYYMM	OLMM			

Table 32. Time formats allowed in the SETVAR directive

OHHMM	OLHHMM	CHHMM	CHHMMSSX	CTIME	OCTIME
OPIATIME	OPLSTIME				

NOP directive

Purpose

This directive determines that the job does not run. Like the existing NOP command issued against an operation in the current plan, it produces the following results:

- All triggers and dependencies are maintained.
- Final operation status is set to complete.

Unlike the NOP command, this directive does not update the NOP indicator in the current plan (mapped by the CPOPNOP field of the CPOP data area or the CPLNOP field of the CPLREC3P record).

Syntax

Usage Notes

Unlike the behavior for other directives, after the successful processing for this directive, the scheduler does not change the string //*%OPC to //*>OPC. Therefore, the NOP directive remains active after the processing. You must manually remove it when you no longer need it.

Special attention must be used when setting VARSUB (SCAN) in OPCOPTS. In this case, the NOP directive can be ineffective even if left active, for example, in the case the SCAN directive is not active (*>OPC SCAN instead of *%OPC SCAN) or, in the case it is not at all preceded by the SCAN directive.

SCAN directive

Purpose

If the VARSUB keyword of the OPCOPTS statement is set to SCAN, this directive, when found in the JCL of a computer workstation operation, informs IBM Workload Scheduler for z/OS that variable substitution should start from this line. This applies also for processing the directives, meaning that the processing of the directives starts from the line where SCAN is specified.

Syntax

Usage Notes

The SCAN directive is honored only if the VARSUB parameter of the OPCOPTS statement is set to SCAN.

Assuming that VARSUB(SCAN) is specified, in the following example, `MODULE` will not be substituted because it is before the SCAN directive. The variable `LIBRARY`, occurring after the SCAN directive, is substituted.

Example

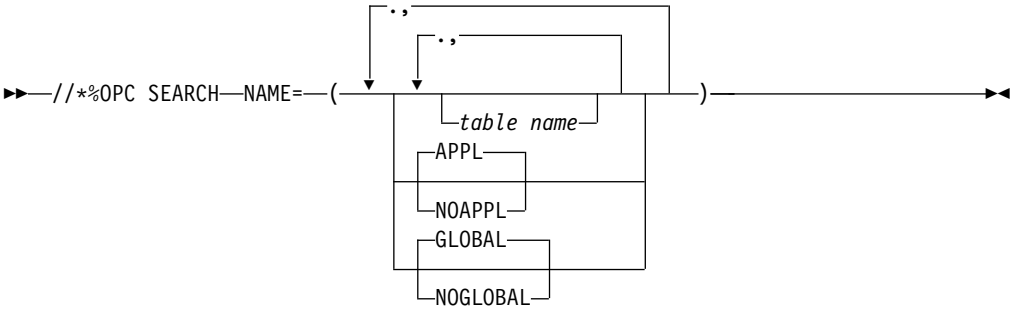
```
//OPSTATUS JOB (ACCOUNT),'Set completed',CLASS=A
//STEP1    EXEC PGM=&MODULE.
//*%OPC SCAN
//STEPLIB  DD DSN=OPC.LOAD.&LIBRARY.,DISP=SHR
//EQQMLIB  DD DSN=OPC.MESSAGE.LIBRARY,DISP=SHR
//EQQMLOG  DD SYSOUT=A
//SYSIN    DD *
/*
```

SEARCH directive

Purpose

This directive defines the variable tables that are searched when attempting to assign a variable a value.

Syntax



Parameters

NAME(*table name,...*, **APPL**|**NOAPPL, GLOBAL**|**NOGLOBAL)**
Identifies the variable tables you want searched, and in what order.

Usage Notes

Use the SEARCH directive to specify the variable tables you want searched. Up to 16 tables, including the application and global tables, can be specified. By default, the variable tables specified using *table name* are searched first, in the order specified. If IBM Workload Scheduler for z/OS does not find a variable in these tables, the application variable table, if it exists, is then searched, followed by the global variable table, if the variable is not found in the application table. A SEARCH directive cannot contain any IBM Workload Scheduler for z/OS variables. The following example shows how you can change the search order of the tables using the SEARCH directive.

Example 1

```
//*%OPC SEARCH NAME=(GLOBAL,TABLE1,NOAPPL)
```

The search order for variables in JCL containing the SEARCH directive given would be:
1. GLOBAL
2. TABLE1

The NOAPPL keyword specifies that the application variable table will not be searched.

Example 2

```
//*%OPC SEARCH NAME=(TABLE1,TABLE2,TABLE3)
```

In this example, the search order for variables in a job containing the SEARCH directive given would be:
1. TABLE1
2. TABLE2
3. TABLE3
4. The application variable table (if it exists)
5. The global variable table (if it exists)

A SEARCH directive causes all variables in the job before the directive to be resolved. If the SEARCH directive is used more than once, the last specified search order is used to resolve any new variables found. Variables that have already been

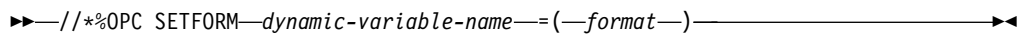
assigned values retain those values, even if they are found again after a SEARCH or TABLE directive that would have caused a change in their values.

SETFORM directive

Purpose

This directive defines the format of dynamic-format supplied variables. After IBM Workload Scheduler for z/OS processes the SETFORM directive, you can refer to the variable and perform arithmetic calculations using the variable. You can redefine the variable many times within the job, if you need to.

Syntax



Parameters

dynamic-variable-name=(*format expression***)**
The dynamic variable uses the format defined in the format expression.

Usage Notes

The dynamic variable name must be one of the supplied dynamic variables (see Table 27 on page 498).

The format expression can contain a combination of time-related keywords, date-related keywords, and delimiters.

The date-related keywords are:

CC Represents the century. This is used in combination with YY to define the format of a full year, such as 1997.

YY Represents the last two figures in the year.

MM Represents the month.

DDD Represents day-in-year. This is substituted before DD: the character string DDDDDD is understood as two DDD keywords, not three DD keywords.

DD Represents the day in the month.

The time-related keywords are:

HH Represents the hour.

MM Represents the minutes.

Any other characters in the format expression are regarded as delimiters. These delimiters can be alphabetic, numeric, or any symbol except the IBM Workload Scheduler for z/OS variable substitution characters `&`, `%`, `?`, `=`, and the parentheses ().

For the time-related dynamic variables, OCTIME, OPIATIME, OPLSTIME, and CTIME, only `HH` and `MM` are recognized. `YY`, for example, is not substituted. `MM` is substituted by the minutes part of the time.

For date-related dynamic variables, only CCYY, YY, MM, DD, and DDD are recognized. CC without YY is not recognized. HH is not substituted. MM is substituted by the month part of the date.

You can use more than one delimiter between keywords.

For example, MM//DD-- YY is a valid format expression.

Delimiters are optional; that is, you can define consecutive keywords with no delimiters, such as DDMMYY.

If the expression includes dynamic-format supplied variables containing the first or the last day in the month or in the year of the occurrence IA, the calculated date must fall within the range of four years earlier and seven years later than the current year. For example, if the current year is 1997, the resulting date of the temporary variable must be later than 92/12/31 and earlier than 05/01/01.

In the following examples, assume that the occurrence input arrival time is at 4:10 PM on December 31st 1997.

Example

```
//*%OPC SCAN
//*%OPC SETFORM OCDATE=(YY/MM/DDD)
```

The resulting &OCDATE variable would be: 97/12/365

The examples in Table 33 use the same occurrence input arrival date.

Table 33. Dynamic-format substitution results

Dynamic format variable	Format expression	Result
OCDATE	YY-MM-DDABC	97-12-31ABC
OCTIME	HH MM	16 10 (Note the MM substitutes as minutes for time variables and substitutes as month for date variables.)
OCDATE	DDDDD	36531. DDD is the 365th day of the year, and DD is the day of the month.
OCDATE	DDDD	365D. DDD is the 365th day of the year, but no match was found for the last D.
OCDATE	YYMMHHMMSS	9712HH12SS. This is a date variable, so HH is not substituted.

SETVAR directive

Purpose

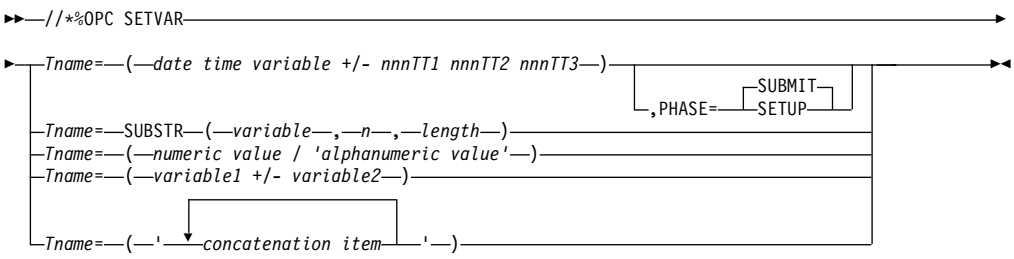
This directive creates a temporary variable by using one of the following values:

- An arithmetic expression together with supplied date or time variables.
- A substring of another variable.
- The result of an arithmetic addition or subtraction.
- Concatenated strings or variables set to an alphanumeric value.

After IBM Workload Scheduler for z/OS processes the SETVAR directive, you can use the temporary variable in the same way as you use other variables. You can

redefine a temporary variable later in the job.

Syntax



Parameters

Tname=(*date time variable +/- nnnTT1 nnnTT2 nnnTT3***)**

Tname
The name of the temporary variable, beginning with the letter *T*.

date time variable
One of the following defined formats:
Date formats:
See Table 29 on page 512.
Day-in-year formats:
See Table 30 on page 512.
Day-in-month formats:
ODD, OLDD, CDD
Day-in-week formats:
OWWD, CWWD
Day-of-week formats:
ODAY, OLDAY, CDAY
Week formats:
OWW, OLWK, CWW
Month formats:
See Table 31 on page 512.
Year formats:
OYY, OYYYY, CYY, CYYYY
Time formats:
See Table 32 on page 512.
Hour formats:
OHH, OLHH, CHH, CYYY

nnn A number in the range 0 to 999.

TT1 The first possible type. You can specify the following values:
For date-related variables

WD Work days, as defined for the calendar used by the occurrence.

CD Calendar days.

WK Weeks. Weeks are converted to days before the calculation is performed.

MO Months. Performing calculation on the month portion affects only the month, and possibly the year. The calculation always generates valid results, handling actual months durations and leap years. For example, adding one month to 080131 gives 080229 (considering the leap year).

YR Years.

For time-related variables

HH Hours.
MM Minutes.
SS Seconds.

TT2 The second possible type, valid only for time-related variables. You can specify the following values:
MM Minutes.
SS Seconds.

TT3 The third possible type, valid only for time-related variables. You can specify only the value **SS** (seconds).

You can use the format *nnnTT1 nnnTT2 nnnTT3* only for time-related variables, to add or subtract hours, minutes, and seconds to or from a given time. Specify this triple format only if you want to specify hours, minutes, and seconds.

Using duplicated types, as for example in 6HH, 5MM, 7MM, is not allowed.

PHASE=SETUP|SUBMIT
Specifies whether the SETVAR calculation should take place during the setup or submit phase of the operation. This parameter is optional, and if nothing is specified, the default SUBMIT is assumed.

Note: If you use setup phase, you can still use submit-phase date or time variables (those beginning with the letter C) in the expression for the temporary variable.

variable
The name of the source string variable. Use an existing variable name properly defined and accessible. You can specify any supplied or user-defined variable. The length of the variable that is replaced is limited to the remaining JCL row length that is not used by the statement.

n An integer in the range 1 to 60. It defines the starting position, in *variable*, of the substring variable. If it exceeds the length of *variable*, the resulting substring is padded with blank.

length An integer in the range 1 to 60. It defines the length of the substring variable. If it exceeds the length of *variable*, the resulting substring is padded with blank.

numeric value
An integer in the range 0 to 99999, defining the value of the temporary variable.

alphanumeric value
String of alphanumeric characters, defining the value of the temporary variable. Enclose the string in single quotation marks. It can be up to 48 characters.

If the length of the whole statement in the JCL reaches column 72, the error message EQQJ585E is issued.

variable1
An integer in the range 0 to 99999, defining the first operand of an arithmetic addition or subtraction, whose result defines the value of the temporary variable. The arithmetic expression cannot include blank characters.

variable2

An integer in the range 0 to 99999, defining the first operand of an arithmetic addition or subtraction, whose result defines the value of the temporary variable. The arithmetic expression cannot include blank characters.

concatenation item

One of the following:

- A variable previously set to an alphanumeric value.
- A string of alphanumeric characters.

Enclose the item list in single quotation marks. The result cannot exceed 48 characters.

Usage Notes

These examples show how to use temporary variables created through SETVAR:

Example 1 (with an arithmetic expression)

If the occurrence input arrival date is 97/12/26, the expression is substituted as follows:

```
TVAR=(360+4)
TVAR=364
```

If the occurrence input arrival date is 97/12/30, the expression is substituted as follows:

```
TVAR=(364+4)
TVAR=003
```

Example 2 (with dynamic-format variable)

```
//*%OPC SCAN
//*%OPC SETFORM CDATE=(ACCURATE DATE CCYY MM DD)
//*%OPC SETVAR  TDATE=(CDATE + 1CD)
```

If the occurrence input arrival date is 97/12/26, the expressions are substituted as follows:

```
CDATE = 'ACCURATE DATE 1997 12 26'
TDATE = 'ACCURATE DATE 1997 12 27'
```

Note: If the date calculation results in dates earlier than 1 January 1984 or later than 31 December 2071, the substitution fails with an error message.

If the expression includes dynamic-format supplied variables containing the first or the last day in the month or in the year of the occurrence IA, the calculated date must fall within the range of four years earlier and seven years later than the current year. If the current year is 1997, the resulting date of the temporary variable must be later than 92/12/31 and earlier than 05/01/01.

Example 3 (SUBSTR usage)

- Using a variable defined in a JCL variable table:

  ```
  //*%OPC SETVAR  TVAR=SUBSTR(&VAR1,2,4)
  ```

  VAR1 is a variable defined in a JCL variable table.

  TVAR is a substring of VAR1 value, starting from position 2 for a length of 4 characters.

- Using a predefined variable:

```
//*%OPC SETFORM OCDATE=(YYMMDD)
//*%OPC SETVAR TVAR1=('&OCDATE')
//*%OPC SETVAR TVAR2=SUBSTR(&TVAR1,3,2)
//*%OPC SETVAR TVAR3=(OCDATE + 1MO)
//*%OPC SETVAR TVAR4=SUBSTR(&TVAR3,3,2)
```

  If the occurrence input arrival date is 08/06/16, the expressions are substituted as follows:

```
TVAR1 = 080616
TVAR2 = 06
TVAR3 = 080716
TVAR4 = 07
```

  In fact the SUBSTR parameter identifies a substring of TVAR1 and TVAR3 values, starting from position 3 for a length of 2 characters. According to the format set by the SETFORM directive, it identifies the MM part of the date value.

Example 4 (arithmetic with temporary variables)

```
//*%OPC SETVAR TX=(1)
//*%OPC SETVAR TY=(2)
//*%OPC SETVAR TZ=(&TX+&TY)
```

TZ is a temporary variable set to the result of the arithmetic addition.

Example 5 (concatenating temporary variables)

```
//*%OPC SETVAR T001=('STRING1')
//*%OPC SETVAR T002=('STRING2')
//*%OPC SETVAR T003=('&T001 &T002 CONCATENATED STRINGS')
```

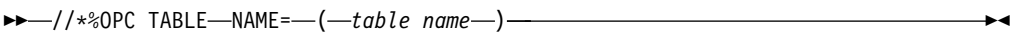
T003 is a temporary variable set to the following value: STRING1 STRING2 CONCATENATED STRINGS

TABLE directive

Purpose

This directive defines a variable table that will be searched before the variable tables in any existing concatenation when resolving JCL variables.

Syntax



Parameters

NAME=(*table name***)**
Identifies the variable table that you want to precede any existing table concatenation.

Usage Notes

The TABLE directive is used to include a variable table at the front of any existing table concatenation. The table specified by *table name* must have already been created using the OPC JCL VARIABLE TABLES panel (see "User-defined variables and variable tables" on page 499). The *table name* specified can be the name of a table or an & or % variable. This variable follows the standard IBM Workload Scheduler for z/OS format and can be promptable or not promptable.

More that one TABLE directive can be used within the operation JCL. As each table statement is found, the *table name* it specifies is added to the front of the table search list. Up to 16 tables can be concatenated in this way, including application and global variable tables.

When a variable is assigned a value, this value is unaffected by any later table concatenations.

In the following example, variables `HIONE` and `data set2` are defined in both TABLE1 and TABLE2.

Example

```
//*%OPC SCAN
//*%OPC SEARCH NAME=(TABLE2)
//DDNAME1 DD DSN=&HIONE..FINANCE,DISP=SHR
//*%OPC TABLE NAME=(TABLE1)
//DDNAME2 DD DSN=&HIONE.&DATASET2.,DISP=SHR
```

The search order for variables found after the TABLE directive is reached would be:

1. `TABLE1`
2. `TABLE2`
3. The application variable table (if it exists)
4. The global variable table.

The variable `HIONE` was set before the TABLE directive was reached. The value it is assigned, therefore, is taken from TABLE2, not from TABLE1. The variable `data set2`, however, because it was not found before the TABLE directive, is assigned a value from TABLE1.

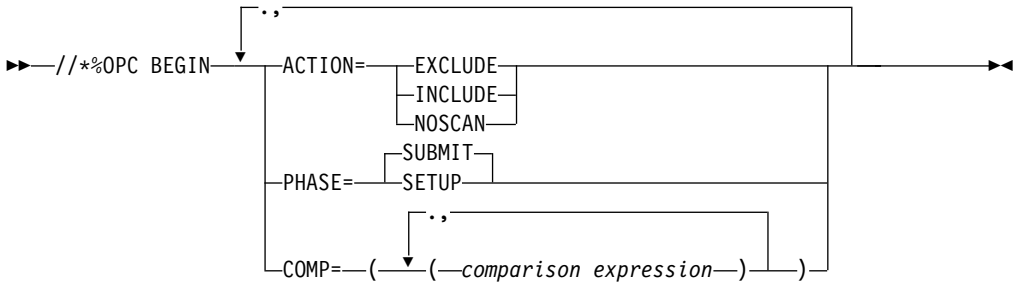
BEGIN and END directives

Purpose

These directives, used in pairs, denote the following, depending on the value of the ACTION keyword:

- The start and end of IBM Workload Scheduler for z/OS variable substitution
- The start and end of the lines to be *included in* the tailored job
- The start and end of the lines to be *excluded from* the tailored job

Syntax



Parameters

ACTION=(EXCLUDE|INCLUDE|NOSCAN)
Specifies which BEGIN/END action is required.

EXCLUDE
This specifies that the lines following this BEGIN directive up to the next END ACTION=EXCLUDE directive should be excluded from the job that is submitted for this operation.

INCLUDE
This specifies that the lines following this BEGIN directive up to the next END ACTION=INCLUDE directive should be included as part of the job that is submitted for this operation.

NOSCAN
This specifies that any variables following this BEGIN directive up to the next END ACTION=NOSCAN directive should not be substituted. When you specify NOSCAN, you do not specify a PHASE parameter, because NOSCAN is valid at both submit and at setup.

PHASE=SETUP|SUBMIT
Specifies whether the BEGIN/END pair should take effect during the setup or submit phase of the operation. This parameter is required only if ACTION=EXCLUDE or INCLUDE.

COMP=((*comparison expression***), (***comparison expression***),...)**
Specifies comparison expressions that are used to decide whether the BEGIN directive should be acted on. If the comparison expression is true, the BEGIN directive is honored. For details on defining comparison expressions, see "The COMP keyword on BEGIN and FETCH directives" on page 525.

Usage Notes

In a job, every BEGIN directive must have a matching END directive specifying the same ACTION. For example, the directive:

```
//*%OPC BEGIN ACTION=EXCLUDE,PHASE=SUBMIT
```

requires the following matching END directive:

```
//*%OPC END ACTION=EXCLUDE
```

If IBM Workload Scheduler for z/OS detects an unpaired BEGIN or END, the processing ends in error. Even a BEGIN statement that is not honored because its comparison expression is not true requires a matching END statement.

Only the following directives can lie within the domain of a BEGIN ACTION=NOSCAN directive and an END ACTION=NOSCAN directive:

- SEARCH
- SETFORM
- SETVAR
- TABLE

When these directives are in the range of a NOSCAN directive, they are always acted upon even if there is a comparison condition that is false.

Note: When the SETVAR directive is within the NOSCAN range, all the variables in the same NOSCAN range that follow SETVAR are in any case substituted.

BEGIN and END directives that specify ACTION=INCLUDE or ACTION=EXCLUDE cannot be nested and cannot overlap. They can, however, completely contain a nested NOSCAN domain.

Consider the following examples:

Example 1

```
//*%OPC SCAN
//*%OPC BEGIN PHASE=SETUP,ACTION=INCLUDE          1
//DDNAME1 DD DSN=&HIONE..&DATASET1,DISP=SHR       2
//DDNAME2 DD DSN=&HIONE..&DATASET2,DISP=SHR        3
//*%OPC END ACTION=INCLUDE                         4
```

Example 1 is valid. Lines 2 and 3 will be included in the job for the operation.

Example 2

```
//*%OPC SCAN                                      1
//*%OPC BEGIN PHASE=SUBMIT,ACTION=EXCLUDE         2
//EXEC PGM=MYPROG                                 3
//*%OPC BEGIN PHASE=SETUP ACTION=INCLUDE          4
//DDNAME1 DD DSN=&HIONE..&DATASET1,DISP=SHR       5
//SYSOUT  DD SYSOUT=A                             6
//*%OPC END ACTION=EXCLUDE                        7
//DDNAME2 DD DSN=&HIONE..&DATASET2,DISP=SHR       8
//*%OPC END ACTION=INCLUDE                        9
```

Example 2 is invalid. An EXCLUDE action (lines 2 and 7) overlaps an INCLUDE action (lines 4 and 9). Error message EQQJ533 will be issued.

Example 3

```
//*%OPC SCAN                                      1
//*%OPC BEGIN PHASE=SUBMIT,ACTION=INCLUDE         2
//EXEC PGM=MYPROG                                 3
//*%OPC BEGIN ACTION=NOSCAN                       4
//DDNAME1 DD DSN=&HIONE..&DATASET1,DISP=SHR       5
//SYSOUT  DD SYSOUT=A                             6
//*%OPC END ACTION=NOSCAN                         7
//DDNAME2 DD DSN=&HIONE..&DATASET2,DISP=SHR       8
//*%OPC END ACTION=INCLUDE                        9
```

Example 3 is valid. The NOSCAN domain defined by lines 4 and 7 is completely contained within the BEGIN and END ACTION=INCLUDE (lines 2 and 9).

Note also that the variable `HIONE` on line 8 will be substituted, but the variable `HIONE` on line 5 will not be substituted because it is within a NOSCAN domain.

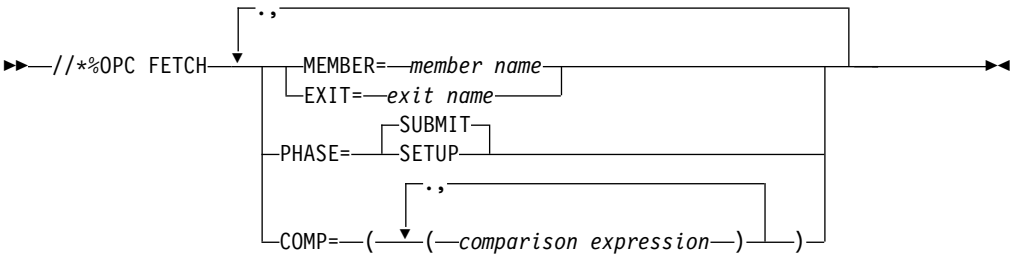
BEGIN and END directives that specify ACTION=INCLUDE or ACTION=EXCLUDE can modify the structure of JCL from one run to another. For this reason, to apply again the same directives in a Restart and Cleanup path, ensure that they do not alter the structure of the JCL. For details, refer to "JCL changes considerations" on page 392.

FETCH directive

Purpose

This directive lets you include lines, fetched from a partitioned data set member or supplied by an exit, in your job.

Syntax



Parameters

MEMBER=(*member name***)**
Specifies the member name of a partitioned data set allocated to ddname EQQJBLIB. The lines in this member are included immediately after the FETCH directive.

EXIT=(*exit name***)**
Specifies an exit to be called when the FETCH statement is invoked. This exit supplies lines to be inserted immediately after the FETCH directive in the job. For more details about exits, see *Customization and Tuning*.

PHASE=SETUP|SUBMIT
Specifies whether the FETCH should take effect during the setup or submit phase of the operation.

COMP=((*comparison expression***), (***comparison expression***),...)**
Specifies comparison expressions used to decide whether the FETCH directive should be acted on. If the comparison expression is true, the FETCH directive is honored. For details on defining comparison expressions, see "The COMP keyword on BEGIN and FETCH directives" on page 525.

Usage Notes

The FETCH directive is used to include lines from other partitioned data sets or as supplied by an exit. Lines included by a FETCH directive cannot contain another FETCH directive. BEGIN and END directives with action INCLUDE or EXCLUDE cannot be included in lines inserted by a FETCH directive.

IBM Workload Scheduler for z/OS variables can be used to represent the values of any keywords, but not the keywords themselves. A FETCH directive cannot lie between a BEGIN/END directive pair that specifies ACTION=INCLUDE or ACTION=EXCLUDE.

Example

```
//*%OPC SCAN
//*%OPC FETCH PHASE=SUBMIT,
//*%OPC       MEMBER=JCL1,
//*%OPC       COMP=(&DAY..EQ.1)
```

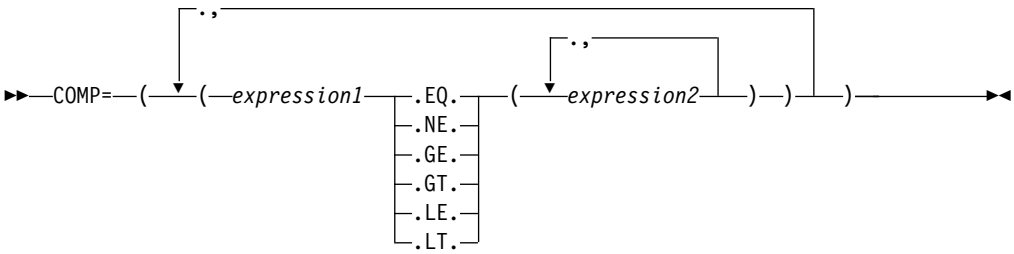
FETCH directives can modify the structure of JCL from one run to another. For this reason, to apply again the same directives in a Restart and Cleanup path, ensure that they do not alter the structure of the JCL. For details, refer to "JCL changes considerations" on page 392.

The COMP keyword on BEGIN and FETCH directives

Purpose

A comparison expression lets you specify conditions when BEGIN and FETCH directives will be honored.

Syntax



Parameters

expression1

This specifies a string made up of &-variables and alphanumeric literals. Any global search characters it contains are treated as literals. The value of *expression1*, arrived at by resolving any variables specified, will be tested against the values given by *expression2*.

.Operators.

These values are operators that specify which comparison should be made between *expression1* and any *expression2* values.

.EQ. *Expression1* must equal one of the *expression2* values for the expression to be true.

.NE. All *expression2* values must not equal the *expression1* value for the expression to be true.

.GT. *Expression1* must be greater than the *expression2* value for the expression to be true.

.GE. *Expression1* must be greater than or equal to the *expression2* value for the expression to be true.

.LT. *Expression1* must be less than the *expression2* value for the expression to be true.

.LE. *Expression1* must be less than or equal to the *expression2* value for the expression to be true.

expression2

This parameter can be made up of &-variables, literals, or, if .EQ. or .NE. operators are specified, one of the two global search characters, % and *.

The length of the resolved value cannot exceed 44 characters. The % global search character represents any single alphanumeric character. The * global search character represents any alphanumeric string, including a null string.

If GT, GE, LT, or LE is specified:

- Multiple values of *expression2* are not supported.
- Global search characters are not supported.

- If the strings on both sides of the operators are of different lengths, the comparison is made using the shorter string.

Note: The % symbol does not signify a % IBM Workload Scheduler for z/OS variable within a COMP keyword. The %- and ?-variables are not valid within a COMP statement.

Usage Notes

The COMP expression cannot exceed 256 characters unresolved, and cannot be more than 1024 characters after substitution; *expression2* can be any &-variable, either user-defined or defined by IBM Workload Scheduler for z/OS. Neither *expression1* nor *expression2* can have embedded blanks.

Consider the following examples:

Example 1

```
//*%OPC FETCH PHASE=SETUP,
//*%OPC       MEMBER=MYJCL,
//*%OPC       COMP=(&APPL..EQ.(APPL1,APPL2,APPL3))
```

If `&APPL.` is equal to `APPL1` or `APPL2` or `APPL3`, the expression is true, and the FETCH directive will be honored.

Note the two periods following `&APPL.`. The first signifies the end of the variable `APPL`; the second signifies the start of the comparison operator `EQ`.

Example 2

```
//*%OPC FETCH PHASE=SETUP,
//*%OPC       MEMBER=MYJCL,
//*%OPC       COMP=(&DAY..NE.(1,3,5))
```

In example 2, if `&DAY` is not equal to 1 or 3 or 5, the expression is true, and the FETCH directive will be honored. If `DAY` had been equal to any one of the comparison values, the expression would have been false.

For the COMP keyword to be *true*, all the comparison expressions that it consists of must be *true*. This is shown in the following example:

Example 3

```
//*%OPC BEGIN ACTION=INCLUDE,
//*%OPC       COMP=((&APPL..EQ.(APPL1,APPL2,APPL3)),
//*%OPC             (&DAY..NE.(1,3,5)))
          .
          .
          .
//*%OPC END ACTION=INCLUDE
```

For the COMP statement in example 3 to be true, the expressions `(&APPL..EQ.(APPL1,APPL2,APPL3))` and `(&DAY..NE.(1,3,5))` must both be true.

The *expression2* values that you specify can be made up of &-variables, alphanumeric literals, and the * and % global search characters. National characters, left and right parentheses; (and), and blanks are not allowed; if they are specified, the results are unpredictable. The * global search character represents a character string of any length; the % global search character represents exactly 1

character. If variables and global search characters are combined, the variables are resolved before any comparisons are made using the global search characters.

Example 4

```
//*%OPC BEGIN ACTION=INCLUDE,
//*%OPC       COMP=(&MYVAR..EQ.(TSO199,TSO2%%.,&VALUE1.*))
          .
          .
          .
//*%OPC END ACTION=INCLUDE
```

In example 4, the variable `&MYVAR` must have one of the following values for the comparison expression to be true:

- TSO199
- TSO2 followed by any 2 alphanumeric characters except blanks
- The value of variable `&VALUE1` followed by an alphanumeric string of any length, including length 0.

Example 5

```
//*%OPC BEGIN ACTION=EXCLUDE,PHASE=SUBMIT,
//*%OPC       COMP=(&CYYMMDD..GE.000101)
          .
          .
          .
//*%OPC END ACTION=EXCLUDE
```

Note that COMP statements can give unexpected results with some of the date formats of the supplied variables. When date variables are substituted, they are compared as numerals, not as dates.

In example 5, `&CYYMMDD` is the current date and `000101` represents 1 January 2000. If the value of *expression1* is greater than 000101, the comparison expression is true—even though a date in the 20th century is earlier than 1 January 2000. You will also have problems with comparing dates specified in formats like DDMMYY or MMDDYY.

Restrictions on the use of variables

IBM Workload Scheduler for z/OS imposes some restrictions on the values that variables can take and positions in the JCL where you can use variable substitution.

Line-length errors

Normally, job lines are a maximum of 71 characters. In jobs containing in-stream data, the in-stream data lines can be up to 80 characters. If the value of the variable being substituted is longer than the length of the variable name, truncation of the line might occur if the newly created line is longer than the maximum length allowed. For example, if you define a variable `&data set`, which has a length of 8 characters including the &, but give it a value 'MY.data set.NAME', with a length of 15 characters, you must ensure that there is enough room at the end of the line to allow for the substitution. If IBM Workload Scheduler for z/OS calculates that a line-length error will occur, substitution ends and the operation status is set to `E`, ended-in-error, with the error code `OJCV`. IBM Workload Scheduler for z/OS will, however, truncate comments on lines if necessary without giving an error.

IBM Workload Scheduler for z/OS substitutes variables in a series of passes. A truncation error occurs only if, after the final pass of a phase, the line produced is longer than permitted. The final pass is the pass that resolves the last remaining variable. During preceding passes, IBM Workload Scheduler for z/OS permits the line to extend beyond the normal limits of a job.

Note: It is recommended that substitution on in-stream data lines occur only for job library members that use the ISPF profile option STD numbers off. When STD numbers are present in columns 73–80, variable substitution on in-stream data lines can produce unpredictable results. Do not use the string `OPCSMSG` in positions 73-79, because IBM Workload Scheduler for z/OS uses this to position displayed lines at error messages.

Strings you cannot use variables to represent

IBM Workload Scheduler for z/OS variables can represent the values of most keywords, but you cannot use variables to represent certain keywords in both standard z/OS JCL and in IBM Workload Scheduler for z/OS directives.

- In the case of z/OS JCL, the restricted keywords are:
  - `JOB` in the JOB statement
  - `EXEC` in the EXEC statement
  - `INCLUDE` in the INCLUDE statement
  - `DD` in the DD statement
  - `PROC` in the PROC statement
  - `PEND` in the PEND statement

  If these fields are replaced by variables, the results are unpredictable.
- In the case of the IBM Workload Scheduler for z/OS directives, the restricted keywords are:
  - The string `//*%OPC`
  - The following command names:
    BEGIN
    END
    FETCH
    NOP
    SCAN
    SEARCH
    TABLE
  - The keyword to the left of each equals sign:
    ACTION
    COMP
    EXIT
    MEMBER
    NAME
    PHASE
  - Certain values to the right of the equals sign:
    APPL
    EXCLUDE
    GLOBAL
    INCLUDE
    NOAPPL
    NOGLOBAL
    NOSCAN
    SETUP
    SUBMIT

The use of variables that contain SCAN terminating keywords should be avoided.

You can substitute the following directive variables:

- *Table name* in the TABLE directive
- *Member name* in the FETCH directive
- *Exit name* in the FETCH directive
- All variables in the comparison expressions on the FETCH, INCLUDE, and EXCLUDE directives

Other directive variables, such as the stepname in the ERRSTEP keyword of the RECOVER statement, cannot be substituted.

Avoiding loops in variable substitution

IBM Workload Scheduler for z/OS does not let you define a variable-substitution loop. If you give variable `&A` the *value*&B and then give *variable* `&B` the value &A, a *variable loop* is formed. If IBM Workload Scheduler for z/OS detects that a variable has recurred in a variable for variable type substitution, the substitution ends in error. There are three possible loops:

- Substitution of variables by variables (described here)
- Dependency of variable A on variable B, which depends on variable A
- A combination of both of these cases

Order of variable substitution

If you specify a compound variable `%VAR1%VAR2...DATA`, where `VAR1` is a promptable variable and `VAR2` is a (not promptable) setup variable, the substitution fails, because IBM Workload Scheduler for z/OS resolves the compound variable right-to-left.

When you make one variable dependent on another, the independent variable must occur first (you can put it in a comment line), and must be substitutable in the same phase or in an earlier phase. This restriction does not apply to non-centralized scripts.

Using a default calendar name

IBM Workload Scheduler for z/OS sometimes needs a calendar when it substitutes variables. The subsystem looks for a calendar in this sequence:

1. An explicitly specified calendar, connecting the calendar name to the application occurrence
2. When you have manual job setup, and only for variables resolved at the setup phase, the calendar specified in the OPTIONS panel
3. The calendar called DEFAULT

Variable substitution for jobs running on fault-tolerant workstations

This section describes the automatic variable substitution provided for job definitions stored in the EQQSCLIB data set. It enables you to specify variables when you set a statement keyword in the job definition. Variable substitution occurs when:

- The Daily Planning process creates the Symphony file.
- The job is added to the plan using the Modify Current Plan dialog.

Activating variable substitution

You activate variable substitution by specifying VARSUB in the first statement of your job definition. Refer to *Customization and Tuning* for the full syntax. A variable consists of up to 8 alphanumeric characters.

Any non-alphanumeric character, except blanks, can be used as a symbol to indicate that the characters that follow represent a variable. You can define two kinds of symbols using the PREFIX or BACKPREF keywords in the VARSUB statement: it allows you to define simple and compound variables.

Supplied Variables and User-defined Variables tables are supported. Refer to "Supplied variables" on page 494 and "User-defined variables and variable tables" on page 499 for details. For information about associating variable tables with applications, see "Associating variable tables with applications" on page 488.

The following example shows how to use a simple variable. When scheduling the operation, the scheduler automatically sets the simple VUSER variable to the value that is specified in the E2EVARTAB variable table that is defined in the Application Description file.

```
VARSUB
  TABLES(E2EVARTAB)
  PREFIX('&')
JOBREC
  JOBCMD('dir')
  JOBUSR('&VUSER ')
```

In the following example of a compound variable, two substitution steps are performed automatically. The %OWSID string is processed first. OWSID is an operation-related supplied variable that is automatically set to the workstation ID for the current operation: assuming that FTW1 is the workstation ID, the first substitution step produces &FTW1SDIR.\my.cmd string. If you define the variable &FTW1SDIR in the E2EVARTAB application description table and set it to the c:\win32app\maestro value, the final result is that c:\win32app\maestro\my.cmd will be scheduled.

```
VARSUB
  TABLES(E2EVARTAB)
  PREFIX('&')
  BACKPREF('%')
JOBREC
  JOBSCR('&%OWSID.SDIR.\my.cmd')
  JOBUSR('tws')
```

Restrictions

You can have variables that depend on other variables, according to the data specified in the dependency value list as described in "Making one variable dependent on another" on page 502. Dependent and independent variables must be defined inside the same table, and a default value must be assigned to the independent variable.

Variable substitution for job types with advanced options

You can apply variable substitution also to job types with advanced options (jobs that run tasks within the areas of File Transfer, Web Services, Database, Java, and more). If you use the JOBREC command to create or modify these jobs, apply the variable substitution rules documented in the preceding sections. If you use the Dynamic Workload Console, the rules for doing this diverge from standard. This section documents how to implement variable substitution for this type of jobs

when you edit them on the Dynamic Workload Console, and the differences and limitations with respect to the standard process.

Adding variables in the job definitions on the Dynamic Workload Console

In the job definition lists of the Dynamic Workload Console, the following job types are categorized as job types with advanced options:

- Executable
- Java
- WebServices
- FileTransfer
- J2EE
- XaJob
- Database
- JCL
- MSSQL Job
- Any custom jobs for which you develop both the underlying code and the definition and management panels.

When you edit any of these jobs, you can insert variables in the definition fields using the syntax:

`${variable_name}`

where the value for the variable is in one of the tables specified by the VARTABLES keyword described in the next section.

You can use compound variables, that is, more variables joined together as follows:

`${VAR1${VAR2}...${VARn}}`

where the variables are resolved in several passes starting from the rightmost first and proceeding to the left.

Limitations

Variable substitution for job types with advanced options defined from the Dynamic Workload Console is very straight forward but does not allow most of the options available for normal jobs or for this type of jobs when defined with JOBREC. It is also useful to reiterate that:

- Variable dependency is not supported, due to the difficulty in these jobs to enforce the rule that the independent variable must come first and to the impossibility to use comment lines to "place" the independent variable before the dependent one.

Available user exits

The SEQQSAMP sample library that was created during installation contains the EQQJVXIT exit, which is a sample exit coded to apply variable substitution. When you specify a job definition variable, you can specify the name of this exit that is called when substitution of the variable is required. You can use the exit to supply the value of a variable. Look in EQQJVXIT and its coded documentation for details.

Configuration requirements

To be able to implement variable substitution on these jobs, specify the following keywords in the HTTPOPTS initialization statement:

VARSUB (NO |YES)
Specifies whether variable substitution is enabled for jobs with advanced options. YES means that variable scanning will be run on this type of jobs. NO means that variable scanning will not take place.

VARTABLES (GLOBAL |APPL |*table1*, *table2*, ...)
Identifies the variable tables that must be searched and the search order:

GLOBAL
Points to the table defined in the GTABLE keyword of the OPCOPTS controller.

APPL Points to the application variable table.

table1, *table2*, **...**
Point to the tables named here. Their names can be no longer than 16 characters and the number of tables in this list is limited to 16.

VARFAIL (YES |NO)
Specifies whether the scheduler is to issue an error message when a variable substitution error occurs. If you specify NO, the variable string is left unchanged without any translation.

See the details on the HTTPOPTS initialization statement on the *Customization and Tuning* guide.

Chapter 26. Job scheduling and WLM

This chapter describes the possible integration and exploitation of the WorkLoad Manager (WLM) component of z/OS. Today, schedulers process different types of work with different completion and resource requirements. Every scheduler aims at making the best use of its resources, at maintaining the highest possible throughput, and at achieving the best possible system response. WLM makes this possible.

With WLM, you define performance goals and assign a business importance to each goal. You define the goals for work in business terms and the system decides the amount of resources, such as CPU and storage, it should provide to meet these goals. WLM constantly monitors the system and adapts processing to meet the goals.

You can also tell WLM which are the resources a job needs to run and WLM will run it on a system where these resources are available.

The workloads, their requirements, and their performance goals are defined to WLM through the service definition. Workload management provides an online panel-based application for setting up and adjusting the service definition. You specify the service definition through this ISPF administrative application. There is one service definition for the entire Sysplex. It contains all the information WLM needs to process, that is:

Service Policy
A named set of performance goals (eight characters long) that workload management uses as a guideline to match resources to work. When activated, a service policy is merged with the service definition and applies to all the Sysplex.

Service Class
A named group of work (eight characters long), within a workload, with similar performance characteristics:
- Performance goals
- Resource requirements
- Business importance

Resource Group
A named amount of processor capacity (eight characters long) across the Sysplex. It can be associated to a service class in the service class definition.

Classification Rules
Define how to assign an incoming work to service classes and report classes.

Application Environment
A named group of application functions (32 characters long) that execute in server address space and can be requested by a client.

Scheduling Environment
A named list of resource names (16 characters long) along with their required states. You can specify up to 999 unique scheduling environments in a service definition, according to the following convention:
- Alphanumeric and the special characters @, $, #, and _ are allowed.

- Underscore (_) must be imbedded

The scheduling environment can be defined in the job card of a JCL (SCHENV=*SE_name*) so that, at submit time, WLM has a list of the systems where the job can run (a system where the scheduling environment is active), and pick one according to the active service policy.

When no system with an active scheduling environment is available, the job is not started and is placed on the WLM hold queue: it will be started as soon as the scheduling environment becomes active on a system within the Sysplex. If the scheduling environment does not exist at all, the job fails with JCL error

Workload
A collection of service classes. It is used for reporting purposes.

Report Classes
A group of work used for reporting.

IBM Workload Scheduler for z/OS is able to submit large quantities of work into z/OS systems. The work is submitted only after a number of predetermined conditions are met, but the scheduler does not know the state of the system (in terms of load and capacity, but also in terms of resource availability) when the work is submitted.

Some of the main objectives of IBM Workload Scheduler for z/OS are:
- Running your workload as efficiently as possible, in order to complete all work according to your time requirements.
- Monitoring the workload constantly to detect any possible problems and fix them immediately.

To match these objectives, IBM Workload Scheduler for z/OS exploits the services of WLM by providing integration with:

Service Class
After the jobs are defined as critical to WLM (at the AD and CP operation levels), IBM Workload Scheduler for z/OS uses customizable criteria (either as a controller initial parameter or within the operation definition) to check if these jobs are running late: if they are, the scheduler moves them to the predefined WLM high performance service class.

Scheduling Environment
Integration is accomplished by:
- Associating a scheduling environment to the operations (via IBM Workload Scheduler for z/OS ISPF panels or programming interfaces). At submission time, the JCLs are tailored by adding the SCHENV=*SE_name* statement in the JOB cards. A pre-existing SCHENV keyword in the JOB card is taken into account depending on the OPCOPTS SECHECK parameter.
- Monitoring the scheduling environment as follows:
  1. If the associated scheduling environment is not available, the job is not submitted and is assigned the *waiting for scheduling environment* extended status.
  2. As the scheduling environment becomes available, an exit activated by one of the trackers forwards an event to the scheduler which then submits the job again.

Integrating with the service class

To minimize delays in the execution of the workload, IBM Workload Scheduler for z/OS:

1. Detects that a critical job is running late.
2. Calls a documented WLM interface to move the job to a higher performance service class.
3. Conveys additional system resources so that the job can complete in a shorter time.

The delay in the batch workload is therefore reduced.

Environment

To benefit from the WLM function, your system must be a SYSPLEX (at least MONOPLEX) environment running in WLM goal mode and you must set up a higher-performance service class for occasional use (refer to the WLM documentation).

In the OPCOPTS initialization statements, you have to include the WLM statement with the appropriate parameters (see *Customization and Tuning* to enable IBM Workload Scheduler for z/OS to send promotion requests to WLM.

When a job should be set as critical

You should always set a job as critical if its delay could imply a delay in the plan. WLM knows the availability of the overall resources against the system workloads when the current plan is executed and the real duration of a job is determined by this factor. Therefore, it is better also that you set as critical those jobs that would be on a critical path if their estimated durations were only minimally longer than at present. To set a job as critical, you have to enter Y in the CRITICAL field on the JOB, WTO, AND PRINT OPTIONS panel (accessible from either the APPLICATION DESCRIPTION panel or the MODIFYING THE CURRENT PLAN panel).

Selecting WLM assistance policies

When you have decided that a job should be considered as critical, IBM Workload Scheduler for z/OS allows you to choose between different assistance policies. To activate a particular policy, you have to specify the code that identifies it in the POLICY field on the JOB, WTO, AND PRINT OPTIONS panel (accessible from either the APPLICATION DESCRIPTION or MODIFYING THE CURRENT PLAN panel). If you do not specify a policy for a particular critical job, IBM Workload Scheduler for z/OS applies either the common policy specified in the WLM statement of OPCOPTS or the default common policy (if one has not been specified). Valid assistance policy codes are:

L Long Duration. When a critical job runs over the expected duration (as specified by the user), it is promoted to a higher-performance class by the scheduler. This policy is activated by specifying the letter L in the Assist Policy field on the APPLICATION DESCRIPTION panel.

Note: The resources are used also when not necessary, but for a short interval.

D Deadline. When a critical job runs over its real deadline (calculated as Latest Start Time + Duration), it is promoted to a higher-performance class by the scheduler.

Note: This policy is always recommended when the S(mart) policy is not used. The resources are used only when strictly necessary, but it might be too late.

S Latest Start Time. When a critical job starts after its latest start time, it is promoted to a higher-performance class by the scheduler.

Note: The resources are used also when not strictly necessary, but it can prevent delayed termination of jobs.

C Conditional. The assistance policy is a smart compromise between the Deadline and the Latest Start Time policies as follows:

1. IBM Workload Scheduler for z/OS checks if the conditions of the Deadline policy are met and promotes the job.
2. If the conditions of the Deadline policy are not met, the promotion is immediate for jobs started with a significant delay with respect to the remaining time to deadline. The time to deadline can have different weights according to the Threshold value that you specify in the WLM statement of OPCOPTS. The default value is 20%. If you specify a value of 0%, the Latest Start Time policy is automatically applied in this second step. If you specify a value of 100%, the Latest Start Time policy is applied only when the time from the Latest Start Time is greater than that remaining to the deadline.

If a different policy is not specified in the WLM statement, this is the policy that IBM Workload Scheduler for z/OS uses as a common policy.

Note: This policy is always recommended, but it requires additional tuning efforts for correct setting of the Threshold value.

The advantages and disadvantages of the assistance policies are:

Table 34. Advantages and disadvantages of assistance policies

Assistance Policy (Intervention Option)	Advantages	Disadvantages
Duration	• Gentle smoothing • Low impact	• Possibility of intervention when not actually necessary • Limited gain
Deadline	• Gentle smoothing • Low impact • 100% certainty that intervention is required	Limited gain
Latest Start Time	• High gain • High probability that intervention is required	High risk of overcompensating
Conditional	• Best action taken for every situation • No decision necessary by you	Tuning efforts to set the Threshold value

The Workstation Analyzer checks for late operations every two minutes. When it discovers a late operation that is critical, there might be additional two minutes delay before the WLM action is taken (for example, to promote the job to the service class).

Integrating with the scheduling environment

The objective is to facilitate the association of WLM scheduling environments with IBM Workload Scheduler for z/OS jobs.

The main benefits are:

- JCLs no longer have to be manually tailored to associate a scheduling environment with a job or to modify an existing association. In fact:
  - The association can be made within the definition of the operation (through the ISPF panel or the PIF).
  - Global changes for groups of jobs can be made with Mass Update and Batch Loader support.
- Jobs can be monitored for problems related to the WLM scheduling environment.
  - The new Waiting for Scheduling Environment extended status for operations enables a user to track scheduling environment problems via ISPF.
  - The possibility to filter operations by their scheduling environment name enables a user to identify all operations blocked by a specific scheduling environment.
- The retry mechanism is based on the detection of scheduling environment availability. As soon as the associated scheduling environment becomes available, an event is sent to the controller to retry the operations waiting for it.
- The integration is supported across the entire Sysplex.
  - The availability of the scheduling environments is checked for at the tracker level, where WLM macros are used with sysplex-wide scope.
  - The possibility to define a scheduling environment at the job level preserves the administrator from the need to define scheduling environments by sysplex. For example, scheduling environment SE1 can be defined both in Sysplex A and Sysplex B, but they are two separate objects with different status.

Associating a scheduling environment with a job

To associate a Scheduling Environment with an operation at the application description and current plan levels, you can use, via ISPF, PIF, BCIT or OCL:

- At submit time, the EQQUX001 controller user exit. EQQUX001 receives in input the scheduling environment value stored in the CP operation definition and has the option to change it. The returned value is then stored in the CP.
- At plan creation time, the EQQDPX01 DP batch user exit. EQQDPX01 is called for every new operation (with the exception of fault-tolerant end-to-end scheduling operations); that is, for each operation extracted from LTP. It receives in input the scheduling environment value associated to the operation and has the option to change it. The returned value is then stored in the CP.

Note that the concept of scheduling environments does not apply to started tasks (the SCHENV= keyword cannot be inserted into a started task).

Submitting prevention and automatic tailoring

If a scheduling environment is associated to an operation, when the time to submit the operation arrives:

- The scheduling environment is monitored for availability at tracker level. The tracker does not submit the operation as long as the scheduling environment is not available.
- The JCL is tailored by inserting the SCHENV=*CP defined Scheduling Environment name* parameter in the JCL JOB card if the availability check is positive.

Scheduling environments are monitored and defined in the JCLs according to the value of the OPCOPTS SECHECK parameter specified in the tracker that will be submitting the operation. You have the option to:

- Not use scheduling environments (no check nor tailoring).
- Manage scheduling environments only if they are defined at operation level in the current plan.
- Manage scheduling environments also if the related operations do not have the association defined in the current plan but have the JCL containing the SCHENV= keyword.

For details, see *Customization and Tuning*.

Pre-existing definition in the JCL JOB card

By default, when no scheduling environment name is defined for an operation in the current plan, any SCHENV=*SE_name* contained in the JCL JOB card is supported. If the operation has a scheduling environment name defined in the current plan, the SCHENV=*SE_name* contained in the JCL JOB card is overridden.In this way, no extra processing is requested for the tracker submitting the job and you can activate this function at your will.

Checking for scheduling environment availability

The tracker submitting the job uses the WLM Query Service to check if the scheduling environment is available:

- If the scheduling environment is available on any system in the sysplex, the job is submitted and WLM has the task to identify the system where the job will run.

  Whenever the new OPCOPTS JESPLEX parameter is specified, the associated list of system names is used as an additional filter in the WLM query to check for scheduling environment availability at JESplex level. This is required when there are more than one JESplex within the same sysplex.

  Note: If you use virtual workstations with the WLM SCHENV interface, all the virtual destinations must be in the same sysplex and JESplex.

  Based on WLM logic, to obtain full workload balancing, you should configure no more than one JESplex in the sysplex. However, deviations from this rule are often found throughout the installed basis. For a description of the new parameter and a troubleshooting for configuration problems, refer to "Multi-sysplex configuration with JESplex matching sysplex" on page 540.
- If the scheduling environment is not available on any system in the sysplex (or at the tracker JESplex level if the OPCOPTS JESPLEX parameter is specified) the operation is assigned the Ready status and the Waiting for scheduling environment extended status.

  This process is not followed if the operation comes from the Restart and Clean up path. In this case, the operation is assigned the **SERC** (SE not available for

R&C operation) error status. Operations that are ready but waiting for the scheduling environment to be available are considered not eligible for submission by the controller.

- If the scheduling environment is not defined in the sysplex, the operation status is set to Error with the **SEUN** (SE undefined) error code.

Restrictions for using job card comments on the right

When the JOB card is tailored to insert or replace the SCHENV keyword, any comments on the right might be ignored and could show truncated in the submitted JCL.

The retry mechanism for operation waiting for SE

To monitor the availability of the scheduling environments, the trackers activate an ENF listener mechanism for event code 57 (the event that reports the status change of a scheduling environment) and for event code 41 (the event that reports on WLM policy activation) according to the value stored in the OPCOPTS SECHECK parameter.

When a scheduling environment becomes again available on a specific image, the tracker generates a new event to report this to the controller. Consequently, the controller resets the extended status of the operation so that it is again eligible for submission.

When a Policy Activation occurs, all the operations waiting for Scheduling Environment belonging to the Sysplex where the Policy change occurred, are resubmitted.

Monitoring operations

All lists currently displaying the operation status, extended status, and error codes, support the new extended status and error codes. By the same token, all commands currently supported for ready operation remain available.

The Scheduling Environment name has been added as filtering criteria in operations list. If the Scheduling Environment name is not defined in the Current Plan at operation level, the Controller stores it in the Current Plan when notified about Scheduling Environment unavailability. If the job submission fails with SEUN or SERC error code, the Scheduling Environment name is not overridden.

Considerations for using the ROUTE JCL statement

A JCL might contain a ROUTE statement that causes the execution of the job on a different image than the Submit task image. JES processes the ROUTE statement after the job submission: at that point, the Submit task already performed the check on scheduling environment availability, therefore the check is effective or not depending on the configuration.

User actions to activate scheduling environment integration

About this task

Following is a list of the required steps to activate scheduling environment integration.

Note: If you do not want to activate scheduling environment integration, no specific actions are requested. By default, the initialization parameters are set for no integration.

1. To activate the function, for each tracker (and for the controller if it uses the submit function) set the SECHECK parameter to a value other than NO. Depending on your requirements, set to ALL or to OPERONLY:

   ALL If you do not plan to define the scheduling environment in the IBM Workload Scheduler for z/OS database

   OPERONLY
   All the other cases.
2. If you use a multi-sysplex configuration, define the new OPCOPTS SYSPLEXID parameter for each tracker. This must be a unique number throughout the entire configuration.
3. If you use multiple JESplex within a sysplex, define the new OPCOPTS JESPLEX parameter for each tracker. This must be a list of system names belonging to the tracker JESplex.or use scheduling environment best practice definitions.

Following is a list of the optional steps to activate scheduling environment integration:

1. Define a scheduling environment at operation level.
2. Implement the EQQUX001 controller exit routine to set the scheduling environment name if appropriate.
3. Implement the EQQDPX01 exit routine to set the scheduling environment name if appropriate (for details, see "Performance considerations" on page 547).
4. Set the SUPPRESSENF parameter to YES, where applicable, to improve performance (for details, see "Performance considerations" on page 547).

Supported configuration

The following sections describe the more complex scenarios where you must take special care when setting up for WLM integration, that is:

- Multi-Sysplex configurations with matching JESplex and Sysplex
- Multi-Sysplex configurations with more JES complexes within a Sysplex

Note: If you use a virtual workstation for an operation that has a scheduling environment defined, then all the destinations in that virtual workstation must belong to the same Sysplex.

Multi-sysplex configuration with JESplex matching sysplex

Invoking the WLM query service at the tracker rather than at the controller level allows for support of multiple Sysplex handled by one controller (macro range is Sysplex-wide). Figure 215 on page 541 shows this type of configuration.

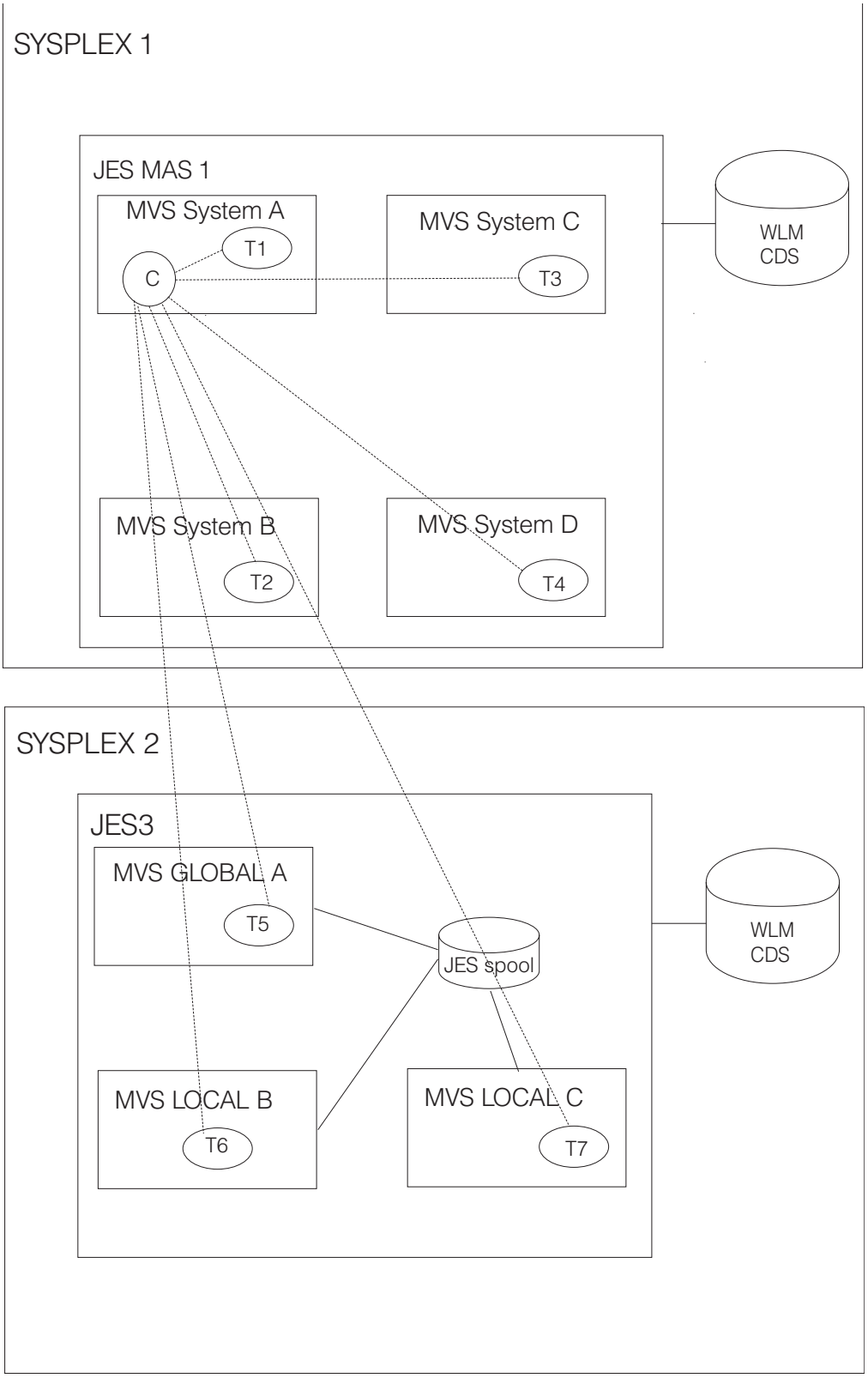


Figure 215. Multi-sysplex configuration: JESplex matching sysplex

In this configuration, it is important that the controller is told from which Sysplex the tracker event communicating the availability of the scheduling environment comes from, so that the operations waiting for that scheduling environment can be

submitted again. To do so, use the **SYSPLEXID (*nn*)** parameter, where ***nn*** can be an integer from 1 to 9999. The default is 1. This parameter applies both to trackers and controllers.

The following scenario, based on Figure 215 on page 541, helps explain how SYSPLEXID is used.

A scheduling environment named DB2x is defined both in Sysplex 1 and in Sysplex 2 and initially it is unavailable in both Sysplexes:

1. You submit a job with SCHENV=DB2x on tracker T3 of system C, Sysplex 1.
2. Tracker T3 finds that the DB2x scheduling environment is not available and sends an IJ4 event, Submit failed, to the controller, with a record of the putting scheduling environment name and of the sysplex ID.
3. The controller places the operation in status READY, WAITING FOR SE and stores both the scheduling environment name (DB2x) and the Sysplex ID (1).
4. DB2x becomes available on Sysplex 2. Tracker T5 of Sysplex 2 warns the controller by sending an event.
5. The controller checks the operation in status READY, WAITING FOR SE against the scheduling environment name (DB2x) and the sysplex ID (2) and finds they do not match.
6. DB2x becomes available on tracker T4 of system D, Sysplex 1. Tracker T4 warns the controller by sending an event.
7. The controller checks the operation in status READY, WAITING FOR SE against the scheduling environment name (DB2x) and the sysplex ID (1) and finds that they do match. The operation is resubmitted.

Multi-sysplex configuration with JESplex not matching sysplex

Figure 216 on page 543 shows a configuration where there are multiple JESplex within a single Sysplex.

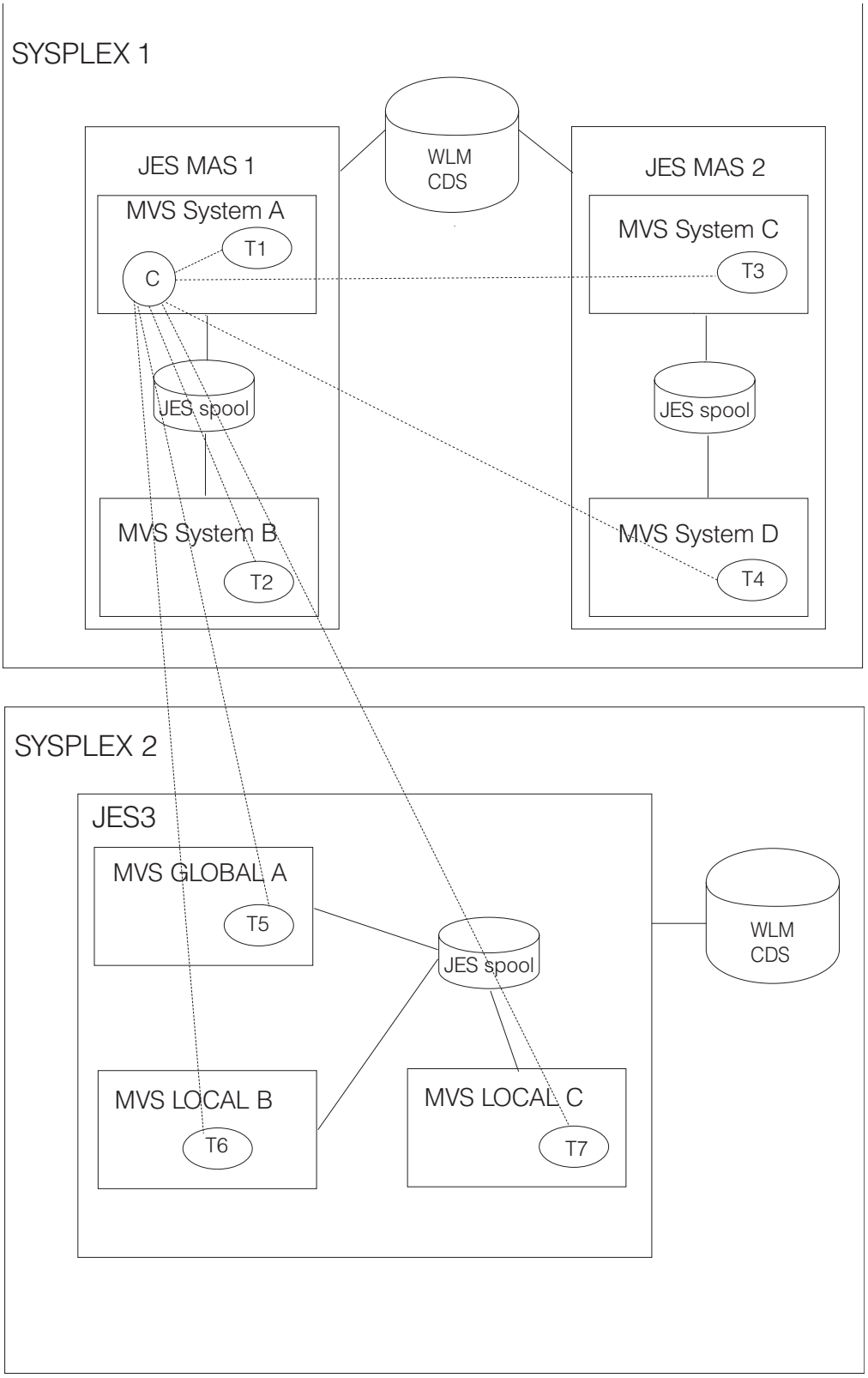


Figure 216. Multi-sysplex configuration: multiple JESplex

According to IBM® recommendations, the best configuration is when the JESplex (JES2 MAS or JES3 Complex) and the Sysplex match. Nevertheless, it is possible to define more JES complexes (JES2 or JES3) within a Sysplex. In this situation, a job

submitted in a JES complex cannot be routed by WLM to another JES complex, regardless of the output of the IWMSEQRY service.

Note: If you use virtual workstations with the WLM SCHENV interface, all the virtual destinations must be in the same sysplex and JESplex.

In the configuration shown in Figure 217 on page 545, suppose there is a scheduling environment named DB2x. This scheduling environment is available on system D only. When the IWMSEQRY service is invoked from system A, the returned output indicates that DB2x is available in the Sysplex, overlooking the existence of the MAS 1 boundary. This is a problem: if a job requires DB2x, and it is submitted on system A, it will hang indefinitely in the JES input queue.

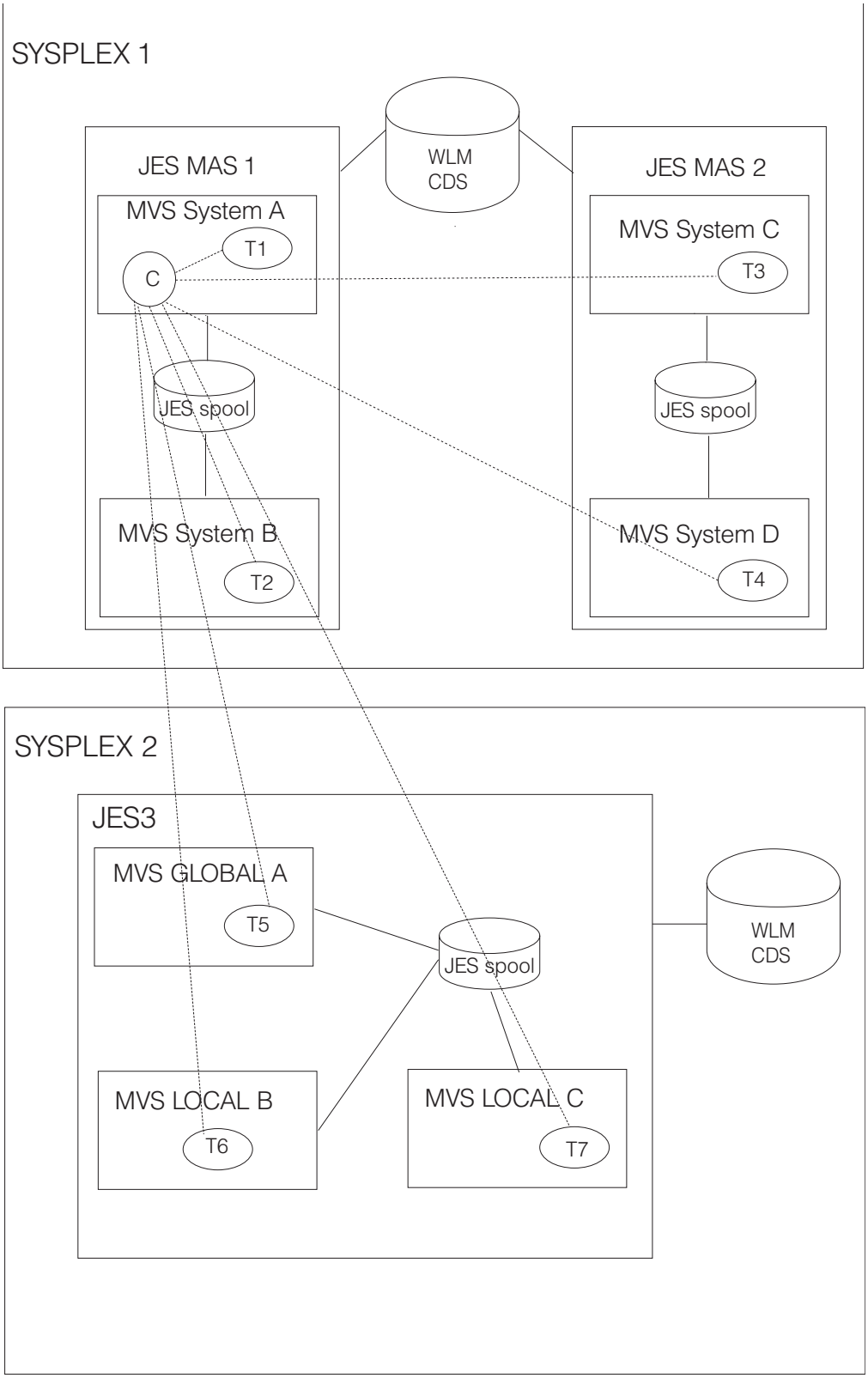


Figure 217. Multiple JES within a Sysplex

From a WLM point of view, this works as designed. To support this type of configuration, you must use the initial parameter statement OPCOPTS JESPLEX.

that informs trackers of the identity of the multiple JESplex. The **JESPLEX (*List of system names*)** parameter provides the system names within the JESplex where the tracker belongs.

In the example shown in Figure 217 on page 545, if TA, TB, TC, and TD are the trackers installed on MVS images A, B, C, and D respectively, the OPCOPTS JESPLEX parameter for each of the trackers must be as shown in Table 35:

Table 35. JESPLEX parameters for the trackers

Tracker name	JESPLEX parameter
TA	JESPLEX (A, B)
TB	JESPLEX (A, B)
TC	JESPLEX (C, D)
TD	JESPLEX (C, D)

When the job is submitted on system A, tracker TA first checks the response of the WLM query if DB2x is available with its own JESplex list (A and B). For this reason, tracker TA understands that DB2x is not available in its own JESplex and therefore does not submit the job.

However, this is a static definition, therefore if you change configuration you have to stop the tracker, update the parameter, and restart the tracker. This problem can be avoided by supporting multiple JESplex in the same Sysplex, without involving the trackers but only following a *best practice* approach to define and use scheduling environments.

For example, consider each MAS as a resource. If you have MAS 1 and MAS 2, define:

MAS1 Required in ON state on MAS 1, in OFF state on MAS 2

MAS2 Required in OFF state on MAS 1, in ON state on MAS 2

This corresponds to the following:

```
                      ....System A      System B      System C      System D
Resource State    MAS 1     ON            ON            OFF           OFF
                  MAS 2     OFF           OFF           ON            ON
```

Thus, proceed as follows:

1. Associate MAS 1 with all the scheduling environments for jobs to be submitted on MAS 1
2. Associate MAS 2 with all the scheduling environments for jobs to be submitted on MAS 2

The following scenario, based on the configuration of Figure 216 on page 543, shows how to define a scheduling environment without using the OPCOPTS JESPLEX parameter. To define the scheduling environment, apply the following rules:

- Assign a letter to each JESplex in the configuration. For example, in Figure 216 on page 543 SYSPLEX 1 JES MAS 1 can be identified with **X**, SYSPLEX 1 JES MAS 2 can be identified with **Y**, and JES3 GLOBAL with **Z**.

- Use the same name for the same resource throughout all MVS images. For example, DB2ACT should indicate, when set to ON, that the DB2 application is active on a specific image.
- Define for each JESplex the MAS*x* resource, where *x* is the letter associated to the JESplex. For example, resources MASX, MASY, and MASZ are to be defined as follows:

Table 36. The MAS resources and their associated JESplex

Resource	SYSPLEX 1 System A	SYSPLEX 1 System B	SYSPLEX 1 System C	SYSPLEX 1 System D	SYSPLEX 2 System A	SYSPLEX 2 System B	SYSPLEX 2 System C
MASX	**ON**	**ON**	OFF	OFF	OFF	OFF	OFF
MASY	OFF	OFF	**ON**	**ON**	OFF	OFF	OFF
MASZ	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**

- If a job requires that application DB2 be active, define 3 different scheduling environments so that they can be associated with the job depending on where the job is run (either MASX, MASY, or MASZ). For example:

  XSEDB2, for the job to run on MASX
  - Resource DB2ACT must be ON
  - Resource MASX must be ON

  YSEDB2, for the job to run on MASY
  - Resource DB2ACT must be ON
  - Resource MASY must be ON

  ZSEDB2, for the job to run on MASZ
  - Resource DB2ACT must be ON
  - Resource MASZ must be ON
- Suppose that job XMYJOB is to be run on MASX with DB2 active. You must associate it with scheduling environment XSEDB2. Suppose you submit this job on MASX system A and the resource status is the following:

Table 37. The MAS resources and their associated JESplex

Resource	SYSPLEX 1 System A	SYSPLEX 1 System B	SYSPLEX 1 System C	SYSPLEX 1 System D	SYSPLEX 1 System A	SYSPLEX 1 System B	SYSPLEX 1 System C
MASX	**ON**	**ON**	OFF	OFF	OFF	OFF	OFF
MASY	OFF	OFF	**ON**	**ON**	OFF	OFF	OFF
MASZ	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**
DB2ACT	OFF	OFF	OFF	**ON**	**ON**	**ON**	**ON**

When the tracker invokes the IWMSEQRY macro, XSEDB2 shows to be unavailable (because the status of DB2ACT is OFF) without having had to define the OPCOPTS JESPLEX parameter.

Performance considerations

From a performance point of view, when you use the WLM scheduling environment integration, consider carefully the following items:
- Activating the ENF 57 and ENF 41 listener exit
- Implementing daily plan batch EQQDPX01 exit

For details, see “The ENF 57 and ENF 41 listener exits” and “The DP BATCH EQQDPX01 exit.”

The ENF 57 and ENF 41 listener exits

When the WLM scheduling environment integration is active (the value of OPCOPTS SECHECK is not set to NO for all trackers), by default each tracker activates its own ENF 57 and ENF 41 listener exits. Therefore, for each image, a pair of these exits are at work.

The ENF 41 exit (EQQZNF41) sends an event every time a change in the WLM policy occurs, so that the controller is informed that a change in scheduling environment availability or definition have taken place. As a consequence, the controller resubmit all the operations in READY, WAITING FOR SE status that belong to the Sysplex where the WLM policy change occurred.

The ENF 57 exit (EQQZNF57) sends an event every time a scheduling environment becomes available, so that the controller is immediately notified that it can submit a pending job (in READY, WAITING FOR SE status) again. This means that, for example, if you have 32 MVS images, when scheduling environment SEDB2 becomes active, the IBM Workload Scheduler for z/OS controller is sent 32 events containing the same information. If you have many scheduling environments that change their status often, the performance of your system might be affected, depending also on the size of the workload on the controller.

To avoid unnecessary processing, you can suppress the activation of exits ENF 57 and ENF 41 on specific trackers, if this is compatible with your configuration. Considering that the tracker is in the same MVS image as the controller (either in the same or in a separate address space), in a Sysplex hosting both the controller and trackers you can use the SUPPRESSENF parameter to reduce the number of exits to the ones running on the controller. Proceed as follows:

1. Activate the exit on the controller: the value of OPCOPTS SECHECK must not be set to NO.
2. Activate the exit on all the trackers that are not located in the same Sysplex where the controller is: on each tracker the value of OPCOPTS SECHECK must not be NO.
3. Suppress the exit on all the trackers located in the same Sysplex where the controller is: on each tracker the value of OPCOPTS SECHECK must not be set to NO and SUPPRESSENF must be set to YES.

The DP BATCH EQQDPX01 exit

Exit EQQDPX01 can be used to set or change a scheduling environment name when creating the daily plan batch, according to user specifications (you can apply your own rules to set the values). Depending on how you implement it, this exit might affect the performance of the batch creation process, because it is called for each new operation (non-FTA) in the plan. For this reason, use this exit only when really necessary and try to avoid time consuming processing, like for example, unnecessary I/O (for instance, open the file at the first call and close it at the last call).

Chapter 27. Loop detection and analysis

Batch daily planning programs (extend, replan, and trial) prevent you from creating current plans that would cause a dependency loop condition. This is achieved by checking each single *network* of the plan, that is each set of operations that are linked to each other by some dependencies.

The scheduler checks for both normal and conditional dependencies. A step dependency determines a check at operation level.

If a loop condition is detected, batch daily planning programs stop creating the plan and start an analysis phase that produces:

- A message with summary information about the loop in the EQQMLOG and EQQLOOP data sets
- A list of messages in the EQQLOOP data set about:
  - The operations involved in the loop and their dependencies
  - The dependencies that the batch daily planning programs suggest to remove, one at a time, to solve the loop
  - The application descriptions sorted by the last update date and time in the application definition

Detecting a loop condition

A current plan is made of one or more networks. A network is made of a number of operations that are linked to one another by some dependencies. Every network must contain at least one of the following operations:

First Operation (FOP)
Operation with no predecessors. It is considered an entry point to the network.

Last Operation (LOP)
Operation with no successors. It is considered an exit point from the network.

To detect a loop condition, batch daily planning programs perform two kinds of check on the network.

The first check performed by batch daily planning programs is to ensure that the network has at least one first and one last operation. If either or both of them are missing, a loop condition is detected and reported as NO ENTRY AND/OR EXIT POINT loop in the EQQMLOG and EQQLOOP data sets. For details about this type of loop, see “"NO ENTRY AND/OR EXIT POINT" loop” on page 550.

The second check performed by batch daily planning programs is to ensure that all the operations in the network can be assigned an *earliest start time* (EAS). When processing the network, batch daily planning programs create a current plan where all the operations are assigned a planned start time, to approximately indicate when each operation can run. If, at the end of this process, one or more operations are left with no EAS assigned, a loop condition is detected. This type of loop is reported as SOME NODES COULD NOT BE CHECKED in the EQQMLOG and EQQLOOP data sets. For details, see “"SOME NODES COULD NOT BE CHECKED" loop” on page 550.

"NO ENTRY AND/OR EXIT POINT" loop

The first check performed by the batch daily planning programs is to ensure that a network has at least a first operation (FOP) and a last operation (LOP).

Suppose you have a plan with the following operations and dependencies:

- Application A, operation 001, predecessor of B, operation 002
- Application B, operation 002, predecessor of C, operation 003
- Application C, operation 003, predecessor of A, operation 001
- Application D, operation 004, predecessor of E, operation 005
- Application E, operation 005, LOP
- Application F, operation 006, predecessor of E, operation 005

Your plan would contain two networks, as shown in Figure 218.

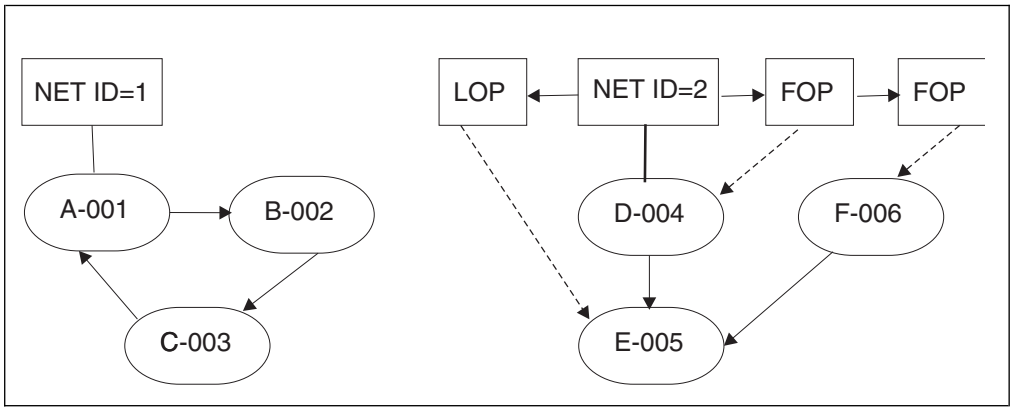


Figure 218. Example of a NO ENTRY AND/OR EXIT POINT loop condition

In this example, network 2 has two first operations (FOP) and one last operation (LOP), which is allowed. Network 1, instead, has neither FOP nor LOP, which means that a loop condition will surely occur. When processing the network, batch daily planning programs detect the loop and issue the message EQQ3150E in the EQQMLOG and EQQLOOP data sets, specifying NO ENTRY AND/OR EXIT POINT as loop type. In the system log, the message EQQ3163E indicates that a loop condition has occurred.

"SOME NODES COULD NOT BE CHECKED" loop

A more complex mechanism used to detect a possible loop condition is to assign an earliest start time (EAS) to each operation in the network. An operation can be assigned an earliest start time only after an EAS has been assigned to all its predecessor operations. (First operations are assigned only an Input Arrival date and time.)

Suppose you add to your network 1 the following operations, as shown in Figure 219 on page 551:

- Application A, operation 007, predecessor of A, operation 001
- Application C, operation 008, successor of C, operation 003

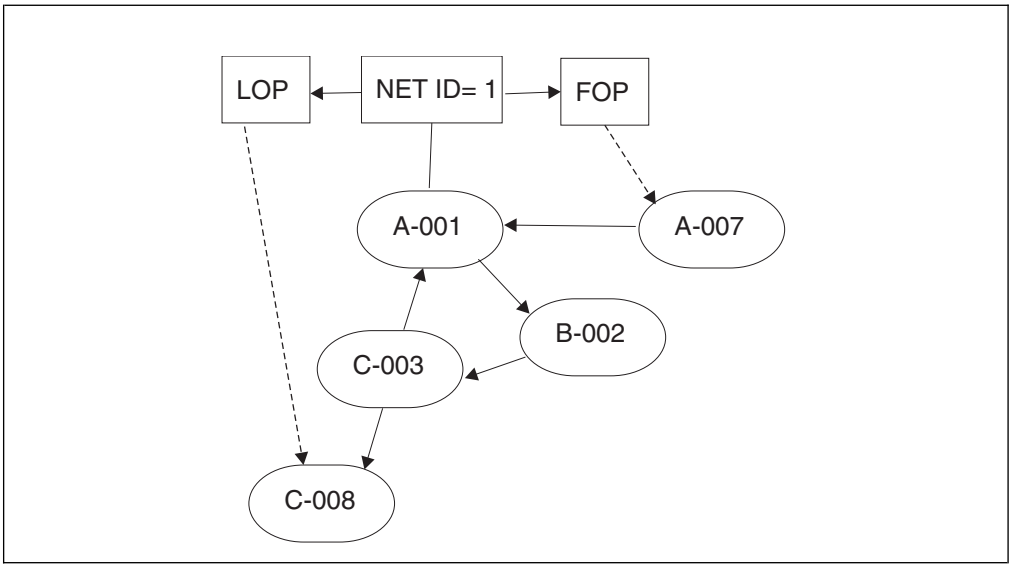


Figure 219. Example of a SOME NODES COULD NOT BE CHECKED loop condition

In this example, network 1 has one FOP (A-007) and one LOP (C-008), which satisfy the first check operated by the batch daily plan programs. Nevertheless, a loop condition is detected when the batch daily plan programs try to assign an earliest start time to the operations in the network, because the only operation that can be assigned a time is A-007. In this case, message EQQ3150E is issued in the EQQMLOG and EQQLOOP data sets, specifying SOME NODES COULD NOT BE CHECKED as loop type and indicating the total number of unchecked operations, including the operations involved in the loop and their direct or indirect successors. In the system log, the message EQQ3163E indicates a loop condition has occurred. The loop analysis phase that starts immediately after a loop condition is detected, discovers that the loop involves only three operations (A-001, B-002, C-003) and batch daily planning programs list them as loop operations (see messages EQQ3151I, EQQ3152I, EQQ3153I, EQQ3154I, EQQ3155I in the EQQLOOP data set).

Starting the loop analysis

When a loop is detected, the current plan is not created or extended and a loop analysis process is started to help you resolve the loop. The loop analysis process is performed iteratively on a matrix representing the network, to progressively reduce the operations involved in the network until no operations are left and the loop is completely resolved. The loop analysis process is done on the matrix, without operating any real action in the network. Any bad dependencies removed and actions taken are reported in the EQQLOOP data set as a suggestion for you to solve the loop, according to your requirements.

After creating a matrix of the network, the loop analysis process performs iteratively a loop reduction activity to:

1. Remove any FOPs and LOPs in the network and leave only the operations involved in the loop. The last FOP removed, if any, is considered as the *loop entry* and its successor is marked as the *closest operation to the loop entry*. In the EQQLOOP data set, message EQQ3151I describes the loop reduction process performed and, at the first iteration, messages EQQ3152I, EQQ3153I, EQQ3154I, and EQQ3155I list all the operations involved in the loop. For details about these messages, see *Messages and Codes*.

2. Identify the dependency to be removed to solve the loop, according to the following criteria in the following order:

   A) IA Time Check
   A predecessor operation whose occurrence has an Input Arrival date (or time) later than the occurrence of the successor operation identifies the dependency to be removed.

   B) Closest To Loop Entry
   If no IA Time Check condition occurs, the dependency between the closest operation to the loop entry, if any, and one of its predecessors is identified as the one to be removed. Only when the network has at least one FOP, the reduction process identifies the closest operation to the loop entry because the loop entry is the last FOP removed. Otherwise, it is not set and the closest to loop entry condition does not occur.

   C) Minimal Net Distortion
   If none of the above conditions occurs, the minimal disturbing dependency is identified as the one to be removed. The disturbance is evaluated based on the throughput affecting the loop operations, such as the number of dependencies for an operation or the presence of external dependencies. The minimal disturbing dependency is identified as the one whose removal would have the least significant impact on the network.

For each dependency to remove, one message EQQ3156I is issued in EQQLOOP explaining the reason of the removal (IA Time Check, Closest To Loop Entry, or Minimal Net Distortion). Examine the EQQLOOP data set to learn the suggestions given to resolve the loop and examine your network to decide the actions to actually take. The information provided by EQQLOOP is a possible path to resolve the loop but you must decide which dependencies you want to remove.

The loop analysis process (reduction, operation analysis, dependency removal) is performed until all the loops in the matrix are solved, that is when no operations are left in the matrix. When all the loops are solved, messages EQQ3157I and EQQ3158I in EQQLOOP detail all the applications involved, listing them by the date and time of the last update made, in descending order. This information helps you identify the changes made in the application definitions that might have caused the loop to occur.

If the resolution of the loop required changes to external dependencies of any application then, before a current plan batch process is run, a long term plan batch must be done to update the long term plan itself and, subsequently, the current plan.

Example of a loop detection and analysis

As an example, consider the network shown in Figure 220 on page 553:

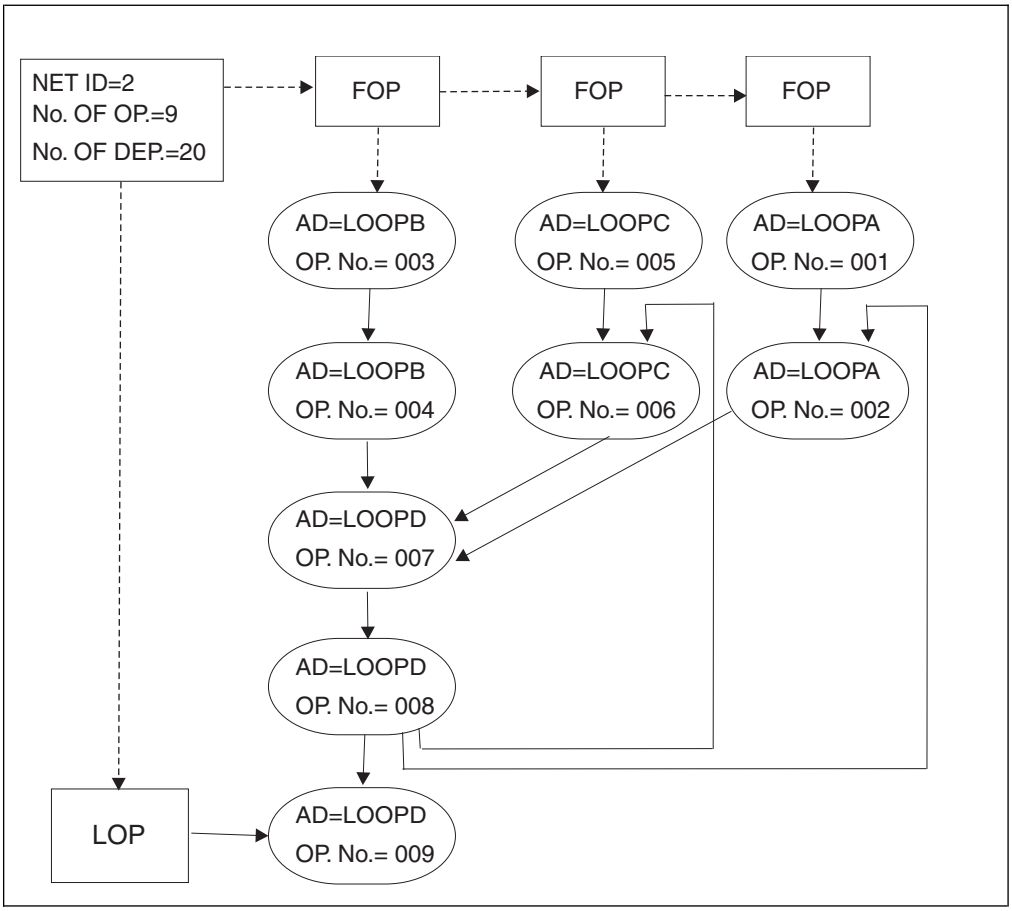


Figure 220. Example of a network

In this network, which has both FOPs and LOPs, it is assumed that all the operations have the same IA date and time. The example shows a multiple dependency loop made up of four operations. The loop detection process detects a loop of type SOME NODES COULD NOT BE CHECKED, because five nodes could not be assigned an earliest start time (EAS) and therefore are identified as not checked. The loop analysis is performed to identify which dependencies can be the reasons of the loop and suggest how to solve it.

The reduction process, at its first iteration, identifies and lists all the loop operations, along with their dependencies. After an analysis of the loop operations, you are suggested to remove a dependency from the network (reason: CLOSEST TO LOOP ENTRY).

The reduction process starts for the second iteration. After the reduction, three operations are left in the network, meaning that there is another loop involving them. After an analysis of the loop operations, you are suggested to remove a dependency from the network (reason: CLOSEST TO LOOP ENTRY).

The reduction process starts the third iteration. At this stage, the reduction process leaves no operations in the network, meaning that the loop is resolved.

All the applications involved in the loops are listed ordered by the last update date and time, in descending order, in the EQQLOOP data set.

After the loop detection process is completed, the following messages are issued in the EQQMLOG data set:

```
EQQ3150E LOOP FOUND IN AN APPLICATION NETWORK:
EQQ3150I - LOOP TYPE                  =SOME NODES COULD NOT BE CHECKED
EQQ3150I - NETWORK ID                 =000000000002
EQQ3150I - TOTAL OPERATIONS           =000000000009
EQQ3150I - TOTAL DEPENDENCIES         =000000000020
EQQ3150I - NO. OF FOPs                =000000000003
EQQ3150I - NO. OF LOPs                =000000000001
EQQ3150I - NO. OF UNCHECKED NODES     =000000000005
EQQ3150I - FIRST OCCURRENCE           =LOOPA      051027 1023
```

During the loop analysis process, the following messages are issued in the EQQLOOP data set:

```
EQQ3150E LOOP FOUND IN AN APPLICATION NETWORK:
EQQ3150I - LOOP TYPE                  =SOME NODES COULD NOT BE CHECKED
EQQ3150I - NETWORK ID                 =000000000002
EQQ3150I - TOTAL OPERATIONS           =000000000009
EQQ3150I - TOTAL DEPENDENCIES         =000000000020
EQQ3150I - NO. OF FOPs                =000000000003
EQQ3150I - NO. OF LOPs                =000000000001
EQQ3150I - NO. OF UNCHECKED NODES     =000000000005
EQQ3150I - FIRST OCCURRENCE           =LOOPA      051027 1023
EQQ3151I LOOP REDUCTION ITERATION 00001 REDUCED LOOP TO 000000004 OPERATIONS
EQQ3152I                           ADID     IADATE   IATM    WSD   OPNO  JOBNM
EQQ3153I LOOP OPERATION:         (LOOPC  ) 051027   1023    CPU1   006  JOBX
EQQ3154I PREDECESSOR OF:         (LOOPD  ) 051027   1023           007
EQQ3155I SUCCESSOR OF:           (LOOPD  ) 051027   1023           008
EQQ3153I LOOP OPERATION:         (LOOPD  ) 051027   1023    CPU1   008  JOBY
EQQ3154I PREDECESSOR OF:         (LOOPC  ) 051027   1023           006
EQQ3154I PREDECESSOR OF:         (LOOPA  ) 051027   1023           002
EQQ3155I SUCCESSOR OF:           (LOOPD  ) 051027   1023           007
EQQ3153I LOOP OPERATION:         (LOOPD  ) 051027   1023    CPU1   007  JOBZ
EQQ3154I PREDECESSOR OF:         (LOOPD  ) 051027   1023           008
EQQ3155I SUCCESSOR OF:           (LOOPA  ) 051027   1023           002
EQQ3155I SUCCESSOR OF:           (LOOPC  ) 051027   1023           006
EQQ3153I LOOP OPERATION:         (LOOPA  ) 051027   1023    CPU1   002  JOBT
EQQ3154I PREDECESSOR OF:         (LOOPD  ) 051027   1023           007
EQQ3155I SUCCESSOR OF:           (LOOPD  ) 051027   1023           008
EQQ3156I REMOVED DEPENDENCY:     (LOOPD  CPU1 0008 JOBY  051027  1023)
EQQ3156I PREDECESSOR OF:         (LOOPA  CPU1 0002 JOBT  051027  1023)
EQQ3156I REASON FOR REMOVAL:     CLOSEST TO LOOP ENTRY
EQQ3151I LOOP REDUCTION ITERATION 00002 REDUCED LOOP TO 000000003 OPERATIONS
EQQ3156I REMOVED DEPENDENCY:     (LOOPC  CPU1 0006 JOBX  051027  1023)
EQQ3156I PREDECESSOR OF:         (LOOPD  CPU1 0007 JOBZ  051027  1023)
EQQ3156I REASON FOR REMOVAL:     CLOSEST TO LOOP ENTRY
EQQ3151I LOOP REDUCTION ITERATION 00003 REDUCED LOOP TO 000000000 OPERATIONS
EQQ3157I                         ADID   VALIDTO   LASTUPD        USER
EQQ3158I LOOP ADID:              LOOPD  991231     051104 0107   USER1
EQQ3158I LOOP ADID:              LOOPA  991231     051027 0644   USER2
EQQ3158I LOOP ADID:              LOOPC  991231     051027 0530   USER3
```

When a batch daily planning ends in error or takes too long, search for message EQQ3150E in the EQQMLOG and EQQLOOP data sets to check whether a loop condition occurred. If a loop condition occurred, detailed information is stored in the EQQLOOP data set.

According to the resolution actions suggested, check if the removed dependencies are the actual dependencies you can remove based on your application definitions. Check messages EQQ3157I and EQQ3158I to see if some application definitions were recently changed, because they might have caused the loop.

Suggestions to speed up the loop resolution

When you make some changes to the operation definitions, to identify possible loops, run daily planning trials. In this way, there will be smaller networks to analyze and fewer messages to check, if a loop condition is detected.

When a loop is detected, ensure that you promptly modify the application definitions to prevent the network from generating the same loop condition again.

The messages generated by the loop analysis process in the EQQLOOP data set are not intended as the only possible way to resolve the loop. They are only a suggestion path to solve the loop; you can adopt it or not, according to your application definitions requirements. For example, consider a network with three operations involved in a loop, all of them having the same Input Arrival (IA) date and time. Suppose the following dependencies link the operations:

- Operation A is predecessor of operation B
- Operation B is predecessor of operation C
- Operation C is predecessor of operation A

The batch daily planning detects a loop condition (A, B, C) and suggests a path to solve it by removing one of the dependencies. The removed dependency is not necessarily the bad dependency, because the IA date and time is the same for all the operations. In this case, no IA TIME CHECK condition occurs. If the network has one or more FOPs, the matrix reduction sets the closest operation to the loop entry and the removed dependency follows this criteria. If the network has no FOPs, the CLOSEST TO LOOP ENTRY condition does not occur; the MINIMAL NET DISTORTION will determine the dependency to be removed.

When applicable, avoid using the same IA date and time for the operations in the network. Setting the IA date and time according to the dependencies makes it easier for the loop analysis process to identify bad dependencies.

Part 2. Controlling and monitoring

Learn how to manage the workload when it becomes part of a plan and is run with real dates and times.

Chapter 28. Monitoring the workload

All operations in the current plan are associated with a workstation. You can use IBM Workload Scheduler for z/OS panels to display the operations. For an overall view, you use the QUERY CURRENT PLAN panel (described later in this chapter in "The QCP panel" on page 576). However, if you want to find out which operations are due to start or are already started at a workstation, use the workstation *ready list*.

Using the Ready List panel

The ready list contains operations that have no outstanding predecessors, operations defined to the workstation that are waiting for a particular time or resource, operations that have already started, and operations that have ended in error. The status codes of operations in the ready list can be A, I, R, *, S, or E. The ready list displayed can also include one operation in C status, the last operation that you manually set to complete. This operation is maintained on the ready list to give you an opportunity to *reset* the operation if you change your mind.

To display the ready list for a workstation, select option 4 from the main menu, which will then display the COMMUNICATING WITH WORKSTATIONS menu (Figure 221). The ready list functions are available by selecting option 1 on this panel.

```
EQQRTOPP ----------
--- COMMUNICATING WITH WORK STATIONS
---------------------
Option ===>

Select one of the following:

1 READY LIST      - Using the ready list

2 WAITING LIST    - Review submitted jobs that have a waiting status

3 JOB SETUP       - Setup the JCL for jobs

4 WORK STATIONS   - Review the status of work stations

9 DEFINE RL       - Define alternative ready list layouts
```

Figure 221. EQQRTOPP - Communicating with workstations

```
EQQRTOPP ------------- COMMUNICATING WITH WORK STATIONS -----------------------
Option ===>

Select one of the following:

1 READY LIST      - Using the ready list

2 WAITING LIST    - Review submitted jobs that have a waiting status

3 JOB SETUP       - Setup the JCL for jobs

4 WORK STATIONS   - Review the status of work stations

9 DEFINE RL       - Define alternative ready list layouts
```

Figure 222. EQQRTOPP - Communicating with workstations

You can customize the layout of the workstation ready list to suit your needs, either by selecting one of the supplied layouts or by building your own layout.

Selecting a ready list layout

When you select the ready list for a workstation for the first time, you must specify the layout to use for the list. Approximately 90 different fields can be displayed in a ready list (see Appendix F, "Fields displayed in ready and error lists," on page 843), but not all of these can be displayed at once. Information on the fields that are to be displayed, and the order in which they should be displayed, is kept in a named *ready list layout*. There might be many different layouts in your installation. Each supplied default layout is designed for a specific workstation type.

If you have not specified a layout for the workstation that you have selected, IBM Workload Scheduler for z/OS displays a list of layouts, so you can then select a layout from this list. The scheduler stores the layout you choose for each workstation in your ISPF profile. When you request the ready list for a workstation, IBM Workload Scheduler for z/OS retrieves the name of the layout ID you prefer from your ISPF profile. If you want to change the layout of the ready list, enter the name of another layout in the corresponding field in the ready list: IBM Workload Scheduler for z/OS displays the ready list again using the new layout you specified. You can get a list of all the ready list layouts by typing an asterisk (*) in the LAYOUT ID field on the SPECIFYING READY LIST CRITERIA panel and then pressing Enter.

```
EQQRSRLP -------------- SPECIFYING READY LIST CRITERIA ------------------------
Command ===>

Enter/Change data below and press ENTER to create a ready list.

WORK STATION NAME  ===> CPU1        (Blank presents a list.)
LAYOUT ID          ===> *_______    An id, blank for default, * for a list

Selection criteria:
 APPLICATION ID    ===> ________________
 OWNER ID          ===> ________________
 JOB NAME          ===> ________
 LOWEST PRIORITY   ===> _           Lowest priority to be selected.
 OPERATION STATUS  ===> ______      Status codes list: A R * S I E or blank

Latest input arrival:              Select only operations with input
 DATE              ===> ________   arrival before this date and time.
 TIME              ===> _____      (Format YY/MM/DD and HH.MM )

Status sort order  ===> CES        List of status codes, A R * S I E or C
                                   (Any three must be selected, or all blank)
CLEAN UP TYPE       ===> _____     Types list: A M I N or blank
CLEAN UP RESULT    ===> _____      Results list: C E or blank
OP. EXTENDED NAME  ===> ________________
OP. SE NAME        ===> ________________
WAITING FOR SE     ===> Y          Y or N, leave blank to select all
```

Figure 223. EQQRSRLP - Specifying ready list criteria

Creating your own ready list layout

About this task

Ready list layouts are kept in two ISPF tables: one for your own use, and one that contains your installation-defined layouts. Your own layout overrides the installation layout.

To change a ready list layout, select option 9, the DEFINE RL option on the COMMUNICATING WITH WORK STATION panel. The scheduler then displays a list of both your own and any installation-defined layouts (Figure 224 on page 562). From this list, you can create new layouts or select a layout to delete, copy, modify, or browse. Any modified installation-defined layout is stored as a private copy of the layout in your ISPF profile. You can delete your own layout, but you cannot delete an installation layout.

To make a set of private layouts available for your colleagues:

1. Create a complete set of layouts. If you want to include a supplied (or old) layout, edit and save it so that it becomes part of your private library.
2. Save (by renaming) the old EQQRLDEF member in the common table library.
3. Copy the EQQRLOUT member from your ISPF profile library to the common table library, renaming it to EQQRLDEF.

```
EQQRLYLL -------------------- READY LIST LAYOUTS ------------  ROW 1 TO 5 OF 5
Command ===>                                                  Scroll ===> PAGE

Enter the CREATE command above to create a new layout or
enter any of the row commands below:
B - Browse, C - Copy, D - Delete, M - Modify

Row Layout      Description                       Owner       Last update
cmd id                                                        date       time
'   C1          Layout 1 for CPU work station     LEIFTO2     96/09/15   08.21
'   C2          Layout 2 for CPU - times          LEIFTO2     96/09/13   13.12
'   C3          Layout 3 for CPU - options        LEIFTO2     96/09/13   13.19
'   WTO         Ready list layout for WTO         XRAYNER     97/02/03   12.28
'   LAYOUT1     My layout                         XRAYNER     97/04/20   13.18
****************************** BOTTOM OF DATA ******************************
```

Figure 224. EQQRLYLL - Ready list layouts

When you modify or create a layout, IBM Workload Scheduler for z/OS presents a list of the available ready-list fields (see Appendix F, "Fields displayed in ready and error lists," on page 843 for a complete list). From this list, shown in Figure 225, you select the fields to be contained in the ready list layout, and the column order. You can also specify whether the field should be highlighted when IBM Workload Scheduler for z/OS displays it. All the items previously selected for display are placed at the top of the list in column order (**1**).

Note that all fields are not applicable for all kinds of workstations or operations. For example, the actual duration field, ACT DUR, will not be applicable for a general automatic workstation as its operations disappear from the Ready List when complete.

On the CREATING A READY LIST LAYOUT panel, you can also specify a text string used by the ISPF select service to invoke a user exit.

```
EQQRLYCL --------------- CREATING A READY LIST LAYOUT ------  ROW 1 TO 7 OF 95
Command ===>                                                  Scroll ===> PAGE

 Enter/change data below:

 LAYOUT ID          ===> SAMPLE__    Identity of this layout
 DESCRIPTION        ===> JCL SETUP LAYOUT_____________
 USER EXIT          ===> ____________________________________________________

 Current layout below:
     Application      Arrived  Ended    PR£     1

 Enter S in the S column to select an item as column title.
 Order selected items by numbering them 001-120 in the S column.
 Enter Y in the H column to highlight a column in the ready list.

 S  H Column title          Lgth Description of column content
 1    Application            16  Application ID
 2    Arrived                08  Operation arrival date actual if arrived
 3    Ended                  08  End date of the operation, or blank
 4    PR£                    04  Number of predecessor operations
      PS£                    03  No. of parallel servers req. by the op.
      UPR£                   04  Number of uncompleted predecessor op.
      R1£                    03  No. of 1st WS resources req. by the op.
```

Figure 225. EQQRLYCL -Creating a ready list layout

Ready list layout user exit

The user exit is passed the status of an operation in the ready list output. It can set the next logical status plus the error code and duration of the selected operation.

Invoking the user exit from the panels

The user exit is invoked when you enter the row command R (reset) or N (set next status) in a row of the READY LIST panel, EQQRLRLM. It is invoked for only those workstations that have been defined as follows:

Type General

Reporting attribute

Manual start and completion

Job setup

N

The actual status of the operation must be one of the following:

Waiting for arrival
Ready
Interrupted
Ready non-reporting

Although defined, the user exit is not invoked for other cases.

Defining and setting up the user exit

You can specify a user exit routine in the USER EXIT field of the CREATING A READY LIST LAYOUT (EQQRLYCL) panel. This specification can be in the form of one of the following command strings, depending on the type of user exit routine:

CMD(*clistname*)
PANEL(*panelname*)
PGM(*modulename*)

Store CLISTs, panels, and programs that comprise the user exit routine in a selected data set that is concatenated in the SYSPROC, ISPPLIB, ISPMLIB, and STEPLIB statements of the procedure or CLIST used for IBM Workload Scheduler for z/OS setup. (For more information about setting up the controller ISPF environment, refer to *Planning and Installation*.)

Communicating with the user interface routine

Communication between IBM Workload Scheduler for z/OS panel and user exit routine is through the ISPF variable defined in shared pool. The panel passes the following variables to the user exit routine:

Table 38. Variables

Variables		
UROSTAT	CHAR(1)	Current operation status
URNSTAT	CHAR(1)	New operation status
UROPERR	CHAR(4)	New operation error code
UROPDUR	CHAR(5)	New operation duration

The UROSTAT variable contains the status value of the current operation. New operation parameters are passed initialized to blank.

Table 39. Variables and descriptions

N3P_COM Variable	Description
OPGROUP	Authority group
OPADI	Application ID
OPIAD	Application input arrival date after MCP
OPIAT	Application input arrival time after MCP
OPTXT	Textual description
OPJBN	OS job name or blank
OPWSN	Workstation name
OPNUM	Operation number
OPJCL	JOB-, SYSOUT-class, or blank
OPFRM	From number or blank
OPPSD	Planned start date
OPPST	Planned start time
OPPED	Planned end date
OPPET	Planned end time
OPOID	Operation input arrival date
OPOIT	Operation input arrival time
OPODD	Operation deadline date
OPODT	Operation deadline time
OPLOD	Latest out for operation date
OPLOT	Latest out for operation time
OPASD	Actual start date
OPAST	Actual start time
OPAAD	Actual arrival date
OPAAT	Actual arrival time
OPISD	Intermediate start date if interrupted
OPIST	Intermediate start time if interrupted
OPAED	Actual end date
OPAET	Actual end time
OPEDU	Estimated duration, hh.mm
OPADU	Actual duration, hhhh.mm
OP£PS	Parallel servers required
OP£R1	WS resources required (r1)
OP£R2	WS resources required (r2)
OPCST	Current status
OPERR	Error code
OPAEC	Automatic error completion (Y or N)
OPPRI	Priority
OPXST	Extended status
OP£SU	Number of successors
OP£PR	Number of predecessors

Table 39. Variables and descriptions (continued)

N3P_COM Variable	Description
OP£SR	Number of special resources
OPAJR	Automatic hold/release (Y or N)
OPASUOP	Automatic submit (Y or N)
OPTJT	Time job (Y or N)
OPRESTA	Restartable operation
OPRERUT	Reroutable operation
OPWRER	Operation was rerouted
OPAWS	Operation alternate WS
OPDWTO	Operation deadline WTO
OPMXLVL	Maximum nesting level
OPUPDA	Operation userdata field
OPMHLD	Operation manually held field
OPNOP	Operation nop field
OPEXEC	Operation execute field
OPMCPUP	Last MCP update
OPJES	Job ID
OPCMJST	Job log status
OPEXDEST	Execution destination
OPEDUS	Estimated duration hh.mm.ss
OPADUS	Actual duration hh.mm.ss
OPMON	External monitor (Y or N)

Using the ready list

The following are some of the tasks you can perform using the ready list:
- "Setting the status of an operation" on page 566.
- "Resetting an operation to its previous state" on page 567.
- "Interrupting an operation" on page 567.
- "Reporting an operation as ended-in-error" on page 567.
- "Viewing operator instructions" on page 568.
- "Preparing jobs at a setup workstation" on page 568.
- "Delaying an operation, and releasing it" on page 572.
- "Removing an operation from the current plan and restoring it" on page 573.
- "Running an operation immediately with EXECUTE" on page 574.
- "Diagnosing delays" on page 575.
- "Rerunning operations in the history database" on page 620.
- "Resetting bind information for a shadow job" on page 576

Select option 1 on the COMMUNICATING WITH WORKSTATIONS panel (Figure 221 on page 559) to see the ready list. Figure 226 on page 566 shows a typical ready list for a computer workstation.

```
EQQRLRLM ------------------------ READY LIST ----------------  ROW 1 TO 8 OF 8
Command ===>                                                  Scroll ===> PAGE

Enter the HIST primary command or
enter any of the following row commands:
N - Set next logical status, N-x - Set specific status( x ),
R - Reset status, O - Operator Instructions, I - Information about operation,
MH Manual hold operation, MR Manual release operation, NP Nop operation,
UN Un-nop operation, EX Execute operation, BND Reset bind information.

WORK STATION       ===> CPU1        Change to switch work station
LAYOUT ID          ===> C1_____     Change to switch layout id

Cmd St no. Jobname  Operation text           Job id   Application      Oi Errc
'' E    7 TESTABND This should REALLY fail  JOB00024  TESTJOBS         N S0C4
'' E    5 TESTJCL  This is supposed to fail JOB00222  TESTJOBS         N JCL
'' EM   9 TESTMANE I manually made this E             TESTJOBS         N MAWS
'' SQ  11 HELDJOB  I put a TYPRUN=HOLD on   JOB00768  TESTJOBS         N
'' S   13 RUNJOB   Just been submitted                TESTJOBS         N
'' RX  10 PAYEMDMP PAYROLL employee dump              PAYEMDMP         Y
'' RH  15 TESTHELD I manually HELD this one          TESTJOBS         N
'' AT   3 TESTTIME Waiting for midnight              TESTJOBS         N
```

Figure 226. EQQRLRLM - Ready list

Enter the SORT command to display the list-field headings and their meanings. The ready list by default sorts the operations by job name within status. However, you can change the sort fields presented on the ready list. See Appendix E, "Status, error, and reason codes," on page 837 for a complete list of status codes and extended status codes. If you sort operations by the actual start times, the jobs that have been running the longest will appear at the top of your display.

You cannot override sort criteria that you have specified on a filter panel with the SORT command.

Setting the status of an operation

When you work with a ready list, you are normally changing the status of an operation in the cases where the workstation does not report the status change automatically. To do this, you can let IBM Workload Scheduler for z/OS assign the next logical status, or you can set the status explicitly.

Letting the scheduler assign the next status

Letting IBM Workload Scheduler for z/OS assign the next status is the easier way: enter the row command N beside the operation whose status is to be changed. The scheduler then changes the status to the next logical status for that type of workstation:

- For automatic reporting workstations, the order is: A, R, S, C.
- For manual start and completion workstations, the order is: A, R, S, C.
- For completion only workstations, the order is: A, R, C.
- For non-reporting workstations, the order is: A, C.

Sometimes you see operations on a ready list in *(asterisk) status. This means the operation is ready, but one or more predecessors are defined on a non-reporting workstation.

Note the difference between A and R status. Only operations with no predecessors have an A status. Operations that have all predecessors completed progress to R status directly from W status.

Setting the status explicitly

To set the status explicitly, enter the row command N-*x*, where *x* is the status you want set for the operation. You might want to do this to immediately set the status of an operation to complete, or to report an operation as interrupted or as ended-in-error. Sometimes IBM Workload Scheduler for z/OS requests more information when you set the status; for example, it might request the duration of the operation, or the error code. When IBM Workload Scheduler for z/OS requests more information, it displays a panel where you should enter the information.

Notes:

1. Setting the operation status to S (started) for operations on computer workstations does *not* cause the job or started task that is associated with the operation to be submitted. First establish *why* the operation is not started. When you have done this, you can remove the cause of the delay so that IBM Workload Scheduler for z/OS can run the work normally. See "Diagnosing delays" on page 575.
2. Setting a WTO operation defined to a general workstation to started does not cause a WTO message to be issued.
3. Setting the status of a started operation to E (error), or to any other status, does not cancel the job.
4. Setting the status of an operation to C (completed) allows successor operations to start (other dependencies permitting), even though the job might still be executing.
5. You cannot set the status to S or E for fault-tolerant workstations.

See Chapter 29, "Updating the current plan," on page 587.

Resetting an operation to its previous state

The scheduler retains on the ready list the most recent operation that you set to the previous logical state by using the R row command or the OPSTAT TSO command. You can reset the operation to its previous state only if the status of successor operations has not changed.

Interrupting an operation

The status of an active operation can be set to I (interrupted) automatically if it is active on a workstation that has the splittable attribute. A computer workstation never has this attribute. You might want to interrupt job setup, for example, if you are half-way through editing a job when you have to break for a meeting.

When you interrupt the operation, the resources that the operation uses are freed. While the operation is in interrupted status, its duration is not incremented. There is no limit to the number of times that an operation can be started and interrupted.

If the status of an operation is not S (started), use the MCP panel to set the status to interrupted. For details, see the MODIFYING OPERATIONS IN THE CURRENT PLAN panel shown in Figure 273 on page 619.

Reporting an operation as ended-in-error

The scheduler automatically reports jobs and started tasks that fail with E (ended-in-error) status. You can manually report operations as ended-in-error on any type of workstation. In these circumstances, you must decide what the error status signifies. The advantage of reporting the operation as ended-in-error is that a problem is highlighted. The scheduler puts the operation in the ended-in-error list, which you should review regularly so that error-recovery action can be taken.

Refer to Chapter 21, "Automatic recovery of jobs and started tasks," on page 395 for information on automatic recovery in IBM Workload Scheduler for z/OS.

To manually report an operation as ended-in-error, enter the N-E row command beside the operation. The scheduler then prompts you for an error code. It is good practice to reserve some error codes for specific error situations. Note that this is not valid for fault-tolerant workstations.

Setting the status of a started operation to E (error), or to any other status, does not cancel the job.

Viewing operator instructions

Some operations might require specific instructions on how they are to be handled. These instructions are known as *operator instructions*. You can tell whether instructions exist for an operation by looking at the code in the Oi ready-list field:

N There are no operator instructions.

Y There are operator instructions.

+ Some operator instructions have been changed recently. The default is 30 days, but the definition of "recent" depends on the setting of the NEWOILIMIT keyword of the JTOPTS parameter at your installation. See your administrator for IBM Workload Scheduler for z/OS.

To browse operator instructions, enter the O command beside the operation. The scheduler then displays the instructions using the ISPF/PDF browse function.

Preparing jobs at a setup workstation

A setup workstation is a general workstation used for preparing jobs. In IBM Workload Scheduler for z/OS, the operation of preparing jobs is immediately followed by the operation that runs the job on the computer workstation. If it is not waiting for other conditions to be met, the job can be started as soon as job setup is complete.

When you set the next logical status for an operation at a job setup workstation (with the N row command), IBM Workload Scheduler for z/OS reports the status of the setup operation as S (started). The action that IBM Workload Scheduler for z/OS takes depends on whether it finds promptable variables in the job that have not been resolved.

Note: When you edit the job using the READY LIST or MCP panels, you edit the latest job from the JS file, which is where IBM Workload Scheduler for z/OS places modified jobs. The original job is always left unaltered in the partitioned data set allocated to the ddname EQQJBLIB (JBLIB). To force IBM Workload Scheduler for z/OS to read a fresh copy of the job from JBLIB, delete all the lines and end the edit.

Preparing jobs without unresolved promptable variables

Type the N row command beside the job to edit it and start the setup operation. The scheduler automatically resolves any non-promptable job variables that are defined to be resolved at setup time and then invokes the ISPF editor.

You can edit the job as required in the EDITING JCL FOR AN OPERATION panel (Figure 227 on page 569).

```
EQQRJCLE --------------- EDITING JCL FOR AN OPERATION ----- SUBSTITUTION ERROR
Command ===>                                                 Scroll ===> PAGE

Edit JCL below and press END to complete,  CANCEL to reject and reset,
or  TSAVE to save changes and interrupt the operation.

Application           : APP2              application 2
Operation             : CPU1 050          job 2
Jobname               : JOB2              JCL last updated by: XRAYNER

****** ***************************** TOP OF DATA ****************************
000001 //*%OPC SCAN
000002 //JOB2     JOB  (&ACCT.,NOBO),'SAMPLE',
000003 //      MSGCLASS=&MSGC.,NOTIFY=XRAYNER,CLASS=A
000004 //OUTPUT1  OUTPUT DEST=&DEST.,DEFAULT=YES
000005 //*
000006 //*       PAYMORE PAYROLL SAMPLE
000007 //*       THIS JOB RUNS PAY04 AND PAY06
000008 //*%OPC RECOVER ERRSTEP=PAY04,TIME=&RTIME.,RESTART=YES   1
000009 //*%OPC RECOVER ERRSTEP=PAY06,RESTART=N
000010 //PAY04    EXEC PGM=PAY04
000011 //STEPLIB  DD DSN=&DPT..OPC.LOADLIB,DISP=SHR
000012 //PAYIN    DD DSN=&DPT..CICS.PAYDB,DISP=SHR
000013 //PAYOUT   DD DSN=&DPT..DAY.TRANS,DISP=SHR
000014 //SYSIN    DD *
=NOTE= //*>EQQJ569E 03/13 13.11.31
=NOTE= //*>         INVALID REFERENCE TO DYNAMIC FORMAT VARIABLE AT LINE 00015
=NOTE= //*>         OF ORIG JCL           2
000015 ?01ODAY. ?02CDATE.                 3
000016 /*
```

Figure 227. EQQRJCLE - Editing JCL for an operation

The job in Figure 227 has several errors:

1. The error message **2** refers to the line following (**3**). CDATE is a dynamic-format variable whose format must be specified in a SETFORM directive before being used.
2. When variables are not found, other variables, such as those on the job card, are not substituted either, even though IBM Workload Scheduler for z/OS has found them. You do not see any substituted variables unless IBM Workload Scheduler for z/OS has found them all.
3. The variable on **1** is wrong. You cannot have variables in IBM Workload Scheduler for z/OS RECOVER directive. The scheduler has not pointed out this error because it does not scan recovery statements unless the job fails.

When you have finished editing the job, exit by entering one of the following commands:

- END, which causes IBM Workload Scheduler for z/OS to save the modified or not modified job in the JCL repository, set the status of the setup operation to C (complete), and start the successor operation (the job itself) unless there are other dependencies.
- CANCEL, which causes IBM Workload Scheduler for z/OS to exit without saving the job in the JCL repository. The status of the setup operation is still R (ready).
- TSAVE, which saves your edited job in the JCL repository for later editing and changes the setup operation to status I (interrupted). Use this command if you want to keep your changes and continue editing later.

Preparing jobs with unresolved promptable variables

The scheduler:

1. Scans a job for variables that are not specified as substitute-at-submit variables.

2. Displays all promptable variables on the LIST OF JCL PREPARATION VARIABLES TO BE SET panel (Figure 228) so that you can enter values.

```
EQQRLVAL -------- LIST OF JCL PREPARATION VARIABLES TO BE SET ----  ROW 1 OF 2
Command ===>                                                  Scroll ===> PAGE

Enter/change data in the rows, and/or enter the row command S to display
the Ready List Variable Response Panel.

Application id        : SCRIPT7           An AIX/6000 transfer script
Operation             : CPU7 015
Jobname               : SCRIPT7
EDIT JCL           ===> Y                 Edit the tailored JCL: Y ,or N

Row Variable Variable             Variable
cmd name     description          value
'   PROMPT1  Line 1 of data       greetings  ____________________________
'   PROMPT2  Line 2 of data       from AIX/6000   ____________________
****************************** BOTTOM OF DATA ********************************
```

Figure 228. EQQRLVAL - List of JCL preparation variables to be set

3. Ends when you enter one of these commands:
   - CANCEL. The scheduler skips variable substitution and does not save the job.
   - END, which causes IBM Workload Scheduler for z/OS to:
     a. Validate all promptable variable values
     b. Substitute promptable variables in the job
     c. Substitute all non-promptable variables
     d. Store the job in the JCL repository.

If errors are found, a message is displayed on the variable list panel.

If you specify that you want to edit the job on the LIST OF JCL PREPARATION VARIABLES TO BE SET panel, IBM Workload Scheduler for z/OS invokes the ISPF edit function when you enter the END command and displays the EDITING JCL FOR AN OPERATION\ panel (Figure 229 on page 571).

```
EQQRJCLE --------------- EDITING JCL FOR AN OPERATION -------------------------
Command ===>                                                Scroll ===> CSR

Edit JCL below and press END to complete,  CANCEL to reject and reset,
or  TSAVE to save changes and interrupt the operation.

Application           : SCRIPT7           An AIX/6000 transfer script
Operation             : CPU7 015
Jobname               : SCRIPT7           JCL last updated by: XRAYNER

# Create a data file
echo 'greetings    '  > $jclfile
echo 'from AIX/6000' >> $jclfile

# Create a file to send
echo 'open SYSTEM'    > $ftpfile
echo 'site file=jes' >> $ftpfile
echo 'site lrecl=80' >> $ftpfile
echo "put $jclfile"  >> $ftpfile

# Invoke FTP to send the file
ftp  < $ftpfile
rm $jclfile

# Invoke command and save return code
$command
src=$?
if [ "$src" -eq 0 ]
  then status=C
  else status=E
fi
```

Figure 229. EQQRJCLE - Editing JCL for an operation

After you have modified the job, the END command saves the job in the JCL repository, and you exit from ISPF edit. If you enter the CANCEL command, you do not cancel the variable values set because they are already stored in the JCL repository.

If the setup operation is for several processor operations (all with the same job name), IBM Workload Scheduler for z/OS displays a list of the operations that you can choose from.

Note: The standard ISPF edit SAVE command has no effect when you are editing a job within IBM Workload Scheduler for z/OS.

Other ways of editing a job

About this task

There are several ways to do job setup using the panels:

- Select the JOB SETUP option from the COMMUNICATING WITH WORK STATIONS panel. You see a selection list that presents a list of operations eligible for setup. Enter J next to one of the operations. This puts you into ISPF edit on the job for that operation. Change the job and press PF3. The changed job is stored in the JCL repository, and the operation is automatically set to C status (complete).

  Note: You can change any job from the JOB SETUP option, even if the operation does not have a job setup operation associated with it. The changed job is stored in the JCL repository as usual. Because there is no setup *operation* associated with this activity that can be marked as complete, this editing procedure has no effect on the schedule in IBM Workload Scheduler for z/OS.

- Use the MCP panel to edit the job for any operation in the current plan. See "Modifying operations" on page 618.
- Set up the job for an individual occurrence in the LONG TERM PLAN panel. The edited job for the future occurrence is stored in the JCL repository.

Delaying an operation, and releasing it

Sometimes you must delay the start of an operation because of a situation beyond your control. For example, the application programmer is manually editing some production files to incorporate an urgent program fix. In such situations, when the operations concerned are already in the current plan and waiting only for a certain time or for predecessors to be complete, you must do something to stop the operation from being started when the scheduling criteria are satisfied. You can:

- Manually HOLD the operation by using the MCP panel, or the ready list if the operation predecessors are already complete.
- Modify the job to include a deliberate error; for example, a comma at the end of the job card for a z/OS job. The job is submitted when all the scheduling criteria are met but does not actually execute until the syntax error is corrected.
- Modify the occurrence to include an extra operation on a general workstation, which becomes a predecessor for the operation you need to delay.

The manual HOLD command, MH, can be issued for an operation on a computer workstation with automatic reporting or on any workstation with no reporting, if the current status of the operation is A, R, *, W, C, or E. The scheduler does not start any operation that has been manually placed in HOLD by a panel user, even though the status of the operation will change when the operation start criteria make the operation eligible to be started. If the operation that was manually placed in HOLD is a time-dependent, suppress-if-late operation, its submission is delayed until the suppress time is reached. When the suppress time has expired, the action set by the SUPPRESSACTION keyword is taken, even if the operation is still manually held. All operations that have been manually placed on HOLD are identified by the extended status code H.

When you no longer want the operation held, you can issue the RELEASE command, MR, and the operation extended status code changes to reflect the current situation. If all start criteria for this operation are met, the operation can start immediately.

If you need to HOLD or RELEASE an operation that is not on the ready list, you can use the MCP panel. See "Modifying operations" on page 618 for more details. These commands can also be entered from the ended-in-error list.

You cannot invoke the next logical status row command against an operation that has been manually held, but you can set a specific status. This does not alter the HOLD indication.

The MH command gives the operation the HOLD property. To remove this property from the operation, use the MR command. Neither the MH command nor the MR command changes the status of an operation directly. A HOLD operation is not automatically scheduled for processing.

Note: You can set the Manually Hold option for an operation directly in the Application Description database, or you can associate the Manually Hold option

with a specific run cycle. When the operation is added to the current plan, either dynamically or not dynamically, the Manually Hold value takes the following value in the following order:

1. The value set in the associated run cycle, if applicable.
2. The value set in the Application Description database.
3. The value overwritten by the user when the operation is added to the CP (from the ISPF panel).

Removing an operation from the current plan and restoring it

If you need to remove an operation (NOP) that is already in the current plan, enter the NP command beside the row in the ready list. NP can be issued for any operation on the ready list that has status A, R, *, W, or (for computer workstations with automatic reporting only) C.

The scheduler processes status changes for NOP operations until they reach a status of A, R, or * (ready). The scheduler ignores time dependency, use of special resources, and other constraints. When a NOP operation reaches the ready status A, R, or *, IBM Workload Scheduler for z/OS immediately sets the operation to status C; the operation is not submitted, and successor operations are eligible to start. NOP operations are identified by the N extended status code.

Attention: Make sure that successor operations in a dependency chain are removed (NOP) before their predecessor operation. This prevents the successor operations from starting when you remove (NOP) their predecessor.

If you want to restore the operation, use the UN command. The UN command does not affect the status of the operation. It merely removes its NOP characteristics. The operation can be treated as any normal operation on the ready list.

The NP command gives to the operation the property NOP. This property can be removed from the operation by the UN command only. Neither the NP command nor the UN command changes the status of an operation directly. A NOP operation is automatically changed to completed status when it reaches ready status, regardless of whether other constraints are met.

Note: The EXECUTE command starts an operation even if it is NOP. See “Running an operation immediately with EXECUTE” on page 574.

Use the MCP panel for an operation that is not on the ready list. See “Modifying operations” on page 618 for more details.

The NP and UN commands can be issued also on operations defined on fault-tolerant workstations, but the result of the commands is different depending on whether the operation has the centralized script option or not. When the centralized script option is used, the NP and UN commands have the same effect they have on operations defined on computer automatic workstations. When the centralized option is not used, the commands result in setting the CANCEL PENDING option in the Symphony file for the related job. Then the job is cancelled locally when the usual conditions are satisfied and consequently the related operation is completed in the current plan. It is also possible for the operations that are handled in the distributed environment to respond differently than usual on time dependencies: if the keyword NOPTIMEDEPENDENCY(YES) is specified in the TOPOLOGY options when the Symphony is created through the daily planning jobs, the jobs are cancelled only after the time dependencies are

locally satisfied. In order to successfully execute the NP and UN commands on an operation that is defined on a fault-tolerant workstation and that does not use the centralized script option, the workstation should be linked.

Note: You can set the NOP option for an operation directly in the Application Description database, or you can associate the NOP option with a specific run cycle. When the operation is added to the current plan, either dynamically or not dynamically, the NOP option takes the following value in the following order:

1. The value set in the associated run cycle, if applicable.
2. The value set in the Application Description database.
3. The value overwritten by the user when the operation is added to the CP (from the ISPF panel).

Running an operation immediately with EXECUTE

The EXECUTE command overrides normal scheduling rules *except* dependencies. You can use the EXECUTE command when:

- An operation is waiting for a resource that is not actually required.
- You want only one job to be submitted through IBM Workload Scheduler for z/OS.
- Automatic job submission is not active for all operations.
- A planned shutdown of a workstation is in progress and an operation is not submitted by IBM Workload Scheduler for z/OS because the job cannot finish in time.

The EXECUTE command, EX, can be issued for an operation on a computer workstation with automatic reporting if the status of the operation is A, *, or R. The EXECUTE command causes IBM Workload Scheduler for z/OS to start the operation without regard to normal scheduling criteria. An operation that you EXECUTE will be started even when:

- Job submission is not active.
- Job options for the operation do not specify automatic submit.
- Time dependency for the operation is not satisfied.
- Required resources are not available.
- The operation has H (manual hold) extended status. It remains in held status.
- The operation has N (NOP) extended status. It remains in NOP status.

In order to successfully execute the EX command on an operation that is defined on a fault-tolerant workstation and that does not use the centralized script option, the workstation should be linked. Moreover, for these operations the EXECUTE command works only if the job is in a consistent status (i.e. not in execution or cancelled) at the time it is received by the appropriate fault-tolerant agent. Otherwise, it is discarded.

Note: If the workstation the operation is defined to is not active and there is no active alternate workstation connected, or the operation is not re-routable, the EXECUTE command is rejected and the operation status is not changed.

You can also request EXECUTE from the MCP panel. See “Modifying operations” on page 618 for more details.

Diagnosing delays

Sometimes you need to run a specific operation in the plan immediately or you need to know why a certain job is not started. Here are some reasons why a computer workstation operation might not be started:

- The workstation is not open.
- Predecessors are not complete.
- No parallel server is available.
- The workstation is offline or has failed and no rerouting is in effect.
- The workstation is active but not connected.
- Not enough workstation resources are available.
- Not all the required special resources are available.
- The operation is waiting for a specific time of day.
- The operation has been manually held.
- The automatic-job-submission option is set to NO for the operation.
- There was an error during job submission.
- The operation is waiting for manual cleanup.
- Restart and cleanup is in progress.
- The scheduling environment is not available

Many of these reasons are indicated by a unique extended status code. For example, operations that are waiting until a particular time of day will have T extended status code. If you are not familiar with the code or if there is no code, request additional information about the operation by entering row command I. See Appendix E, “Status, error, and reason codes,” on page 837 for a full list of error codes.

The SELECTNG APPLICATION OCCURRENCE AND OPERATION INFORMATION panel in Figure 230 shows an operation that is ready but cannot be submitted because job submission is deactivated (**1**).

```
EQQSOPSP  SELECTING APPLICATION OCCURRENCE AND OPERATION INFORMATION ----
Option ===>
Select one of the following:
 1 APPLICATION      - Detailed application occurrence information
 2 OPERATION        - Detailed operation information
 3 OPERATION LIST   - Operations of the application occurrence
 4 DEPENDENCIES     - Immediate predecessor and successor information
 5 RESOURCES        - List of resources used by the operation
 6 JCL              - Browse the JCL
 7 OPERATOR INSTR   - Operator instructions
 8 EXTERNAL DEPS    - Immediate external dependencies of the occurrence
 9 ALL DEPS         - All dependencies of this operation
10 CLEANUP OPTIONS  - Cleanup options
11 EXTENDED INFO    - Operation extended info
12 AUTOMATION INFO  - System automation operation info
13 USER FIELDS      - User fields operation info
14 REMOTE JOB INFO  - Detailed information about remote job
15 STEP LIST        - List of job steps

Application           : PAYW              weekly payroll jobs
Operation             : CPU1 020          pay07, pay10, and pay16
Jobname and Jobid     : PAYWEEK
Status of operation   : Ready             Job submission is deactivated 1
 on Work Station      :
Priority of operation : 5
Planned input arrival: 13/03/02 12.00    Actual input arrival: 13/03/02 20.22
```

Figure 230. EQQSOPSP - Selecting application occurrence and operation information

The ALL DEPS option can be particularly helpful. You can use this function to find out what outstanding predecessors remain before an operation will start and to see the impact of its being late or failing.

Resetting bind information for a shadow job

When you define a cross dependency between a job running in your environment and a job running on a different IBM Workload Scheduler engine, the bind process associates the shadow job to the remote job instance. In the READY LIST panel, with the BND command you can reset the information collected about the remote job and thus make the shadow job eligible for a new bind process.

The BND command can be issued only for shadow jobs in Ready status.

The QCP panel

The QUERY CURRENT PLAN (QCP) panel provides answers to your production status queries. You can request detailed or summary information on individual applications, operations, or workstations, and summary information concerning all the operations. The QCP panel looks at the current plan, which is continuously updated as the operations are processed. You can use the QCP panel to:

- Determine why an operation has not been started.
- Provide status information.
- Display a list of operations that have ended-in-error.
- Decide if intervention is required to speed up the processing of specific applications. You can display the applications that are most critical and those that have missed, or are close to missing, the defined deadline.
- Check information before making modifications to the current plan.
- Display a list of *all* dependencies for an operation. This function is of particular benefit to quickly identify which outstanding predecessors are not completed. The scheduler displays up to 999 levels of dependencies.
- Determine the impact of an operation that has ended in error.

You can reach the QCP panel from anywhere in IBM Workload Scheduler for z/OS panels by entering =6 at the command prompt. This takes you to the QCP menu, displayed in Figure 231. However, you can invoke QCP functions from many places in IBM Workload Scheduler for z/OS. For example, if you enter row command I from the ready list, the QCP panel SELECTING APPLICATION OCCURRENCE AND OPERATION INFORMATION is displayed. This can save time because you do not need to leave an area of the panel to get information.

```
EQQSTOPP -------------- CURRENT PLAN AND STATUS INQUIRY --------------------
Option ===>

Select one of the following:

1 APPLICATIONS    - Query application occurrences
2 MOST CRITICAL   - Query most critical uncompleted application occurrences

3 OPERATIONS      - Query operations (jobs)
4 ENDED IN ERROR  - Query operations ended in error

5 WORK STATIONS   - Query work station activities

6 GENERAL         - Query general information about current plan

7 CRITICAL JOBS   - Query active critical jobs and their critical paths
```

Figure 231. EQQSTOPP - Current plan and status inquiry

The options available from this menu are described in the following sections.

Querying application occurrences

When you select option 1 (APPLICATIONS), IBM Workload Scheduler for z/OS displays a filtering panel where you can specify the selection criteria that determines the applications displayed. For example, you can list only those applications that are not complete, or applications added by the ETT function. If the selection fields are left blank, all application occurrences in the plan in status W, S, C, E, or U will be displayed. Deleted applications are displayed only when you specifically request applications in D status.

If you request additional information by using the S row command, you see the panel in Figure 232:

```
EQQSAOSP ------- SELECTING APPLICATION OCCURRENCE INFORMATION -----------------
Option ===>

Select one of the following:

1 APPLICATION     - Detailed information
2 OPERATION LIST  - Operations of the application occurrence
3 EXTERNAL DEPS   - External dependencies of the occurrence

Application           : EID4D1            Extend EID4 CP by 24hrs.
Owner                 : EID               External Interface Dev.
Status                : Started
Priority              : 5
Variable table        :
Calendar name         :
Occurrence token      :

Input arrival time:
 Planned              : 03/05/26 07.00
 Actual               : 03/05/26 07.01

Group Definition      : DAILYOPC
```

Figure 232. EQQSAOSP - Selecting application occurrence information

From this panel you can request detailed information about the occurrence, the operations defined in the occurrence, or the external dependencies established with the occurrence.

From the CURRENT PLAN AND STATUS INQUIRY panel, select option 2 MOST CRITICAL to display a list of uncompleted occurrences sorted by the latest start time.

The latest start time is the latest time that the operation can start in order to meet the deadline. This calculation considers the operation deadline, estimated duration, resource requirements, and successor processing. When IBM Workload Scheduler for z/OS creates the current plan, it calculates the latest start time for all the operations in a chain of dependencies, starting with the last one.

The occurrences that missed or will miss the defined deadline time are at the top of the list, as shown in Figure 233 on page 578.

```
EQQSMC1L ------ BROWSING MOST CRITICAL OCCURRENCES (left part) ROW 1 TO 8 OF 8
Command ===>                                                  Scroll ===> PAGE

Enter the GRAPH command above to view occurrences graphically or
scroll right or enter the row command S to select an occurrence for details.

Row  L  Application                              S P First critical oper
cmd     id              text                        ws   no. stat latest start
''     JOB8            test var dep             E 7 CPU1 020   E    08 23.55
''     APP6            test variable dep        W 7 SETP 005   A    08 23.56
''     APP1            application 1            W 7 SETP 030   A    09 00.05
''     APP1            application 1            W 7 SETP 030   A    09 00.06
''     APP1            application 1            W 7 SETP 030   A    09 00.25
''     CP              current plan             W 7 CPU1 050   A    09 13.00
''     PAYDAILY        daily payroll jobs       W 5 WTO1 005   A    09 15.51
''     PAYBACKP        backup payroll database  W 5 CPU1 015   W    10 05.54
****************************** BOTTOM OF DATA ********************************
```

Figure 233. EQQSMC1L - Browsing most critical occurrences

You can scroll the list displayed by IBM Workload Scheduler for z/OS from left to right. You can switch between them by entering the left/right scroll commands.

If the workstation name contains **** and the displayed job name contains ******** when you scroll right, the critical path in the occurrence is complete but uncompleted operations still exist. A new critical path is calculated for this occurrence if it is still uncompleted when the next daily plan extend or replan is run.

The shift supervisor and IBM Workload Scheduler for z/OS administrator often use this list to measure how well the production work is progressing relative to the agreed service levels.

Querying operation information

When you are viewing a list of operations, you can request detailed information about a particular operation by typing S in the row command column next to the operation. This takes you to the SELECTING APPLICATION OCCURRENCE AND OPERATION INFORMATION panel. You can reach the panel from the MCP, QCP, or workstation communication panels, from anywhere that a list of operations can be displayed. The panel is shown in Figure 234 on page 579:

```
EQQSOPSP  SELECTING APPLICATION OCCURRENCE AND OPERATION INFORMATION ----------
Option ===>

Select one of the following:

 1 APPLICATION      - Detailed application occurrence information
 2 OPERATION        - Detailed operation information
 3 OPERATION LIST   - Operations of the application occurrence
 4 DEPENDENCIES     - Immediate predecessor and successor information
 5 RESOURCES        - List of resources used by the operation
 6 JCL              - Browse the JCL
 7 OPERATOR INSTR   - Operator instructions
 8 EXTERNAL DEPS    - Immediate external dependencies of the occurrence
 9 ALL DEPS         - All dependencies of this operation
10 CLEANUP OPTIONS  - Cleanup options
11 EXTENDED INFO    - Operation extended info
12 AUTOMATION INFO  - System automation operation info
13 USER FIELDS      - User fields operation info
14 REMOTE JOB INFO  - Detailed information about remote job
15 STEP LIST        - List of job steps

Application           : BACKUP1           Backup transaction db
Operation             : CPU1 005
Jobname and Jobid     : SAMPLEA           JOB05293
Status of operation   : Ended in error    JCL  Also auto recovery error
 on Work Station      :
Priority of operation : 9
Planned input arrival: 13/05/21 00.00  Actual input arrival: 13/05/29 06.28
```

Figure 234. EQQSOPSP - Selecting application occurrence and operation information

The 9 ALL DEPS option shows the dependencies of an operation and helps you determine the impact of late or failed processing.

When selecting a dependency type, you can also customize nesting level and detail for the output list. You can display up to 999 levels of dependencies. The nesting detail level can be:

ALL Show the higher nesting level.

NONE
Show the first nesting level found when exploring the dependency network.

You can display up to 999 levels of dependencies. By customizing nesting level and detail, you can balance proper response time and usability.

After you specify your selection, the panel shown in Figure 235 on page 580 is displayed.

```
EQQSPG1L ------- ALL DEPENDENCIES OF AN OPERATION (left part)  ROW 1 TO 4 OF 4
Command ===>                                                  Scroll ===> PAGE

Enter the GRAPH command above to view operations graphically or
scroll right or enter the row command S to select an operation for details.

Application           : PAYDAILY         daily payroll jobs
Operation             : WTO1 5           PAYX CLOSE DATASET
Jobname               : PAYDAILY

Row Lev Ty Operation                         Jobname   Application id   Status
cmd        ws   no. text
''  1   S  SETP 010 Job setup for paydaily   PAYDAILY  PAYDAILY           C
''  2   S  CPU1 020 Runs pay04 and pay06     PAYDAILY  PAYDAILY           E
''  3   S  CPU1 015 Daily payroll backup     PAYBACKP  PAYBACKP           W
''  4   S  WTO1 030 PAYX OPEN DATASET        PAYBACKP  PAYBACKP           W
''  5   SC CPU1 035 Print job                PAYPRINT  PAYDAILY           W
****************************** BOTTOM OF DATA ********************************
```

Figure 235. EQQSPG1L - All dependencies of an operation (left part)

In the list displayed in Figure 235, the immediate predecessor is defined at level 1 (1 in the LEV column) and the subsequent predecessors at level 2.

The list shown in EQQSPG1L panel is ordered by:

First sort key: LEV
: The nesting level of the dependent operation

Second sort key: TY
: The dependency type

Third sort key: APPLICATION ID
: The application name

Fourth sort key: OPERATION NO
: The operation number

Checking the status of a workstation

Select option 5 WORK STATIONS to display a list of the workstations that includes the current status and reporting attribute. When you request additional summary information with the row command S, the statuses of operations at the workstation are displayed.

```
EQQSWSSP ----- BROWSING SUMMARY OF ACTIVITIES AT A WORK STATION ---------------

Work station          : CPU1             Computer Automatic
Type                  : Computer         JOB ability
Reporting form        : Automatic reporting
Work Station status   : Active
Work Station link     : Linked           Command link sent

Current Plan created  : 02/07/11 07.04
End of planning period: 02/07/11 23.25

                            Number          Duration
Operations:                              estimated   actual
 Completed, C         :         2         0.40       0.00
 Interrupted, I       :         0         0.00       0.00
 Started, S           :         0         0.00
 Ready,  R * and A    :        10         1.14
 Waiting, W           :        62         1.24


Command ===>
```

Figure 236. EQQSWSSP - Browsing summary of activities at a workstation

The estimated duration is the total planned duration (HH.MM) of the operations in that status. For status W, note that the estimated duration is the time that the waiting operations are expected to run once they are started, it does not include the waiting time.

From the BROWSING WORKSTATION ACTIVITY panel, you can browse the system information for the destination of a computer workstation by entering the row command I. However, a *non-local* workstation can be browsed only if it communicates through XCF, NCF, TCP/IP, or the submit/release data set.

Checking the status of the current plan

Option 6 GENERAL provides details about the current plan, such as the following:

- Creation date and time
- End date and time
- When the last current plan backup was taken
- When the first event was written to the job-tracking-event log since the latest backup of the current plan
- If a new current plan is being produced
- If a new current plan has been produced and is being brought into production
- The run number, processing status, and availability for the Symphony file
- The ddname of the following resources:
  - Current plan
  - Job-tracking-event log
  - JCL repository
  - The current MLOG data set in use

The panel is shown in Figure 237.

```
EQQSGCPP --------- BROWSING GENERAL CURRENT PLAN INFORMATION ---------------
Command ===>

Current plan created     : 18/04/03 10.47
Planning period end      : 19/04/03 23.00


Backup information:
 Last CP backup          : 18/04/03 10.48
 First logged event
  after backup           : 18/04/03 10.49   Time stamp:   0003108F 08460341


Daily planning status:
 Under production        : No
 NCP ready               : No

Symphony status:           NOT AVAILABLE
 Symphony run number     :
 Under production        :
 New Symphony ready      :


In use ddname of:
 Current plan            : EQQCP1DS
 Job-tracking log        : EQQJT03
 JCL repository          : EQQJS1DS
 Current MLOG            : EQQMLOG2
```

Figure 237. EQQSGCPP - Browsing general current plan information

CRITICAL JOBS

Select option 7 CRITICAL JOBS to display the list of jobs in the current plan that are defined as targets of critical paths. The SELECTING CRITICAL JOBS (EQQSOCJF) panel is displayed for you to specify the filter criteria for the list. After making your selections, press Enter to display the BROWSING CRITICAL JOB panel.

```
EQQSCJOB ---------------- BROWSING CRITICAL JOBS ------------- Row 1 to 6 of 6

Command ===>                                                  Scroll ===> CSR

Enter any of the row commands below
 S - critical path             H - critical hot list
Press ENTER to refresh.

Row  Application id   Operation Jobname  Input Arrival   Deadline        RL  S  R
cmd                   ws   no.           Date     Time   Date     Time
'''' CRITPATH01       CPU1 012  TESTJOB  08/07/27 12.00  08/07/27 12.00  N   W  P
'''' CRITPATH02       CPU1 016  TESTJOB  08/07/27 12.00  08/07/27 12.00  N   W  P
'''' CRITPATH03       CPU1 011  IEFBR14  08/07/27 10.40  08/07/27 12.00  N   W  P
'''' CRITPATH03       CPU1 012  IEFBR14  08/07/27 10.40  08/07/27 12.00  N   W  P
'''' CRITPATH05       CPU1 011  TESTJOB  08/07/27 10.40  08/07/27 12.00  N   W  P
'''' CRITPATH06       CPU1 012  IEFBR14  08/07/27 10.40  08/07/27 12.00  N   W  P
******************************** Bottom of data ********************************
```

Figure 238. EQQSCJOB - Browsing critical jobs

The Risk Level (RL) field can have one of the following values:

H High risk. According to the current estimated end time or to the value specified for JTOPTS(RISKCONFIDENCE), if any, the job will not complete by the defined deadline. For example, the estimated end time is later than the deadline or the confidence value is lower than the value set for the JTOPTS(RISKCONFIDENCE).

When JTOPTS(RISKCONFIDENCE) is specified, the only condition that causes the high risk level for a critical job is that the confidence value gets lower than the RISKCONFIDENCE value.

P Potential risk. One or more of the critical job predecessors are late, long running, or ended in error.

N None. No problem was detected in the network of the critical job predecessors.

The Recalculation (R) field shows the cause of the recalculation; it can have one of the following values:

C Job on critical path, completed or removed for the hot list

D Dynamic updates to the plan

L Late job

P Daily planning

Enter the right scroll command to scroll the list right:

```
EQQSCJO1 ------- BROWSING ACTIVE CRITICAL JOBS (right part) ----- Row 1 to 3 of 3

Command ===>                                                  Scroll ===> CSR

Enter any of the row commands below:
 S - critical path             H - critical hot list
Press ENTER to refresh.

Row  Operat     Jobname      Estimated End    Last Update     Op   Predecessors
cmd  ws    no.               Date      Time   Date      Time  H N  Late Long
Error
'''' CPU1  001  JOBLOO1      08/01/10  12.48                  N N   0    0     0
'''' CPU1  001  JOBLOO1      08/01/10  00.30                  N N   0    0     0
'''' CPU1  001  JOBLOO1      08/01/10  12.48                  N N   0    0     0
******************************** Bottom of data ********************************
```

Figure 239. EQQSCJO1 - Browsing active critical jobs (right part)

Enter the S row command to display the list of jobs belonging to the critical path for the target you selected. The BROWSING CRITICAL PATH panel is displayed:

```
EQQSCPL1 ----------- BROWSING CRITICAL PATH (left part) -------- Row 1 to 5 of 5

Command ===>                                                  Scroll ===> CSR

Application           :   CRITPATH06
Operation             :   CPU1 12
WLM Class and Policy  :   WLMCLS1  Deadline

Enter the row command S to select an operation for details.
Press ENTER to refresh.

Row  Application id   Operation Jobname  Promot Flags  S P Latest     Input
cmd                   ws   no.           U W    L R        start      arrival
'''' CRITPATH04       CPU1 001  JOBLOO1  N N    N N    U 8  18 00.29   08 00.30
'''' CRITPATH04       CPU1 004  JOBLOO1  N N    N N    W 8  18 00.29   08 00.30
'''' CRITPATH06       CPU1 007  JOBLOO1  N N    N N    W 8  18 00.29   08 00.30
'''' CRITPATH06       CPU1 010  JOBLOO1  N N    N N    W 8  18 00.29   08 00.30
'''' CRITPATH06       CPU1 012  JOBLOO1  N N    N N    W 8  18 00.29   08 00.30
******************************** Bottom of data ********************************
```

Figure 240. EQQSCPL1 - Browsing critical path (left part)

You can scroll the list left and right by entering the left and right scroll commands, respectively.

For a critical job with high or potential risk, you can display a list of the critical job predecessors that are late, long running, or ended with an error, by entering the critical hot list command on the BROWSING CRITICAL JOBS panel.

A business scenario

This scenario shows how an operator can monitor the jobs that are critical for the customer's business and that must complete by their deadline.

The operator uses the product dialog to meet a Service Level Agreement (SLA) that requires a DB2 database up and running each day by 3 PM, after the database backup.

He needs to be informed whether critical jobs risk missing their deadline, to take the appropriate actions if needed. While the plan is running, the operator expects that the scheduler dynamically controls the network of submitted jobs, detecting when a critical job predecessor is late, long running or ended with an error.

Roles

In this scenario, the scheduling administrator and operator are involved:

Scheduling administrator
When planning the operations, he defines:

- Input arrival, duration, and deadline times
- Critical jobs

Operator
Controls the submitted workload by using CRITICAL JOBS and CRITICAL HOT lists.

Setting up the environment

About this task

Plan and schedule your operations:

1. Mark your critical jobs in the z/OS database. The deadline of a critical job should not be later than the deadline of the application to which the job belongs. If this is not the case, message EQQA124I `SPECIFIED OP DEADLINE LATER THAN APPLICATION DEADLINE` is issued, along with the short message `TIME INCONSISTENT`.

   Set DBSTART and DBPRINT as critical jobs, using a job network with the following structure:

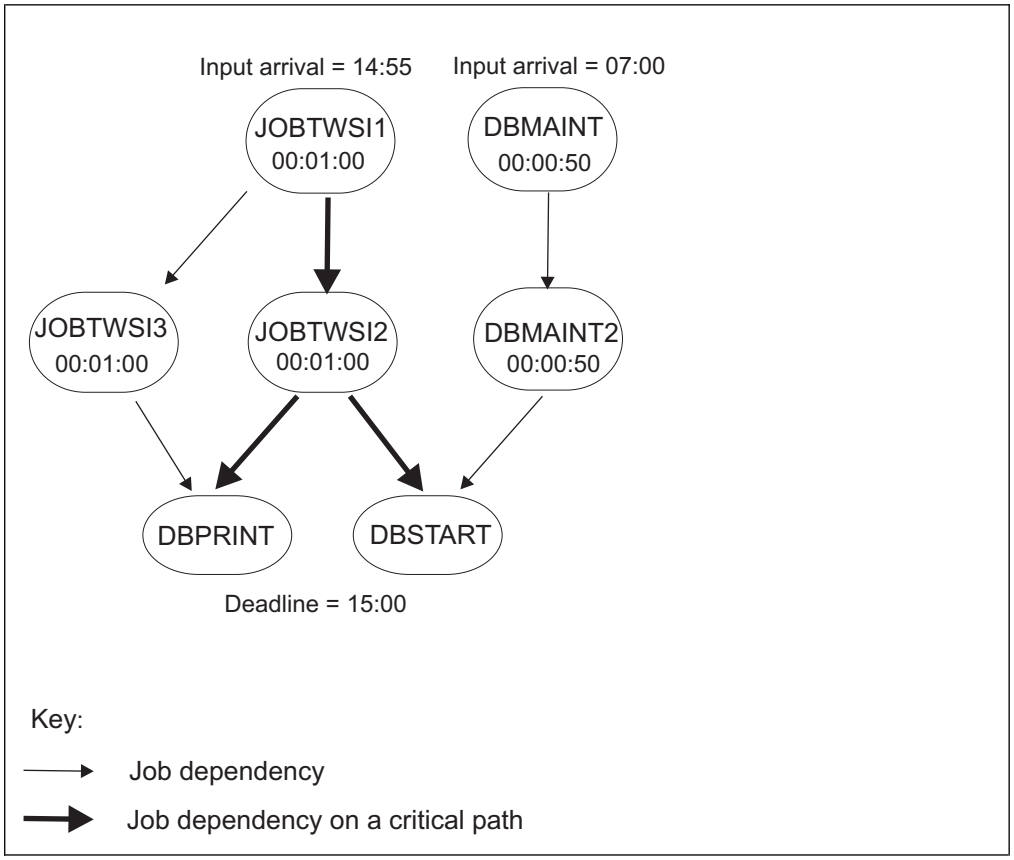


Figure 241. Example of a job network with critical operations

2. Run a daily planning job. The daily planning process calculates the critical paths in your job network, using the deadline, input arrival, and duration settings.

Running the scenario

About this task

After you updated your current plan, you can monitor your critical workload by using the QCP dialog:

1. 1. Select the CRITICAL JOB option. The following list is displayed, showing that the Risk Level (RL) for the DBSTART job is Potential risk:

```
EQQSCJOB ------------ BROWSING CRITICAL JOBS (left part) ---- Row 1 to 2 of 2

Command ===>                                                 Scroll ===> CSR

Enter any of the row commands below
 S - critical path             H - critical hot list
Press ENTER to refresh.

Row  Application id   Operation Jobname  Input Arrival   Deadline        RL  S  R
cmd                   ws   no.           Date     Time   Date     Time
'''' DBAPPL1          CPU1 003  DBPRINT  08/02/15 14.55  08/02/15 15.00  N   W  P
'''' DBAPPL1          CPU1 004  DBSTART  08/02/15 14.55  08/02/15 15.00  P   W  P
******************************** Bottom of data ********************************
```

Figure 242. EQQSCJOB - Browsing critical jobs

2. Select the DBSTART job and enter the critical hot list (H) row command. The displayed panel shows that the L column is set to Y in the Flags field, meaning that DBMAINT is a late job:

```
EQQSCP1L ------- BROWSING CRITICAL HOT LIST (left part) --- Row 1 to 1 of 1

Command ===>                                                  Scroll ===> CSR
Application           :  DBAPPL1
Operation             :  CPU1 4
WLM Class and Policy  :

Enter the row command S to select an operation for details.
Press ENTER to refresh.

cmd                   ws    no.           U W    L R         start     arrival
'''' DBAPPL2          CPU2  001 DBMAINT   N N    Y N     A 5  15 06.58  15 06.00
****************************** Bottom of data ********************************
```

Figure 243. EQQSCP1L - Browsing critical hot list (left part)

3. Check the status of the CPU2 workstation. It is offline.
4. Activate the workstation. The DBMAINT job starts to run.
5. Return to the BROWSING ACTIVE CRITICAL JOBS panel. The refreshed list shows that the Risk Level (RL) for the DBSTART job is now No risk.

```
EQQSCJOB ----- BROWSING ACTIVE CRITICAL JOBS (left part)--- Row 1 to 2 of 2
 Command ===>                                                Scroll ===> CSR

 Enter any of the row commands below:
  S  - critical path            H  - critical hot list
 Press ENTER to refresh.

 Row  Application id   Operation  Jobname  Input Arrival  Deadline       RL S R
 cmd                   ws     no.          Date     Time  Date     Time
 '''' DBAPPL1          CPU1   003 DBPRINT  08/02/15 14.55 08/02/15 15.00 N  W P
 '''' DBAPPL1          CPU1   004 DBSTART  08/02/15 14.55 08/02/15 15.00 N  W P
 ****************************** Bottom of data ********************************
```

Figure 244. EQQSCJOB - Browsing active critical jobs (left part)

Chapter 29. Updating the current plan

This chapter describes the MODIFYING CURRENT PLAN (MCP) panel, which is the most important tool for operators controlling the daily processing of IBM Workload Scheduler for z/OS.

The scheduler schedules work according to the current plan, which is created from information in IBM Workload Scheduler for z/OS databases. However, unplanned situations that require one-time changes to schedules constantly arise.

Situations that might require changes in plans are the following:
- Hardware failures
- Urgent hardware maintenance
- Last-minute changes to business schedules
- Business system reruns
- Unplanned jobs that must run immediately
- A change in work priorities
- Jobs that fail
- Data that arrives late
- Operations that run longer than planned

If you are new to IBM Workload Scheduler for z/OS, read this chapter as a guide to the MODIFYING CURRENT PLAN panel. If you are already familiar with IBM Workload Scheduler for z/OS, use Table 40 to find the information you need quickly.

The history function lets you rerun completed operations that are no longer in the current plan. "Rerunning operations in the history database" on page 620 describes how to use the history function.

Two options in the MODIFYING CURRENT PLAN panel are large enough to need separate chapters:
- Chapter 30, "Handling operations that end in error," on page 637 describes the error list, which you use to handle failed operations.
- Chapter 31, "Monitoring special resources," on page 647 describes the Special Resource Monitor, which you use to change the status of resources and the allocation of resources.

You can manage most situations using the MODIFYING CURRENT PLAN panel, but you can also perform some actions from the READY LIST, which is described in Chapter 28, "Monitoring the workload," on page 559.

Note: You can edit jobs with the modify current plan panel (for example, using option 6), but you must perform job setup operations from the READY LIST.

Table 40. Using the MODIFYING CURRENT PLAN panel

If you need to ...	Use fast path	See page
Diagnose delays	4.1 or 6.3	"Diagnosing delays" on page 575 or "Querying operation information" on page 578

Table 40. Using the MODIFYING CURRENT PLAN panel (continued)

If you need to ...	Use fast path	See page
View the job log	5.2 or 5.4	"Rerunning an occurrence in the current plan from a specific operation" on page 603 or "Restarting ended-in-error operations managing cleanup action" on page 641
Run work on request	5.1	"Running work on request" on page 590
Restart an application occurrence from the beginning	5.2	"Restarting an occurrence from the beginning" on page 602
Rerun an occurrence from a specific operation	5.2	"Rerunning an occurrence in the current plan from a specific operation" on page 603
Delete an application occurrence	5.2	"Deleting an application occurrence" on page 607
Change external dependencies to an occurrence	5.2	"Changing external dependencies to an occurrence" on page 608
Rerun an operation in the history database	4.1, 5.3, 5.4 or 7	"Rerunning operations in the history database" on page 620
Change dependencies to an operation	5.3 or 5.2	"Changing dependencies to an operation" on page 608 or "Changing and adding dependencies" on page 596
Change the details of an operation	5.3 or 5.2	"Changing the details of an operation" on page 608 or "Modifying operations" on page 618
Set the status of an operation	4.1 or 5.2	"Setting the status of an operation" on page 566 or "Changing the details of an operation" on page 608
Reset an operation to its previous state	4.1	"Resetting an operation to its previous state" on page 567
Interrupt an operation	4.1	"Interrupting an operation" on page 567
Report an operation as ended-in-error	4.1	"Reporting an operation as ended-in-error" on page 567
Prepare jobs at a setup workstation	4.1	"Preparing jobs at a setup workstation" on page 568
Delay an operation, and release it	4.1 or 5.3	"Delaying an operation, and releasing it" on page 572 or "Modifying operations" on page 618
Add and delete operations	5.2 or 5.3	"Adding and deleting operations" on page 610 or "Modifying operations" on page 618
Remove and restore operations with NOP and UNNOP	4.1 or 5.3	"Removing an operation from the current plan and restoring it" on page 573 or "Modifying operations" on page 618
Handle operations that have ended in error	5.4	Chapter 30, "Handling operations that end in error," on page 637

Table 40. Using the MODIFYING CURRENT PLAN panel (continued)

If you need to ...	Use fast path	See page
Complete an ended-in-error operation	5.4	"Completing an ended-in-error operation" on page 640
Modify a job that has failed	5.4	"Modifying a job that has failed" on page 640
Restart an ended-in-error operation	5.4	"Restarting ended-in-error operations managing cleanup action" on page 641
Get rerun or recovery instructions (view operator instructions)	5.4 or 4.1	"Getting rerun or recovery instructions" on page 640 or "Viewing operator instructions" on page 568
Specify automatic restart for operations that fail	5.4	"Specifying automatic restart for operations that fail" on page 645
Recover when automatic restart of an operation fails	5.4	"Specifying automatic restart for operations that fail" on page 645
Control and monitor cleanup and restart	5.4	"Using cleanup options" on page 644
Inform IBM Workload Scheduler for z/OS of unplanned changes in resources	5.5	"Informing the scheduler of unplanned changes in resources" on page 623
Change workstation availability	5.5	"Changing workstation availability" on page 626
Redirect work to an alternate workstation	5.5	"Redirecting work to alternate workstations" on page 628
Keep plans up-to-date	3.1 or 3.2	"Keeping plans up-to-date" on page 624
Maintain special resources	5.7	Chapter 31, "Monitoring special resources," on page 647
Complete an application occurrence	5.2	"Completing an application occurrence" on page 606
Handle operations with the OSEQ error code	5.2	"Handling operations with the OSEQ error code" on page 642
Select an ended-in-error list layout	5.4	"Selecting an ended-in-error list layout" on page 638
Create your own ended-in-error list layout	5.9	"Creating your own ended-in-error list layout" on page 638
Run an operation immediately with EXECUTE	4.1 or 5.3	"Running an operation immediately with EXECUTE" on page 574 or "Modifying operations" on page 618

Using fast paths

Table 40 on page 587 shows the fast path to the correct panel in the MODIFYING CURRENT PLAN panel. For example, if the fast path is 5.1, enter `=5.1` on the command line to reach the panel, which is the same as selecting option 5 (MODIFYING CURRENT PLAN panel) in the main menu and selecting option 1 (ADD) in the MODIFYING CURRENT PLAN panel (Figure 245 on page 590).

You can avoid the filter panel, if there is one, by adding .0; for example, 5.3.0 instead of 5.3. If you do this, IBM Workload Scheduler for z/OS uses the previous filter criteria.

Accessing the Modifying Current Plan panel

To enter the panel, select the MCP option from the main menu, and the panel in Figure 245 is displayed.

```
EQQMTOPP ---------------- MODIFYING THE CURRENT PLAN -------------------------
Option ===>

Select one of the following:

1 ADD             - Add a new occurrence to the current plan
2 LIST            - List existing occurrences for further processing

3 OPERATIONS      - List existing operations for further processing
4 ERROR HANDLING  - Handle operations in error
5 WORK STATIONS   - Change status and open interval of work stations

6 JOB SETUP       - Prepare JCL for jobs in the current plan

7 SPECRES         - Special resource monitor

9 DEFINE EL       - Define alternative error list layouts
```

Figure 245. EQQMTOPP - Modifying the current plan

Specifying selection criteria

When you select an option from the main menu, you might see a panel where you can specify selection criteria to reduce the number of entries in the list. The selection criteria is saved between sessions, so you can bypass the panel (for example, by specifying 2.0 instead of 2 for the LIST panel) if you do not need to change the criteria.

Running work on request

You can add work to the plan on request using the MODIFYING CURRENT PLAN panel. Before you can add an application occurrence to the plan, however, a description of the application must exist in the application description database.

If your installation frequently adds work to the plan that does not have an application description defined for it, consider using this method:

1. Create dummy model applications that match the work most commonly added. The simplest model application consists of one computer workstation operation. The job names in these model applications should be dummy names indicating that they are only models.

   Note: Do not specify run cycles for these applications; if you do, IBM Workload Scheduler for z/OS automatically adds occurrences for these applications to the long-term plan and current plan.
2. When you must add work to the plan, select the model application that best corresponds to the work you want to add using the method described in "Adding occurrences to the current plan" on page 591. Change the operation details to match those of the work that you want to add. For example, you can

change the job name, workstation name, and input arrival times for the operations. You can also add or delete operations, external dependencies, and internal dependencies.

Adding occurrences to the current plan

To add an application occurrence to the current plan, you can do any of the following:

- Select option 1 from the MODIFYING CURRENT PLAN panel. (Figure 245 on page 590).
- Enter =5.1 from the command prompt in any other part of IBM Workload Scheduler for z/OS panels.
- Use the CREATE command from the LIST panel (option =5.2).

Note: If you are using the advanced panels, you can add an application occurrence by selecting **Action > Add** from the OPERATIONS IN THE CURRENT PLAN panel. See Figure 268 on page 615 for more information.

Selecting occurrences

You specify selection criteria on the ADDING APPLICATIONS TO THE CURRENT PLAN panel, as shown in Figure 246:

```
EQQMADDP ---------- ADDING APPLICATIONS TO THE CURRENT PLAN --------------------
Command ===>

Specify the information below and press ENTER to add the occurrence,
or specify selection criteria to create a list of applications.

APPLICATION ID     ===> PAYEMDMP________

Input arrival:
 DATE              ===> 03/04/10    Date in format YY/MM/DD
 TIME              ===> _____       Time in format HH.MM

Deadline:
 DATE              ===> ________    Date in format YY/MM/DD
 TIME              ===> _____       Time in format HH.MM

PRIORITY           ===> _           1-9
ERROR CODE         ===> ____        If rerun of occurrence

AUTOMATIC DEP      ===> Y           Automatic dependency add,    Y P S or N
RESOLVE REQUIRED   ===> N           Auto deps must be resolved,      Y or N
GROUP DEFINITION   ===> _____________ Group definition filter
```

Figure 246. EQQMADDP - Adding Applications to the Current Plan panel

The following fields can have a significant effect on the added occurrences:

- ERROR CODE, for details see “Specifying an error code” on page 594.
- RESOLVE REQUIRED and AUTOMATIC DEP, for details see “Including dependencies defined in the database” on page 594
- GROUP DEFINITION, for details see “Grouping occurrences” on page 599.

Values specified in this panel are carried forward to the ADDING AN APPLICATION TO THE CURRENT PLAN panel (Figure 248 on page 593) for each application that you select. INPUT ARRIVAL DATE always contains the current date. The following fields contain the values from your last MCP add:

- APPLICATION ID
- AUTOMATIC DEP

- RESOLVE REQUIRED

You might find it faster to specify only the application ID, group definition, and dependency indicators. If you do not specify input arrival or deadline times, IBM Workload Scheduler for z/OS extracts them from the run cycles defined to the application in the application description database (if any run cycles exist). These fields are filled in when you get to the ADDING AN APPLICATION TO THE CURRENT PLAN panel (see "Adding occurrences").

When you need to add multiple occurrences, or if you do not remember the name of the application, leave the APPLICATION ID field blank, or specify a generic application ID such as PAY* to generate a list of applications.

```
EQQMAADL ---------- SELECTING APPLICATIONS TO ADD TO THE CP -  ROW 1 TO 8 OF 8
Command ===>                                                 Scroll ===> PAGE

Enter the row command A to add an application
or G to add an application group to the Current Plan

Row Application                                Group            Owner
cmd id               description               id               Identity
'   PAYBACKP         backup payroll database                    SAMPLE
'   PAYDAILY         daily payroll jobs                         SAMPLE
'   PAYM1            MONTHLY PAYROLL JOBS      GPAYM            SAMPLE
'   PAYM2            MONTHLY PAYROLL TRANSFER GPAYM             SAMPLE
'   PAYQUERY         AD-HOC payroll query                       SAMPLE
'   PAYRECOV         recover payroll database                   SAMPLE
'   PAYTAXYR         YEARLY PAYROLL RUN                         SAMPLE
'   PAYW             weekly payroll jobs       GPAYW            SAMPLE
****************************** BOTTOM OF DATA ******************************
```

Figure 247. EQQMAADL - Selecting applications to add to the CP

Select the single occurrences that you want to add from this list with the row command A. To add part or all of the application group to which an application belongs, select option G. For a detailed description about how to add application groups to the current plan, see "Adding an application group to the current plan" on page 600.

Adding occurrences

When you select an individual application you want to add to the current plan, IBM Workload Scheduler for z/OS displays the following panel:

```
EQQMAOCP --------- ADDING AN APPLICATION TO THE CURRENT PLAN ------------
Command ===>

Enter the DEP command above to verify automatic dependency resolution, or
enter the OPER command to modify operations.

Application           : PAYDAILY         daily payroll jobs
Owner                 : SAMPLE           payroll application
Operations            : 3
External predecessors : 0

Dependency resolution options:
AUTOMATIC DEP      ===>  Y         Automatic resolution of conditional
                                   and external dependencies, Y P S or N
RESOLVE REQUIRED   ===> N          Auto Deps must be resolved: Y or N
Input arrival:                     Deadline:
 DATE              ===> 03/03/10   DATE   ===> _________ (format YY/MM/DD)
 TIME              ===> 12.00      TIME   ===> ________   (format HH.MM   )
VARIABLE TABLE     ===> PAY_____________ JCL variable table to be used
GROUP DEFINITION   ===> _________________
PRIORITY           ===> 6          1-9
ERROR CODE         ===> ____   If this is a rerun
```

Figure 248. EQQMAOCP - Adding an application to the current plan

Note: If you are using the advanced panels, you can also add occurrences by selecting Add in the Action menu of the OPERATIONS IN THE CURRENT PLAN panel. See Figure 268 on page 615 for more information.

Any values specified on the ADDING APPLICATIONS TO THE CURRENT PLAN panel (see Figure 246 on page 591) are carried forward to this panel. The priority is extracted from the application description. The panel indicates the number of operations in the occurrence and the number of external predecessors.

The scheduler does not accept any command, except CANCEL, until the input arrival and deadline dates and times are specified. If you want the input arrival time to be the current time, you can either specify the necessary time or press Enter. The scheduler uses the current time as default for the input arrival time. If you press Enter again, IBM Workload Scheduler for z/OS uses the current date as default for the deadline date.

You can use the ISPF command delimiter to set up a chain command to do this quickly. For example, if you type **;;;** and press Enter, the panel is re-displayed with the cursor at the deadline time field. All other date and time fields are set by IBM Workload Scheduler for z/OS.

Note: If the added application has a run cycle defined, the input arrival and deadline time is taken from the first run cycle description. If you try to add an application with the same date and time as another occurrence of the same application already in the plan (even if deleted or completed), IBM Workload Scheduler for z/OS rejects it. If you mean to do this, change the time by one minute until the added occurrence is unique. But be careful if you want IBM Workload Scheduler for z/OS to resolve external dependencies: external dependencies can depend on the input arrival time of the added occurrence. For example, if application B depends on application A, what happens if you add an extra occurrence of A and B? When you add A, you must give its occurrence a different input arrival time to the regular occurrence. When you add B, you give its occurrence the same or later input arrival time, and it should become dependent on the added occurrence of A, because that is the closest occurrence with an equal or earlier input arrival time. See “Including dependencies defined in the database” on page 594 for a description of how dependencies are resolved

when there are several candidates. But you can have problems if the *operations* in A and B have explicit input arrival times: these are not affected by the occurrence input arrival time that you specify on the ADDING AN APPLICATION TO THE CURRENT PLAN panel, and you should alter these dependencies manually. See "Changing external dependencies to an occurrence" on page 608 for details.

You can use the DEP and OPER commands to alter dependencies and operation details for this occurrence. When you have specified all the occurrence information, add it to the current plan by issuing the END command.

Specifying an error code

ERROR CODE is an optional field containing a user-defined value up to 4 characters. This value is included in the daily planning reports for the occurrence when it completes. You can use this to identify particular categories of added processing.

For example, you could have an installation standard that all report reprints are added to the current plan with an error code of REPT. Similarly, occurrences added as part of a business system rerun could have an error code RER.

The specification of an error code does not affect the submission or tracking of operations, but it can be a useful tool for measuring the unplanned workload on your system.

You can use the error code to identify the name or the department of the user who requested the processing. This can be helpful when you are converting regularly added occurrences to an automated method by using ETT or PIF.

Including dependencies defined in the database

When you add application occurrences to the current plan, decide if the occurrence or group should be added with the dependencies defined in the application database. With the AUTOMATIC DEP field, you can:

- Add both predecessor and successor dependencies (either applications or operations).
- Add only predecessor dependencies (either applications or operations).
- Add only successor dependencies (either applications or operations).
- Ignore any dependencies specified in the application description.

Because conditional dependencies are considered external dependencies, if set AUTOMATIC DEP to N they are not added even if they refer to internal operations. If an application definition contains conditions and you set AUTOMATIC DEP to N, a confirmation panel (EQQMCADC) is displayed to avoid losing conditions from the plan.

When you request that dependencies be considered for individual occurrences, you can also specify whether or not the predecessors *must* be resolved. If you specify RESOLVE REQUIRED=Y, the scheduler issues a message if any predecessors defined in the application cannot be resolved and the scheduler does not add the application occurrence to the current plan until you enter DEP and delete the unresolved dependency.

If predecessors are added to an application in the AD database, this does not take effect in the current plan until that application is scheduled by daily planning or manually added to the current plan.

You can also delete external dependencies or specify additional dependencies when you are adding an occurrence. For detailed information, see "Changing and adding dependencies" on page 596.

Successor dependencies are added automatically only if the dependency is defined in the applications database at the time the successor occurrence was added to the current plan. When an occurrence is added to the plan, either manually using the MODIFYING CURRENT PLAN panel or automatically scheduled by daily planning, IBM Workload Scheduler for z/OS creates a potential predecessor record for predecessors that are not in the current plan. This can happen if the predecessor (job A) is run on demand. When its successor (job B) is added to the plan (at daily planning), IBM Workload Scheduler for z/OS notices that its predecessor (A) is missing. When you add the on-demand application (A), and specify that IBM Workload Scheduler for z/OS is to resolve successor dependencies, IBM Workload Scheduler for z/OS looks for predecessors that match, and the added occurrence A becomes a predecessor to B, unless B has started or has already completed.

If there are several occurrences of B in the plan, IBM Workload Scheduler for z/OS must choose which occurrence of B to make the successor. The best successor is the first not-started occurrence or operation with an occurrence input arrival later than or equal to that of the occurrence being added.

To handle the resolution of conditional successors, the scheduler might automatically generate conditions, to be consistent with the database definitions and prevent a condition from referring to different occurrences of the same applications. You can change only the description of the conditions that are automatically generated.

For each missing predecessor, IBM Workload Scheduler for z/OS can keep track of up to 1000 successors. If this limit is reached, no more successors are added and a warning message is issued.

If you add an occurrence to the current plan from the MODIFYING CURRENT PLAN panel, and later run a daily planning EXTEND or REPLAN job, daily planning never makes the manually-added occurrence a predecessor or successor of an occurrence that it adds from the long-term plan, even if the dependency is specified in the database. This is because daily planning does not search the current plan to resolve dependencies, but it takes the dependencies directly from the long-term plan. For example:

1. You add an occurrence of PAYDAILY using the MODIFYING CURRENT PLAN panel. PAYDAILY is specified in the database as a predecessor of PAYBACKP.
2. You extend the current plan, which adds an occurrence of PAYBACKP.
3. Even though the application description for PAYBACKP states that it has an external predecessor PAYDAILY, PAYBACKP will not have this dependency, because occurrence dependencies are not added when the current plan is extended unless they were present in the long-term plan.

When you specify resolution of predecessor dependencies, IBM Workload Scheduler for z/OS looks for occurrences that are predecessors to the added operations, but also considering the following rules:

- The predecessor operation can be completed (or started).
- If the added operation has an explicit input arrival time, IBM Workload Scheduler for z/OS takes the predecessor occurrence that has both the following characteristics:

  - The input arrival time is earlier and closest to, or the same as, the input arrival time of the added operation.
  - Contains a candidate predecessor operation.
- If the added operation has no explicit input arrival time, IBM Workload Scheduler for z/OS takes the predecessor occurrence that has both the following characteristics:
  - The input arrival time is earlier and closest to, or the same as, the input arrival time of the added occurrence, as specified on the ADDING AN APPLICATION TO THE CURRENT PLAN panel in Figure 248 on page 593.
  - Contains a candidate predecessor operation.

Note: When resolving a dependency, IBM Workload Scheduler for z/OS uses the input arrival time of the predecessor *occurrence*, not the input arrival time of the operation specified in the dependency.

Changing and adding dependencies

When you add an occurrence, you can make the operations dependent on operations in the plan, even though these dependencies are not defined in the database.

On the ADDING AN APPLICATION TO THE CURRENT PLAN panel, shown in Figure 248 on page 593, enter the OPER command, and the panel in Figure 249 displays, in which you select the operation.

```
EQQMMOPL --------- MODIFYING OPERATIONS IN THE CURRENT PLAN -  ROW 1 TO 1 OF 1
Command ===>                                                 Scroll ===> PAGE

Enter the GRAPH command above to view operations graphically or
change data in the rows, and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat,  D(nn),DD - Delete
J - Edit JCL, O - Browse operator instructions, S - Modify operation details
L - Browse joblog, LJ - Browse joblog via ITOM

Application           : PAYQUERY         AD-HOC payroll query
Owner                 : SAMPLE           payroll application
Input arrival         : 03/07/28  14.11
Status                : Being added


Row Operation                          Jobname  PS Duration Opt Dep Res     Stat
cmd ws   no. text                                 HH.MM.SS S T S/P S R1 R2 N Cu
''  CPU1 050 run as required_________ PAYQUERY  1 00.05.00 Y N     Y  0  0   A
****************************** BOTTOM OF DATA ********************************
```

Figure 249. EQQMMOPL - Modifying Operations in the Current Plan panel

Note: If you are using the advanced panels, you can also open the panel by selecting Modify in the Occurrence menu of the OPERATION IN THE CURRENT PLAN panel (see "Occurrence" on page 616 for more information).

Select the operation. The panel in Figure 250 on page 597 appears.

```
EQQMMODP -------- MODIFYING AN OPERATION IN THE CURRENT PLAN ------------
Option ===>

Select one of the following:

 1 DEPENDENCIES        - Delete and add (internal and external)
 2 SPEC RESOURCES      - Special resources
 3 AUTOMATIC OPTIONS   - Job, WTO, and print options
 4 TIME                - Time specifications
 5 JCL                 - Edit JCL for MVS job
 6 GENERAL             - General information
 7 CLEANUP OPTIONS     - Cleanup Options
 8 EXTENDED INFO       - Extended Information
 9 AUTOMATION INFO     - Automation info
10 USER FIELDS         - User fields operation info
11 REMOTE JOB INFO     - Remote job information

Application           : PAYQUERY         AD-HOC payroll query
Operation             : CPU1 050         run as required
Jobname               : ROXINO
Input arrival         : 03/07/28  14.11
Duration(HH.MM.SS)    : 0005.00
External predecessors : No       Conditional predecessors : No
External successors   : No       Conditional successors   : No
Special resources     : Yes      Number of conditions     : 0
```

Figure 250. EQQMMODP - Modifying an Operation in the Current Plan panel

Note: If you are using the advanced panels, you can display the MODIFYING OPERATION IN THE CURRENT PLAN by either:

- Entering M in the Row cmd column next to the selected operation in the OPERATIONS IN THE CURRENT PLAN panel (see Figure 263 on page 612)
- Selecting Modify in the TABLE ROW COMMANDS panel after selecting an operation in the OPERATIONS IN THE CURRENT PLAN panel (see Figure 264 on page 613).
- Selecting Modify in the Operation menu of the OPERATION IN THE CURRENT PLAN panel (see Figure 269 on page 616).

In panel EQQMMODP, select option 1 (DEPENDENCIES). The panel shown in Figure 251 is displayed.

```
EQQMMDPL -------- MODIFYING DEPENDENCIES IN THE CURRENT PLAN - Row 1 to 1 of 1
Command ===>                                                 Scroll ===> PAGE

Enter any of the following command above:
 COND - handle conditional dependencies   CREATE - create a new dependency
enter the row command D to delete a dependency:

Application     : PAYQUERY
Input arrival   : 09/06/21  08.14
Operation       : CPU1 050
Overall Conditions Status :

CHECK DEPENDENCIES  ===> Y   Y - When leaving panel (only not conditional ones)
                             N - At occurrence update (all dependencies)

Row Trans Application id   Input Arrival  Operation                    S D  Con
cmd time  (ext deps only)  date     time  ws   no. text                     ID
 '  00.01 APPLZ                          CPU1 001                     A P  000
```

Figure 251. EQQMMDPL - Modifying dependencies in the current plan

To create non-conditional dependencies, enter the CREATE command. The panel shown in Figure 252 on page 598 is displayed.

```
EQQMMADP --------- CREATING A DEPENDENCY IN THE CURRENT PLAN ------------
Command ===>

Specify the identity of an operation or occurrence below and press ENTER
to create it as a dependency, or, if the operation or occurrence is not
uniquely defined, to show a list of operations.

Application           : PAYQUERY         AD-HOC payroll query
Input arrival         : 09/06/21  08.14
Operation             : CPU1 050         run as required

DEPENDENCY TYPE    ===> P           P - Predecessor, S - Successor
DEPENDENCY         ===> _           O - Operation, A - Appl occurrence

Dependency            :             Identity of dependency
 APPLICATION ID    ===> P*_____________
                                     Blank means internal dependency
 INPUT DATE        ===> ________     Date in format YY/MM/DD
       TIME        ===> _____        Time in format HH.MM
 WORK STATION      ===> ____
 OPERATION NUMBER  ===> ___
 JOBNAME           ===> ________
```

Figure 252. EQQMMADP - Creating a dependency in the current plan

You can specify the details of the predecessor or successor in the CREATING A DEPENDENCY IN THE CURRENT PLAN panel, but it is easier to use a generic search character in the ID (P* in Figure 252) and press Enter.

The DEFINING DEPENDENCIES IN THE CURRENT PLAN, shown in Figure 253, is displayed.

```
EQQMMDLL --------- DEFINING DEPENDENCIES IN THE CURRENT PLA  ROW 1 TO 13 OF 27
Command ===>                                                  Scroll ===> PAGE

Enter P or S below to define the type (T). Blank will delete the dependency.

Application            : PAYQUERY         AD-HOC payroll query
Input arrival          : 03/06/21  08.14
Operation              : CPU1 050         run as required

T Application id   Input arrival  Jobname  Operation                         S
                   date     time           ws   no. text
_ PAYBACKP         09/06/15 12.00 PAYBACKP CPU1 015 Daily payroll backup     C
_ PAYBACKP         09/06/15 12.00 PAYBACKP WTO1 030 PAYX OPEN DATASET        C
_ PAYBACKP         09/06/17 12.00 PAYBACKP CPU1 015 Daily payroll backup     C
_ PAYBACKP         09/06/17 12.00 PAYBACKP WTO1 030 PAYX OPEN DATASET        C
_ PAYBACKP         09/06/20 12.00 PAYBACKP CPU1 015 Daily payroll backup     C
_ PAYBACKP         09/06/20 12.00 PAYBACKP WTO1 030 PAYX OPEN DATASET        C
_ PAYBACKP         09/06/21 12.00 PAYBACKP CPU1 015 Daily payroll backup     W
_ PAYBACKP         09/06/21 12.00 PAYBACKP WTO1 030 PAYX OPEN DATASET        W
_ PAYDAILY         09/06/17 12.00 PAYDAILY WTO1 005 PAYX CLOSE DATASET       C
_ PAYDAILY         09/06/17 12.00 PAYDAILY SETP 010 Job setup for paydaily   C
_ PAYDAILY         09/06/17 12.00 PAYDAILY CPU1 020 Runs pay04 and pay06     C
_ PAYDAILY         09/06/20 12.00 PAYDAILY WTO1 005 PAYX CLOSE DATASET       C
_ PAYDAILY         09/06/20 12.00 PAYDAILY SETP 010 Job setup for paydaily   C
```

Figure 253. EQQMMDLL - Defining dependencies in the current plan

A wildcard search such as the one in Figure 252 is useful when you have several operations with the same name. Use the following row commands to specify the dependencies:

P Makes the operation in the row a predecessor of the operation that you are adding.

S Makes the operation in the row a successor of the operation that you are adding.

blank Removes the dependency between the operation in the row and the one that you are adding.

Note: Changes that result in a conflicting status (such as specifying that an operation is a predecessor of a completed operation) are rejected.

Changing and adding conditional dependencies: To handle conditional dependencies, enter the COND command from the panel shown in Figure 251 on page 597. The panel shown in Figure 254 is displayed.

```
EQQMMCCL ------- MODIFYING CONDITIONAL DEPENDENCIES IN THE CP  Row 1 to 1 of 1
Command ===>                                                 Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, D(nn),DD - Delete
S - Specify conditional dependencies

Application     : PAYQUERY
Input arrival   : 09/06/21  08.14
Operation       : CPU1 05

Row  Cond Text                     Cond     Rule              Status  Ext.
cmd  no.                           Deps                               Status
'''  001  NEW CONDITION__________  0
```

Figure 254. EQQMMCCL - Modifying conditional dependencies in the CP

By entering the available row commands, you can:

- Change a condition, depending on its status. In fact you can:
  - Modify type, operator and operands (status or return code values) of a selected condition dependency, until the status is undefined both for the selected dependency and the condition itself.
  - Manually reset the status of a step-level dependency that is undefined because of missing step-end information. Row commands are supported to reset the status to true or false.

    Consider that if you set the condition to false the scheduler sets to suppressed by condition status (X) the operation that owns the condition.
  - Delete or add condition dependencies, until the condition status is undefined.
- Delete undefined conditions and create new ones, until the overall condition status for the selected operation is undefined. Typically, you can delete or create conditions for operations in ready or waiting status.

Grouping occurrences

When you add occurrences to the current plan, you can specify that the occurrence should become a member of an existing occurrence group or that a new occurrence group should be created. Related occurrences can be handled as a single entity when they are defined in an occurrence group. An occurrence group, and therefore all member occurrences, can be completed or deleted from the current plan using a single panel request.

The daily planning process automatically creates occurrence groups in the current plan if such a group exists in the long-term plan for the corresponding period.

When an occurrence is defined as a group member, it cannot be individually completed or deleted. Group members must be removed from the group if individual complete or delete is required.

Adding an application group to the current plan

If you enter the G row command in the SELECTING APPLICATIONS TO ADD TO THE CP panel beside an application that belongs to a group, you can add all or part of that group to the current plan.

```
EQQMAAGL ----------- ADDING AN OCCURRENCE GROUP TO THE CP ---  ROW 1 TO 2 OF 2
Command ===>                                                  Scroll ===> PAGE

Enter/change data below and/or enter row command D to exclude an application
from add.

Group Definition      : GPAYM

AUTOMATIC DEP      ===> N           Automatic resolution of external
                                    dependencies,  Y P S G or N
IA DATE            ===> 03/03/14    Date in format YY/MM/DD
IA TIME            ===> 12.00       Time in format HH.MM
DL DATE            ===> 03/03/14    Date in format YY/MM/DD
DL TIME            ===> 18.00       Time in format HH.MM
VARIABLE TABLE     ===> PAY_____________ JCL variable table to be used
PRIORITY           ===> _           1-9

Cmd Application      Description              Pty Owner
'   PAYM1            MONTHLY PAYROLL JOBS      5  SAMPLE
'   PAYM2            MONTHLY PAYROLL TRANSFER  5  SAMPLE
```

Figure 255. EQQMAAGL - Adding an occurrence group to the CP

Excluding some applications

When IBM Workload Scheduler for z/OS displays the ADDING AN OCCURRENCE GROUP TO THE CP panel, you see a list of all applications that are members of the group you have selected. From the list, you can exclude specific applications defined in the group. In this panel, you enter the input arrival and deadline time that will be used for all occurrences in the group. Note that only the applications that are valid for the input arrival date and time that you specify are contained in the list. If an application that is normally part of the group is not valid for the specified input arrival date, it is not listed as part of the group.

Specifying dependency resolution

About this task

You can specify whether dependencies should be resolved and if all occurrences in the group should be added using the same priority or JCL variable table. When you request automatic dependency resolution for an application group, IBM Workload Scheduler for z/OS will first attempt to establish any dependencies to other applications within the group that is being added.

The applications in an application group are handled as a single entity, but when the group is added to the current plan, the occurrences are generated one at a time. If IBM Workload Scheduler for z/OS is abnormally terminated during such a transaction, the occurrences already added to the current plan will not be backed out, and the other occurrences will not be automatically added when IBM Workload Scheduler for z/OS is restarted. The order that IBM Workload Scheduler for z/OS creates the occurrences depends both on the application name and the structure of the dependencies between the applications. The order does not affect how the dependencies are created.

When an occurrence group is added, IBM Workload Scheduler for z/OS resolves dependencies only within the group if you specify option G on the AUTOMATIC DEP field in Figure 255. For all other options, dependencies will be resolved as

normal for each added occurrence, with the exception that dependencies are always resolved within the group if possible.

Before adding any occurrence, IBM Workload Scheduler for z/OS checks for dependency loops in the occurrence group. If it detects a loop, one of the dependencies forming the loop will not be resolved within the group. However, if there is another occurrence, external to the group, that matches the dependency criteria, the dependency will be resolved to this external occurrence if option Y or P is specified in the AUTOMATIC DEP field. A warning message is issued.

If an application defines a dependency that cannot be satisfied within the group, IBM Workload Scheduler for z/OS will attempt to establish the dependency to another occurrence, outside the group, in the current plan. You can see the dependencies established for occurrences created by adding the application group by entering the GRAPH command on the MODIFYING OCCURRENCES ADDED TO THE CURRENT PLAN panel (Figure 256).

When you have entered the required data and deleted any rows that you do not want to include in the group, enter END or press PF3. The applications required in the group are added to the plan. Initially, these occurrences are held by IBM Workload Scheduler for z/OS to let you modify the operation data or modify dependencies for any occurrences in the group. If you do not want to proceed with the group add, enter CANCEL on the ADDING AN OCCURRENCE GROUP TO THE CP panel (Figure 255 on page 600).

When the occurrences are added to the plan, IBM Workload Scheduler for z/OS displays this panel, which lists only those occurrences added as a result of adding the group:

```
EQQMAMOL ----- MODIFYING OCCURRENCES ADDED TO THE CURRENT PLAN       ALL ADDED
Command ===>                                                  Scroll ===> PAGE

Enter the DELETE command to delete all occurrences and exit, or
Enter the GRAPH command to display occurrence list graphically or
enter any of the row commands below:
B - Browse, D - Delete, M - Modify, RG - Remove from group,
C - Complete, W -Set to Waiting, R - Rerun

Row Application                                Input arrival   S   P  G
cmd id               text                      date     time
'' PAYM1             MONTHLY PAYROLL JOBS      03/03/14 12.00  W   5  Y
'' PAYM2             MONTHLY PAYROLL TRANSFER  03/03/14 12.00  W   5  Y
```

Figure 256. EQQMAMOL - Modifying occurrences added to the current plan

Note: If you are using the advanced panels, you can perform these occurrence tasks from either the Table Row Commands table (see Figure 264 on page 613) or from the Occurrence menu of the OPERATION IN THE CURRENT PLAN panel (see "Occurrence" on page 616).

From the MODIFYING OCCURRENCES ADDED TO THE CURRENT PLAN panel, you have access to the complete range of MCP services. At this point, the occurrences are still in a hold state; if you enter CANCEL from this panel, the occurrences remain held. The occurrences are already added to the plan, but you can mark them deleted with the DELETE command. If you do this, you cannot add these occurrences later with exactly the same input arrival date and time (because the occurrences, even though marked deleted, are still in the plan). If you need to add them again later, change the arrival time slightly.

After making any modifications, enter END or press PF3 to release the occurrences. If your conversation with IBM Workload Scheduler for z/OS subsystem is cancelled for any reason while the occurrences are still in a hold state, they remain held.

Note: While you are using the panel in Figure 256 on page 601, nobody else can access the listed occurrences. Release the lock as soon as you can.

Restarting an occurrence from the beginning

The LIST option of the modify current plan panel takes you to the MODIFYING OCCURRENCES IN THE CURRENT PLAN panel:

```
EQQMOCLL --------- MODIFYING OCCURRENCES IN THE CURRENT PLAN   ROW 1 TO 4 OF 4
Command ===>                                                 Scroll ===> PAGE

Enter the CREATE command to add a new occurrence or
enter the GRAPH command to display occurrence list graphically or
enter any of the row commands below:
B - Browse, D - Delete, M - Modify, RG - Remove from group, DG - Delete Group,
C - Complete, W -Set to Waiting, R - Rerun, CG - Complete Group

Row Application                              Input arrival   S   P  G  Add
cmd id               text                    date     time            func
'' CP               current plan             03/06/08 11.00  C   7  N
'' PAYBACKP         backup payroll database  03/06/08 12.00  W   5  N
'' PAYDAILY         daily payroll jobs       03/06/08 12.00  W   5  N
'' PAYW             weekly payroll jobs      03/06/09 14.00  W   5  Y  D
****************************** BOTTOM OF DATA ********************************
```

Figure 257. EQQMOCLL - Modifying occurrences in the current plan

To restart an application occurrence from the beginning, enter W in the row command field for the occurrence. After you confirm the request, IBM Workload Scheduler for z/OS resets the status of all operations in the occurrence to W (waiting). All operations (whose predecessors have completed) are then automatically resubmitted if all other criteria for submission are fulfilled. In this process, all external and conditional successors that have a status of ready are reset to W (waiting) status. If they are conditional successors, the scheduler might reset the related conditions to undefined, meaning that:

- Single dependencies in existing conditions are reset to undefined.
- Each condition is reset to undefined depending on the specified rule.

If an external or conditional successor has started, however, the request to restart is rejected, and an error message is displayed. If this happens, consider deleting the external successor dependency and then reset the occurrence to waiting status. See "Changing dependencies to an operation" on page 608 for details on how to delete dependencies.

Note: If you are using the advanced panels, you can rerun an occurrence from either the Table Row Commands panel (see Figure 264 on page 613) or from the Occurrence menu of the OPERATION IN THE CURRENT PLAN panel (see "Occurrence" on page 616).

If you want to reset the status of successors as well, you need RERUN instead of SET TO WAITING. See "Rerunning an occurrence in the current plan from a specific operation" on page 603.

Note:

1. Row commands are usually executed immediately. Thus, if you cancel the rerun against which you have issued a NOP command, the operation remains removed (no-oped), because the NOP command has already been processed.
2. If at some point an operation was set to HOLD or NOP, the HOLD or NOP status will stay in effect when the occurrence is set to waiting. To see which operations have been set to HOLD or NOP, request a list of the operations using option 5.3.
3. You might need to HOLD or NOP operations that will be reset by the command.
4. When an operation is rerun, IBM Workload Scheduler for z/OS uses the job that was last submitted for the operation.
5. Same restrictions apply as for changing the operation status to ready by selecting option 6 (GENERAL) from the MODIFYING AN OPERATION IN THE CURRENT PLAN panel. In particular, a step or job restart request might imply a request to change to ready the status of an operation with conditional successors already started, completed, suppressed by condition, or ended in error. In this case the scheduler issues message EQQM208E. Only when rerunning an occurrence you might indirectly obtain this kind of change.

Rerunning an occurrence in the current plan from a specific operation

If an occurrence is still in the current plan, you can rerun it from a particular operation if all external dependencies for that occurrence are in READY status (R, *, or A). To do so, select the occurrence with the row command R on the MODIFYING OCCURRENCES IN THE CURRENT PLAN panel (Figure 257 on page 602). The RERUNNING AN OCCURRENCE IN THE CURRENT PLAN panel (Figure 258) is displayed, where you can specify which operation in the occurrence you want to restart from.

Note: If an operation ends in error, use the error list to rerun it.

```
EQQMROCL -------- RERUNNING AN OCCURRENCE IN THE CURRENT PLAN  ROW 1 TO 1 OF 1
Command ===>                                                  Scroll ===> PAGE

Enter/change data below and/or enter any of the following row commands:

S - Set restart point, RC - Restart and Cleanup, L - Browse joblog,
J - Edit JCL, O - Browse operator instructions, MH - Manual HOLD oper,
MR - Manual RELEASE oper, NP - NOP oper, or UN - Undo NOP oper,
FSR - Fast path SR, FJR - Fast path JR, FSC - Fast path SC
LJ - Browse joblog via ITOM

Application           : APP1             application 1
Input arrival         : 03/04/29 20.17
Calendar name         : DEFAULT

DEADLINE DATE      ===> 03/05/01    Date in format YY/MM/DD
DEADLINE TIME      ===> 22.00       Time in format HH.MM
PRIORITY           ===> 7           1-9 where 1=low, 8=high and 9=urgent
ERROR CODE         ===> ____        For reporting purposes

Row  Operation                         Jobname  Status Error Man Nop Cln Log
cmd  ws   no. text                                      code  Hld     T S Stat
''   CPU1 050 job1 in app1             JOB1       E    JCL    N   N  A
****************************** BOTTOM OF DATA ******************************
```

Figure 258. EQQMROCL - Rerunning an occurrence in the current plan

Note: If you are using the advanced panels, you can rerun an occurrence and enter the commands in Figure 258 by either:

- Using the TABLE ROW COMMANDS panel (see Figure 264 on page 613)
- Selecting Rerun the occurrence from the Occurrence menu in the OPERATION IN THE CURRENT PLAN panel (see "Occurrence" on page 616).

When rerunning an occurrence, you can choose to restart the step or the job. To do this, you must select which step will be the restart point by using the S command on the RERUNNING AN OCCURRENCE IN THE CURRENT PLAN panel. The operation status of the restart point is then set to R (ready). From that step forward in the occurrence, the statuses of the operations are automatically modified to waiting. In cases where an operation changes from C (complete) status to either R (ready) or W (waiting) status, you must decide if cleanup actions on the data sets should be performed. When you request restart and cleanup actions and job log information is available, you can choose to restart the operation from a particular step. The scheduler automatically tailors and verifies the job for restart. Use the OPERATION RESTART AND CLEANUP panel (Figure 259) to initiate restart and cleanup actions.

```
EQQRCLSE --------------- OPERATION RESTART AND CLEANUP -----------------------
Option ===>

Application           : APLIC             01/02/26  13.10
Operation             : CPUA 10
Jobname and jobid     : JOB1           JOB00163

Clean Up Result       :


Edit JCL        ===> N             Edit JCL before Restart
Expanded JCL    ===> Y             Use Expanded JCL


Select one of the following:

1 STEP RESTART                   - Request a Step Restart
2 JOB RESTART                    - Request a Job  Restart
3 START CLEANUP                  - Request Cleanup
4 DISPLAY CLEANUP                - Display Cleanup result
```

Figure 259. EQQRCLSE - Operation restart and cleanup

For additional details about restart and cleanup actions at the job or step-level, see Chapter 30, "Handling operations that end in error," on page 637.

If there are conditional or external dependencies defined on the operation, they are included on the LIST DEPENDENCY STATUS CHANGE panel (Figure 260 on page 605) that is displayed automatically. From the RERUNNING AN OCCURRENCE IN THE CURRENT PLAN panel, you can modify the jobs of the dependent operations before IBM Workload Scheduler for z/OS resets them. The modified job is saved in the JCL repository when you exit and confirm the occurrence rerun. As in rerunning occurrences, the same procedures apply to dependencies.

You can use RERUN to reset dependent occurrences that have already completed. This can save you the trouble of adding the occurrences again if you need to rerun all or part of a business system and occurrences have not been planned out of the current plan. You select the point from which you must start the rerun and all successor dependencies are automatically set to waiting status.

Note: The real status of the operations is still unchanged. Whether any further row commands will be allowed depends on the real status, rather than on the status currently displayed. The effective rerun is executed only after confirmation on the

LIST DEPENDENCY STATUS CHANGE panel.

```
EQQMOSTL -------------- LIST DEPENDENCY STATUS CHANGE  ------  ROW 1 TO 2 OF 2
Command ===>                                                  Scroll ===> PAGE

Enter row command S to edit the JCL for the dependency operations,
or enter row command RC restart and cleanup, L to browse joblog,
MH Manually HOLD oper, MR Manually RELEASE oper,  NP NOP oper,
LJ - Browse joblog via ITOM, UN Undo

Application           : PAYBACKP         backup payroll database
Input arrival         : 03/04/29 12.00
Owner                 : SAMPLE
Status                : W
Calendar name         : MONTHLY

Row Dependency                                    Stat M N Dep Nest. Pred Cln
cmd Application id   Input arrival  WS   Jobname  O  N H P typ level type T S L
''  PAYBACKP         09/04/29 12.00 CPU1 PAYBACKP W  C N N PC  1          Y
''  PAYDAILY         09/04/29 12.00 CPU1 PAYDAILY E  C N N P   2          N
****************************** BOTTOM OF DATA ******************************
```

Figure 260. EQQMOSTL - List dependency status change

The list includes both non-conditional and conditional dependencies.

Depending on whether you rerun an occurrence before or after a daily planning process, it might result in different outputs. In fact, daily planning removes from the current plan:

- Normal dependencies on completed predecessors. This is the default behavior, however, you can configure the behavior so that dependencies are retained, even after they are resolved. Refer to the **KEEPCOMPDEPS** parameter in the BATCHOPT initialization statement documented in *Customization and Tuning*.
- Evaluated conditions, both true and false. Single condition dependencies are removed provided that the corresponding condition is not undefined.

Once you selected an operation as restart point, the scheduler automatically:

- Modifies conditional predecessors to completed and conditional successors to waiting, as for standard dependencies.
- Sets to `True - Forced by rerun` the conditions on the conditional predecessors.

  It applies even if those conditions are on operations that are not involved in the rerun processing.
- Sets to `Undefined - Forced by rerun` the conditions on the conditional successors. Such conditions might include dependencies with different status values, for example a combination of all the possible status values: undefined because not evaluated yet, true, false, or undefined because of missing step-end information.

Note:

1. Row commands are usually executed immediately. Thus, if you cancel the rerun against which you have issued a NOP command, the operation remains removed (no-oped), because the NOP command has already been processed.
2. If at some point an operation was set to HOLD or NOP, the HOLD or NOP status will stay in effect when the occurrence is set to rerun. To see which operations have been set to HOLD or NOP, request a list of the operations using option 5.3.

3. Rerunning an occurrence is a powerful request that might reset the status of the job network including the restart point. In particular, it is the only manual request that can reset the suppressed by condition status.

   Therefore consider using HOLD or NOP command for any impacted operation that is to be prevented from starting.
4. When an operation is rerun, IBM Workload Scheduler for z/OS uses the job that was last submitted for the operation.
5. For a fault-tolerant agent, you cannot issue the S, RC, NP, or UN row commands in the LIST DEPENDENCY STATUS CHANGE panel.
6. Same restrictions apply as for changing the operation status to ready by selecting option 6 (GENERAL) from the MODIFYING AN OPERATION IN THE CURRENT PLAN panel. In particular, a step or job restart request might imply a request to change to ready the status of an operation with conditional successors already started, completed, suppressed by condition, or ended in error. In this case the scheduler issues message EQQM208E. Only when rerunning an occurrence you might indirectly obtain this kind of change.

Completing an application occurrence

When you want to complete the entire application occurrence, enter C in the row command field for the occurrence on the MODIFYING OCCURRENCES IN THE PLAN panel. The scheduler presents a confirmation panel that includes a list of operations or occurrences that depend from the occurrence for which you have requested completion. The dependencies with the predecessors are deleted. The normal dependencies listed are also considered complete if you enter Y. From this panel, you can request that IBM Workload Scheduler for z/OS HOLD or NOP a dependent operation. After your confirmation, IBM Workload Scheduler for z/OS sets all operations to C (complete) status, except for the suppressed by condition operations, that keep their status.

If you manually set an occurrence to Completed through the MCP function, some dependencies could be deleted because no longer consistent. This deletion does not produce any JT record, but is tracked only in the MT0 data area that is appended to the occurrence completion JT record. As a consequence, this kind of deletion is not specifically registered in the audit report.

Note:

1. If you are using the advanced panels, you can set a selected operation to complete from the:
   - TABLE ROW COMMANDS panel (see Figure 264 on page 613).
   - Action menu in the OPERATION IN THE CURRENT PLAN panel (see Figure 268 on page 615).
   - Occurrence menu in the OPERATION IN THE CURRENT PLAN panel (see "Occurrence" on page 616).
2. If you set the status of an application occurrence to complete, IBM Workload Scheduler for z/OS can submit its successor operations or occurrences.
3. The selected occurrence can contain an in-error operation, with conditional successors in final status, because of already evaluated conditions. The scheduler does not evaluate again these conditions after the occurrence status change, in fact no operation reruns, but sets them to the `Frozen by complete` extended status.

Deleting an application occurrence

You can delete an application occurrence from the current plan by entering D in the row command field for the occurrence in the MODIFYING OCCURRENCES IN THE CURRENT PLAN panel. The scheduler then displays a confirmation panel showing all external dependencies for the occurrence. After your confirmation, all operations in the occurrence are deleted. Additionally, you can delete occurrences on a fault-tolerant agent in the same way.

Note: If you are using the advanced panels, you delete an application occurrence from the TABLE ROW COMMANDS panel. See Figure 264 on page 613 for more information.

Except for conditional dependencies, for each operation in the deleted occurrence, IBM Workload Scheduler for z/OS automatically connects all its external predecessors to its external successors. By doing this, IBM Workload Scheduler for z/OS maintains the consistency of the network of operations. For conditional dependencies, network split cannot be prevented because the scheduler cannot redefine the rule criteria.

To prevent unwanted dependent operations from starting after the deletion, first change the external dependencies, as described under "Changing external dependencies to an occurrence" on page 608. Alternatively, you can HOLD or NOP a dependent operation from the list displayed.

Note: The scheduler retains the deleted occurrences for reporting purposes and to ensure that the long-term plan is updated if the occurrence exists in the long-term plan. So you cannot add another occurrence of the same application to the current plan with the same input arrival time as the deleted occurrence. You can display deleted occurrences using the QUERY CURRENT PLAN panel.

Modifying an application occurrence

Requests to modify application occurrences in the plan might include requests to change:

- Input arrival and deadline times
- Priority
- Operation information
- JCL variable table used by the occurrence operations
- External and internal dependencies

To change an occurrence, enter M in the row command field for the occurrence in the MODIFYING OCCURRENCES IN THE CURRENT PLAN panel (Figure 257 on page 602). You can change occurrence times and priority on the resulting MODIFYING AN OCCURRENCE IN THE CURRENT PLAN panel.

You can also change operations (see "Changing the details of an operation" on page 608 for detailed information) and display the list of external dependencies for verification and deletion. See "Changing external dependencies to an occurrence" on page 608 for detailed information.

Note: If you are using the advanced panels, you modify an application occurrence from the Occurrence menu in the OPERATION IN THE CURRENT PLAN panel. See "Occurrence" on page 616 for more information.

Changing external dependencies to an occurrence

You can display all external dependencies to an occurrence by entering the DEP primary command on the MODIFYING AN OCCURRENCE IN THE CURRENT PLAN panel. This takes you to the RESOLVING EXTERNAL DEPENDENCIES IN THE CP panel, where you can verify or delete the dependencies. You cannot add external dependencies from this panel. You can add external dependencies only by modifying individual operations.

Note: If you are using the advanced panels, you can the change external dependencies of an occurrence from the Operation menu on the OPERATION IN THE CURRENT PLAN panel. See Figure 269 on page 616 for more information.

Changing dependencies to an operation

To change dependencies to an operation, get the list of operations by entering OPER in the command line of the MODIFYING AN OCCURRENCE IN THE CURRENT PLAN panel. In the list of operations, enter S in the row command field to get details of the operation. Select option 1 (DEPENDENCIES) in the MODIFYING AN OPERATION IN THE CURRENT PLAN, as described in "Changing and adding dependencies" on page 596. You can then delete dependencies and create new ones. You can handle both internal, external, and conditional dependencies.

In instances where you change dependencies for a fault-tolerant agent, insure that there is enough time for the dependency event to reach the distributed agent. If the operation starts before the dependency event reaches the agent, the operation status is set to error with the OSEQ error code.

Changing the details of an operation

About this task

To change the details of an operation, display the list of operations by entering OPER in the command line of the MODIFYING AN OPERATION IN THE CURRENT PLAN panel. The MODIFYING OPERATIONS IN THE CURRENT PLAN panel is displayed, where you can modify items such as:

- Workstation name
- Job name
- Operation text
- Use of workstation resources
- Submit options
- Time options
- Operation status
- User fields

Note: If you are using the advanced panels, you can change the details of an operation by either:

- Selecting Modify from the TABLE ROW COMMANDS panel (see Figure 264 on page 613).
- Selecting Modify from the Operation menu in the OPERATION IN THE CURRENT PLAN panel (see Figure 269 on page 616).

You can perform several actions by specifying the appropriate value in the command field of an operation, for example:

J To edit the JCL for the job.

L To view the output of completed operations. IBM Workload Scheduler for z/OS retrieves the output from the operation. Enter **L** a second time to browse the output.

O To browse the operator instructions for the operation.

S To display more details about the operation by returning to the MODIFYING AN OPERATION IN THE CURRENT PLAN panel.

Note:

1. If you modify an operation by mistake, when you are returned to the MODIFYING AN OPERATION IN THE CURRENT PLAN panel use the CANCEL command to discard the changes. However, if you modified the JCL using the **J** command, the changes that you made take effect even if you exit from the MODIFYING AN OPERATION IN THE CURRENT PLAN panel using CANCEL.
2. PF3 is the confirmation of a modify request. By entering PF3, the resulting operation values comprise the changes specified together with the existing values that have not been changed. If a modify request is entered and PF3 is issued without any change, the operation values are set to the existing values (for example, if the submit option was set to Y, the operation is submitted). If a modify request is entered by mistake, when you are returned to the MODIFYING AN OPERATION IN THE CURRENT PLAN panel, use CANCEL to discard the request.
3. Changes that would force a status change of a started or completed dependent operation are rejected.

Modifying extended information

About this task

From the MODIFYING AN OPERATION IN THE CURRENT PLAN panel, enter **8** to modify the information describing the operation. You can use the string to filter queries of operations.

Note: If you are using the advanced panels, you can change the details of an operation by either:

- Selecting Modify from the TABLE ROW COMMANDS panel (see Figure 264 on page 613).
- Selecting Modify from the Operation menu in the OPERATION IN THE CURRENT PLAN panel (see Figure 269 on page 616).

In the MODIFYING EXTENDED INFO IN THE CURRENT PLAN panel, type the information in the Operation Extended Name field and (or) in the Operation Scheduling Environment Name field, as shown in this example.

```
EQQMMXDP --- MODIFYING EXTENDED INFO IN THE CURRENT PLAN --------
Command ===>

Application:          PAYDAILY             daily payroll jobs
Operation:            CPU1  020            Run pay04 and pay06
Job name:             PAYDAILY
Enter change data below:
Operation Extended Name:
daily payroll data for accounting_______________________________
Operation Scheduling Environment Name:
DB2ACTIVE_____________________________
```

Figure 261. EQQMMXDP - Modifying extended info in the current plan

After the scheduling environment name is added or changed in the plan, at job submission time it is used to check if the job can be submitted and, if this is so, to tailor the JCL by adding the SCHENV=*SE_name* keyword in the JOB card.

For more information, see Chapter 26, "Job scheduling and WLM," on page 533.

Adding and deleting operations

To add or delete operations, request a list of operations by entering OPER in the command line of the MODIFYING AN OCCURRENCE IN THE CURRENT PLAN panel. In the list, you can enter these row commands:

I Inserts a blank row for a new operation
R Copies existing operations to be added as new
D Deletes operations.

Note: If you are using the advanced panels, you can perform these same tasks from the Occurrence menu on the OPERATION IN THE CURRENT PLAN panel. See "Occurrence" on page 616 for more information.

When you generate a new row with the insert or repeat row command, the operation number is initially set to `000`. This shows that the operation is not yet defined, and that you must assign a unique number to the operation. By default, the new operation is set up as a successor to the operation preceding it in the list.

When an operation is repeated with the repeat row command, all information except the operation number is copied to the new operation.

When an operation is deleted, IBM Workload Scheduler for z/OS automatically connects all its predecessors with its successors to maintain the consistency of the network of operations. You cannot delete an operation whose deletion splits the operation network of the application occurrence into several operation networks. If you need to delete an operation that would do this, you must first change the dependencies in the application so that the network is not split.

Listing and browsing operations

To save you time and help you work more efficiently, IBM Workload Scheduler for z/OS allows you to create a list of all the operations in the current plan. In one panel, this list summarizes the high-level information of all operations such as workstation name, job name, and duration. From this list you can select an operation and, in a single panel, browse all the detailed information for that operation. At a glance, the color of the job name indicates the status of the operation (see "Operation status codes" on page 837).

This section explains how to use these list and browse functions and which tasks you can perform.

Note: To perform these list and browse tasks, you must use the advanced panels (see Panels Style). You can change from the basic style of panels (default) to the advanced style panels from the main menu by entering 0.8.

Creating a list of operations

To create a list of operations, enter 6.3 (or 5.3, if you want to be able modify them) from the main menu to open the SELECTING OPERATIONS panel. Leave all the criteria fields blank in this selection panel to see the entire list of operations in the current plan, or enter criteria to create a more specific operations list. The OPERATIONS IN THE CURRENT PLAN panel opens, as shown in Figure 262.

```
 Action  View  Help

EQQMOPRV -----------------OPERATIONS IN THE CURRENT PLAN ---------------------
Command  ===> _____________________________________________Scroll ===> PAGE

    View: Compact (EQQMOPRT)        Row 1 of 22                           >>
Row  Application ID Operation          Input Arrival     Dep   Cond   Dep  SXU
cmd                 WS  No.  Jobname  Date     Time   Suc  Pre  Suc   Pre
____ PAYDAILY      CPU3 040  IEFBR1R  11/05/24 18.00   1    1    0     0   E N
__/_ PAYDAILY      CPU3 060  IEFBR1R  11/05/25 18.00   0    1    0     1   C N

____ PAYDAILY      CPU1 010  IEFBR14  11/05/25 20.00   0    0    0     0   A N
____ PYWEEKLY      CPU3 060  IEFBR1R  11/05/25 18.00   0    1    0     0   R N
```

Figure 262. EQQMOPRV - Operations in the Current Plan panel (compact view)

At a glance you can see all the operations in the current plan, and all the key information. The >> symbol indicates when there is more data available to the right. Use F11 to scroll right. Based on which view you are in (Compact, Full, or Job Detail), different amounts and types of data are available. The example shown in Figure 262 show input arrival time, dependencies, conditional dependences, operation status (S), extended status codes (X), and unexpected return codes (U). The color-coding of the job name, status, and unexpected return codes help you immediately see the operation status. For more information on the color codes, see "Operation status codes" on page 837. The Full and Job Detail views provide additional types of information such as planning details, high-level monitoring, and operation text description.

The OPERATIONS IN THE CURRENT PLAN panel has the following three menus that allows you to quickly and efficiently access other information and perform other tasks:

Action

Allows you to:

- Add an application to the current plan. This is the same as using the ADD primary command.
- View the operations in the History database. This is the same as using the HIST primary command.
- Sort a table (see "Sorting list output" on page 42). This is the same as using the SORT primary command.

View Allows you to choose the type and amount of operation data displayed. The name of the template the panel is using is displayed next to the name

of the view. There is a different template for each type of view of each type of advanced panel. See "Specifying panel views" on page 40 for more information about the types of views.

Help Provides general help information and defines all the primary commands. Alternatively, you can enter HELP in the command line or press PF key 1 for the same information.

In the OPERATIONS IN THE CURRENT PLAN panel, enter B or S in the Row cmd column next to the operation you want to browse. Alternatively, you can enter a forward slash (/) in the Row cmd column of the operation and enter 1 in the TABLE ROW COMMANDS panel (see Figure 264 on page 613).

Browsing operation information

When you use the advanced panels (see Panels Style), you can browse, in a single panel, all the information for an operation in your current plan. This browse panel removes the need to go to several different panels to obtain data such as operation status, dependencies, operation times, operation options, and resources.

To open the browsing panel, create a list of your operations as described in "Creating a list of operations" on page 611. From the list, select the operation you want to browse by entering either of the following:

- B or S in the Row cmd column next to the operation.
- Forward slash (/) in the Row cmd column of the operation (as shown in Figure 263), and then selecting Browse in the TABLE ROW COMMANDS panel (see Figure 264 on page 613).

```
 Action  View  Help

EQQMOPRV -----------------OPERATIONS IN THE CURRENT PLAN ----------------------
Command  ===> _____________________________________________Scroll ===> PAGE

    View: Compact (EQQMOPRT)        Row 1 of 22
Row  Application ID Operation          Input Arrival     Dep   Cond   Dep  SXU
cmd                  WS  No.  Jobname  Date     Time   Suc  Pre  Suc   Pre
____ PAYDAILY      CPU3 040  IEFBR1R  11/05/24 18.00   1    1    0     0   E N
__/_ PAYDAILY      CPU3 060  IEFBR1R  11/05/25 18.00   0    1    0     1   C N
____ PAYDAILY      CPU1 010  IEFBR14  11/05/25 20.00   0    0    0     0   A N
____ PYWEEKLY      CPU3 060  IEFBR1R  11/05/25 18.00   0    1    0     0   R N

********************************** end of data ******************************
```

Figure 263. EQQMOPRV - Enter forward slash to select an operation

```
EQQSRCLP                      TABLE ROW COMMANDS

Choose the numeric option of the following commands

                                Line 1 of 33
_B__ 1.  Browse details (B/S)
     2.  Modify (M)
     3.  Browse JCL (BJ)
     4.  Edit JCL (J)
     5.  Browse joblog (L)
     6.  Browse joblog via ITOM (LJ)
     7.  Browse operator instructions (O)
     8.  Recovery Info (RI)
     9.  Target Critical Job (TCJ)
     10.  Hold operation (MH)
     11. Release held operation (MR)
     12. NOP operation (NP)
     13. UN-NOP the operation (UN)
     14. EXECUTE operation (EX)
     15. Kill (K)
     16. Set NEXT logical status (N)
     17. Set specific status (N-x)
     18. Reset status (R)
     19. Set the operation to complete (C)
     20. Simple Job Restart (SJR)
     21. Attempt automatic recovery (ARC)
     22. Restart and CleanUp (RC)
     23. Fast path to run Job Restart (FJR)
     24. Fast path to run Step Restart (FSR)
     25. Fast path to Start Cleanup (FSC)
     26. Modify the occurrence (MOD)
     27. Rerun the occurrence (RER)
     28. Set the occurrence to complete (CMP)
     29. Set to wait all ops. of occ. (WOC)
     30. Delete Operation (D)
     31. Delete Occurrence (DEL)
     32. Complete the occurrence group (CG)
     33. Remove from group (RG)
     34. Delete the occurrence group (DG)
     35. Reset bind information (BND)
     36. Browse STEP LIST (BSL)
```

Figure 264. EQQSRCLP - Table Row Commands panel

The browse panel, named OPERATION IN THE CURRENT PLAN, opens, as shown in Figure 265 on page 614. Scroll down to see all the operation details. The details are categorized into sections. Each section is prefixed by a code so that you can easily jump to the required section using the **find** command, without having to scroll through each section. For example, to quickly display the Dependencies section, type `find DEP-` at the command prompt.

```
  Action  Operation  Occurrence View  Help

EQQSOPSD ------------------ OPERATION IN THE CURRENT PLAN ------------------
Command  ===> _____________________________________________Scroll ===> PAGE

    View: Full (EQQSOPST)             Line 1 of 85                        >>
Jobname . . . . . : IEFBR1R
Operation . . . . : CPU3 060
------------------------------------------------------------------------------
Extended name . . :
User field  . . . :

Application . . . : PAYDAILY
Input Arrival . . : 11/05/25  18.00
Owner . . . . . . : PAYDEPT
Variable table  . :                       Calendar name . . : DEFAULT
Authority group . :                       Occurrence token  : C6064CEDBFCE5208

ST-----------------------------Operation status -----------------------------
Status  . . . . . : E
RC  . . . . . : UNTV              Orig RC  :
Recovered by COND : N
Unexpected RC . . :
```

Figure 265. EQQSOPSD - Operation in the Current Plan panel (showing main information)

```
  Action  Operation  Occurrence View  Help

EQQSOPSD ------------------ OPERATION IN THE CURRENT PLAN ------------------
Command  ===> _____________________________________________Scroll ===> PAGE

    View: Full (EQQSOPST)             Line 13 of 85                       >>
Jobname . . . . . : IEFBR1R
Operation . . . . : CPU3 060
------------------------------------------------------------------------------
Jobid . . . . . :                   Sdest :             Xdest : *******
  on Workstation  :

DEP------------------------------- Dependencies -----------------------------

Predecessors . . . . . .:            Successors . . . . . : 0
Conditional Predecessors  :          Conditional Successors . : 0

Predecessors and successors

Row  Type  Cond  Jobname    S  Operation                        Application ID
cmd        no.                  ws    no.   text
____  PC   400   SLDJOB     C  WS01  001                        APPLPRE
____  S          SLDJOB     X  WS01  002                        APPLLISAUF
```

Figure 266. EQQSOPSD - Operation in the Current Plan panel (showing dependencies)

```
  Action  Operation  Occurrence View  Help

EQQSOPSD ------------------ OPERATION IN THE CURRENT PLAN --------------------
Command  ===> _____________________________________________Scroll ===> PAGE

    View: Full (EQQSOPST)             Line 66 of 97                        >>
Jobname . . . . . : IEFBR15
Operation . . . . : WS01 03
------------------------------------------------------------------------------
UF----------------------------- User Fields ---------------------------------


UFName                UF Value
                      --- + --- 1 --- + --- 2 --- + --- 3 --- + --- 4 --- + ---
adouser               adovalue
user001               123569885320466858441
usertemp              tempvalue311

SAUT--------------------------- Automation info -------------------------------
Command text


Automated Function :                  Security Element :

Completion Info
```

Figure 267. EQQSOPSD - Operation in the Current Plan panel (showing user fields)

In addition to displaying all the information for the operation, the OPERATION IN THE CURRENT PLAN panel has a menu that provides you with a quick and efficient way to access other data or perform other tasks, such as creating operation user fields. The following sections describe the menu options.

Action

Allows you to perform administration actions on the status of an operation. Figure 268 shows a list of the possible actions.

```
  Action  Operation  Occurrence View  Help

____ 1.  Hold operation (MH)
     2.  Release held operation (MR)
     3.  NOP operation (NP)
     4.  UN-NOP the operation (UN)
     5.  EXECUTE operation (EX)
     6.  Reset bind information (BND)
     7.  Kill (K)
     8.  Set NEXT logical status (N)
     9.  Set specific status (N-x)
    10.  Reset status (R)
    11.  Set the operation to complete (C)
    12.  Simple Job Restart (SJR)
    13.  Attempt automatic recovery (ARC)
    14.  Restart and Cleanup (RC)
    15.  Fast path to run Job Restart (FJR)
    16.  Fast path to run Step Restart (FSR)
    17.  Fast path to Start Cleanup (FSC)
```

Figure 268. List of administrative tasks available from the Action menu

Alternatively, you can enter any of the commands (in parentheses) in the panel command line or in the Row cmd column of the OPERATIONS IN A CURRENT PLAN panel. The Primary commands section of the Help menu explains these commands.

Operation

Allows you to perform actions and commands to modify or browse either the properties of an operation or its JCL. Figure 269 on page 616 shows a

list of the possible actions and commands.

```
 Action  Operation  Occurrence View  Help

____  1. Modify (M)
      2. Browse JCL (JB)
      3. Edit JCL (J)
      4. Browse joblog (L)
      5. Browse joblog via ITOM (LJ)
      6. Browse operation instructions (O)
      7  Recovery Info (RI)
      8. Target Critical Job (TCJ)
      9. Immediate predecessor and successor information (DEP)
     10. List of resources used by the operation (SR=)
     11. All dependencies of this operation (ADEP)
```

Figure 269. List of operation actions available from the Operation menu

Alternatively, you can enter any of the commands (in parentheses) in the panel command line or in the Row cmd column of the OPERATIONS IN A CURRENT PLAN panel. The Primary commands section of the Help menu explains these commands.

Occurrence
Allows you to perform actions and commands to modify or browse the application that contains the operation. Figure 270 shows a list of the possible actions and commands.

```
 Action  Operation  Occurrence View  Help

_____ 1. Modify the occurrence (MOD)
      2. Rerun the occurrence (RER)
      3. Set the occurrence to complete (CMP)
      4. Set to wait all ops. of occ. (WOC)
      5. Complete the occurrence group (CG)
      6. Remove from group (RG)
      7. Detailed application occurrence information (OCC)
      8. Operations of the application occurrence (OPER)
      9. Immediated external dependencies of the occurence (OCCDEP)
```

Figure 270. List of operation actions available from the Occurrence menu

Alternatively, you can enter any of the commands (in parentheses) in the panel command line or in the Row cmd column of the OPERATIONS IN A CURRENT PLAN panel. The Primary commands section of the Help menu explains these commands.

View Allows you to change the view of the information for the operation. The full view provides more extensive data than the shortened, compact view. The name of the template the panel is using is displayed next to the name of the view. There is a different template for each type of view of each type of advanced panel.

Help Provides general help and defines all the primary commands. Alternatively, you can enter HELP in the command line or press PF key 1 for the same information.

Browsing the resolution interval of mandatory pending predecessors

For operations in waiting status for mandatory pending predecessors you can view the time interval within which the input arrival time of the predecessor must fall for the dependency to be resolved, as well as the resolution criterion specified for that dependency.

This information can be viewed in both ISPF and the Dynamic Workload Console.

In ISPF, starting from choice 5 (Modify the current plan) or 6 (Query the current plan), selecting 3 (Operations) to display the Selecting Operations (EQQSOPFP) panel, and entering the appropriate selection criteria, acquire a list of operations in `waiting` status for mandatory pending predecessors.

- If you are viewing the basic style panels:
  1. Enter B in the `Row cmd` column next to the operation you want to view if you started with option 5.3, or enter S if you started with option 6.3. This action displays the Predecessors and successors to an operation (EQQSPP1L) panel.
  2. Press F11 twice to scroll to the extreme right of the panel (EQQSPP3L).

```
EQQSPP3L - PREDECESSORS AND SUCCESSORS TO AN OPERATION (right Row 1 to 14 of 14
Command  ===>                                                  Scroll ===> PAGE

Issue command COND to show list of defined Conditions.
Scroll right or enter the row command S to select an operation for details.

Application               : BPENDICONDMIX
Operation                 : CPU1 2
Jobname                   : JOBB
Overall Conditions Status : Undefined

Row Type   Operation                          Resl Mandatory Pending Interval
cmd        ws   no.  text                     Crit From           to
...   P         001  **MANDATORY PEND. PRED*  A    13/08/31 01.00 13/09/14 23.00
...   P         001  **MANDATORY PEND. PRED*  C                   13/09/07 10.00
...   P         001  **MANDATORY PEND. PRED*  R    13/09/06 23.30 13/09/07 20.30
...   P         001  **MANDATORY PEND. PRED*  S    13/09/07 00.00 13/09/08 00.00
...   P         001  **PENDING PREDECESSOR**  S
...   P    CPU1 001  **PENDING PREDECESSOR**  A
...   PC        001  **PENDING COND PRED  **  A
...   PC        001  **PENDING COND PRED  **  A
...   PC        001  **PENDING COND PRED  **  C
...   PC        001  **PENDING COND PRED  **  C
...   PC        001  **PENDING COND PRED  **  R
...   PC        001  **PENDING COND PRED  **  R
...   PC        001  **PENDING COND PRED  **  S
...   PC        001  **PENDING COND PRED  **  S
******************************** Bottom of data ******************************


 F1=HELP      F2=SPLIT     F3=END       F4=RETURN   F5=RFIND     F6=RCHANGE
 F7=UP        F8=DOWN      F9=SWAP     F10=LEFT     F11=RIGHT    F12=RETRIEVE
```

Figure 271. EQQSPP3L - Displaying the Mandatory Pending Interval column (basic style panels).

- If you are viewing the advanced style panels:
  1. Enter B or S in the `Row cmd` column next to the operation you want to view. This action displays the Operation in the current plan (EQQSOPSD) panel.
  2. Press F8 to scroll the panel down to the `Predecessors and successors` section.

3. Press F11 twice to scroll to the extreme right of the panel and display the Resolution Criteria and Mandatory Pending Interval columns.

```
  Action  Operation Occurrence View  Help

EQQSOPSD -----------------OPERATION IN THE CURRENT PLAN ---------------------
Command  ===> _____________________________________________Scroll ===> PAGE

<< View: Full (EQQSOPST)        Row 22 of 100
Jobname . . . . . : JOBB
Operation . . . . : CPU1 002
 ------------------------------------------------------------------------------

Predecessors and successors

Row  Type Cond Jobname  S Operation Resl Mandatory Pending Interval
cmd       no.             ws   no.  Crit From           to
____ P    0                    001  A    13/08/31 01.00 13/09/14 23.00
____ P    0                    001  C                   13/09/07 10.00
____ P    0                    001  R    13/09/06 23.30 13/09/07 20.30
____ P    0                    001  S    13/09/07 00.00 13/09/08 00.00
____ P    0                    001  S
____ P    0    JOBB     A CPU1 001
____ PC   400                  001  A
____ PC   430                  001  A
____ PC   400                  001  C
____ PC   430                  001  C
____ PC   400                  001  R
____ PC   430                  001  R
____ PC   400                  001  S
____ PC   430                  001  S
********************************** end of data *****************************

Conditions
 F1=Help      F2=Split     F3=End       F4=Actions   F5=Rfind     F6=Retrieve
 F7=Up        F8=Down      F9=Swap     F10=Left     F11=Right    F12=Cancel
```

Figure 272. EQQSOPSD - Displaying the Mandatory Pending Interval column (advanced style panels).

where:

Resl Crit
Displays the criterion specified for the resolution of the dependency in the dependency definition.

Mandatory Pending Interval
Shows the interval where the Input Arrival Time of the predecessor must be so that the dependency is solved. The interval boundaries are listed in terms of `From` and `To` dates. A blank `From` date signifies that the left side of the interval is open.

Modifying operations

The most direct way to modify an operation is to select option 3 (OPERATIONS) from the MODIFYING THE CURRENT PLAN panel (fast path 5.3) to open the Selecting operations panel. After specifying the criteria for selecting the operation, the MODIFYING OPERATIONS IN THE CURRENT PLAN panel opens, as shown in Figure 273 on page 619.

```
EQQMOPRL ---- MODIFYING OPERATIONS IN THE CURRENT PLAN (left p ROW 1 TO 11 OF 11
Command ===>                                                  Scroll ===> PAGE

Enter the GRAPH command above to view list graphically,
enter the HIST command to select operation history list, or
enter any of the following row commands:
J   - Edit JCL                     M   - Modify       B   - Browse details
DEL - Delete Occurrence            MH  - Man. HOLD    MR  - Man. RELEASE oper
O   - Browse operator instructions NP  - NOP oper     UN  - UN-NOP oper
EX  - EXECUTE operation            D   - Delete Oper  RG  - Remove from group
L   - Browse joblog                K   - Kill         RI  - Recovery Info
LJ   - Browse joblog via ITOM      FJR - Fast path JR
RC  - Restart and CleanUp          FSR - Fast path SR
TCJ - Target Critical Job          FSC - Fast Path SC
BND - Reset bind information

Row Application id   Operat   Jobname   Input Arrival     Dep    Cond Dep  S
cmd                  ws   no.           Date     Time  Suc  Pre  Suc  Pre
'''  CP              CPU1  050 XRAYNERC 06/04/28 12.00    0  0      0    0 S
'''  MAWS            CPU1  010 MAWS     06/04/27 16.28    0  0      0    0 A
'''  PAYBACKP        CPU1  015 PAYBACKP 06/04/28 12.00    1  1      0    0 W
'''  PAYBACKP        WTO1  030 PAYBACKP 06/04/28 12.00    0  1      0    0 W
'''  PAYDAILY        WTO1  005 PAYDAILY 06/04/28 12.00    1  0      0    0 C
'''  PAYDAILY        SETP  010 PAYDAILY 06/04/28 12.00    1  1      0    0 C
'''  PAYDAILY        CPU1  020 PAYDAILY 06/04/26 12.00    0  0      0    0 C
'''  PAYDAILY        CPU1  020 PAYDAILY 06/04/27 12.00    1  0      0    0 C
'''  PAYDAILY        CPU1  020 PAYDAILY 06/04/28 12.00    1  1      0    0 E
'''  PAYW            CPU1  030 PAYWSLIP 06/04/27 12.00    1  1      0    0 C
'''  PAYW            PAY1  095 PAYWSLIP 06/04/27 12.00    0  1      0    0 R
****************************** BOTTOM OF DATA ********************************
```

Figure 273. EQQMOPRL - Modifying operations in the current plan (left part)

This panel lists the operations in the current plan that fulfill the list criteria you specified. Using row commands, you can perform the full range of MCP services on these operations.

Note: If you are using the advanced panels, you can perform these modification tasks from the:

- TABLE ROW COMMANDS panel (see Figure 264 on page 613).
- Action menu in the OPERATION IN THE CURRENT PLAN panel (see Figure 268 on page 615).
- Operation menu in the OPERATION IN THE CURRENT PLAN panel (see Figure 269 on page 616).

To display job options and expected duration time, scroll the list to the right:

```
EQQMOPRR ---- MODIFYING OPERATIONS IN THE CURRENT PLAN (right  ROW 1 TO 11 OF 11
Command ===>                                                  Scroll ===> PAGE

Enter the GRAPH command above to view list graphically,
enter the HIST command to select operation history list, or
enter any of the following row commands:
J   - Edit JCL                     M   - Modify        B   - Browse details
DEL - Delete Occurrence            MH  - Man. HOLD     MR  - Man. RELEASE oper
O   - Browse operator instructions NP  - NOP oper      UN  - UN-NOP oper
EX  - EXECUTE operation            D   - Delete Oper   RG  - Remove from group
L   - Browse joblog                K   - Kill          RI  - Recovery Info
RC  - Restart and CleanUp          FJR - Fast path JR  LJ  - Browse joblog via ITOM
TCJ - Target Critical Job          FSR - Fast path SR
BND - Reset bind information       FSC - Fast Path SC


Row Application id   Operat   Op Op Duration
cmd                  ws   no. ST HN HH.MM.SS
'''  CP              CPU1 050 YY NN 00.03.00
'''  MAWS            CPU1 010 YN NN 00.01.00
'''  PAYBACKP        CPU1 015 YN NN 00.05.00
'''  PAYBACKP        WTO1 030 YN NN 00.01.00
'''  PAYDAILY        WTO1 005 YY NN 00.01.00
'''  PAYDAILY        SETP 010 YN NN 00.03.00
'''  PAYDAILY        CPU1 020 YN NN 00.05.00
'''  PAYDAILY        CPU1 020 YN NN 00.05.00
'''  PAYDAILY        CPU1 020 YN NN 00.05.00
'''  PAYW            CPU1 030 YN NN 00.05.00
'''  PAYW            PAY1 095 YN NN 00.01.00
****************************** BOTTOM OF DATA ********************************
```

Figure 274. EQQMOPRR - Modifying operations in the current plan (right part)

Select an operation that belongs to a critical path and enter the row command to browse information about the target critical job for the selected operation.

To perform actions on operations that are no longer in the current plan, use the HIST primary command.

Note: If you are using the advanced panels, refer to "Browsing operation information" on page 612 for information on how to browse operations.

Rerunning operations in the history database

You might want to rerun an operation that is not part of the current plan, because the daily plan removed it, as not requiring further processing (for details refer to "Removing data from NCP by running daily planning" on page 282). To do this, you use the history function.

The history function stores operation data in the history database, a DB2 database that contains operations from the most recently completed occurrences from a previous current plan. The HIST command lets you select operations from the history database for further processing, provided that the operations are defined on computer workstations. It is not possible to perform Restart and Cleanup (RC) for an operation that is retrieved from the history database. Message EQQM600E is issued if this is attempted.

Updating the history database

If you do not use the history function, the daily plan process creates a current plan that includes new occurrences as well as the non-completed occurrences from the

old current plan. However, completed occurrences from the old plan do not appear in the new one. To save information about completed occurrences, you must use the history function.

When the history function is active, the daily plan process stores information about completed occurrences in the history database when it extends the current plan. The history update stores information about the most recently completed occurrence of an application unless the RETAINOPER keyword is specified in the BATCHOPT statement. If the RETAINOPER keyword is specified, the value of the keyword determines how many calendar days the operation is kept in the database before being removed or replaced by a newer occurrence of the operation. If RETAINOPER is not specified, the operation is kept in the history database indefinitely or until it is replaced by a more recent occurrence.

Before you can use the history function, a DB2 database must be installed with IBM Workload Scheduler for z/OS table definitions and the OPERHISTORY and DB2SYSTEM keywords must have been defined on the BATCHOPT and OPCOPTS statements for your subsystem. This is described in *Planning and Installation* and *Customization and Tuning*.

Processing history operations

You can display a list of the history operations by selecting option 7 (Old Operations) on the main menu, or by entering the HIST command on any of these panels:

- MODIFYING OPERATIONS IN THE CURRENT PLAN (5.3)
- HANDLING OPERATIONS ENDED IN ERROR (5.4)
- READY LIST (4.1).

Note: If you are using the advanced panels, you can click **Action > History** from the menu on the OPERATIONS IN THE CURRENT PLAN panel. See Figure 268 on page 615 for more information.

Note: After you issue the HIST command, a confirmation panel displays. Enter Y to confirm the command.

After the HIST command is processed, the following panel displays:

```
EQQHISTL-------------------- OPERATIONS HISTORY LIST ---------------------------

Enter one of the row commands below:
  B   - Browse operations details     L   - Browse joblog
  DS  - Deselect the operation        M   - Modify occurrence
  J   - Edit JCL                      S   - Select the operation
  LJ  - Browse joblog via ITOM

Row  Application id   Operation Jobname  Input Arrival  Actual   start
cmd                   ws   no.           Date     Time  Date     Time    Status
'''
''  PAYBACKP         CPU1  10  PAYB10   03/08/01 08.00 03/08/31 10.17
''  PAYBACKP         CPU1  20  PAYB20   03/08/01 08.00 03/08/31 10.17
''  PAYDAILY         CPU1  10  PAYD10   03/08/01 08.00 03/08/31 10.17
''  PAYDAILY         CPU1  20  PAYD20   03/08/01 08.00 03/08/31 10.17
S'' PAYDAILY         CPU1  30  PAYD30   03/08/01 08.00 03/08/31 10.15
''  PAYDAILY         CPU1  40  PAYD40   03/08/01 08.00 03/08/31 10.16    AH
''  PAYDAILY         CPU1  50  PAYD50   03/08/01 08.00 03/08/31 10.17    AH
''  PAYW             CPU1  10  PAYW10   03/08/01 08.00 03/08/31 10.16
''  PAYW             CPU1  20  PAYW20   03/08/01 08.00 03/08/31 10.16
```

Figure 275. EQQHISTL - Operations history list

The history command might take a long time to process, depending on:

- The quantity of data that is to be retrieved from the DB2 tables.
- The quantity of archived CP data that is stored in the DB2 database.
- Whether you specified any filtering options. To considerably reduce the command processing time, specify some filtering criteria.

During the processing time, the GENERAL SERVICE task that manages the panel requests locks the CP, preventing other IBM Workload Scheduler for z/OS requests from accessing the CP. The maximum amount of data that can be returned from the DB2 database to the TSO dialog is set by the MAXHISTORYROWS parameter of the OPCOPTS initialization statement. To run the HIST command, ensure that you have at least READ access for the HIST fixed resource.

In the OPERATIONS HISTORY LIST panel, you see the row commands that can be issued against the operations. Two row commands, B and J, can be issued before you select an operation.

The B row command lets you browse the operation details. If you issue the command before selecting the operation, the details you see will be from the history database. In particular, occurrence token data is displayed as blank characters in hexadecimal format. If you have selected the operation and changed input arrival time before browsing, the details will show the new input arrival time and updated occurrence token data.

The J row command displays the job for editing. If it exists in the JS data set, the job you edit will be the one used when the occurrence was most recently run. If this copy does not exist, the job will be taken from the job library data set.

Note: If any scheduler or system variables are used in the JCL, the job submitted by the RESTART processing might be very different from the one originally submitted.

Selecting a history operation

When you select an operation, you add it to the current plan and make it available for processing with additional row commands.

You select a history operation with the S row command. Selecting an operation displays this panel, where you can change the input arrival or deadline time:

```
EQQHIPUP----------SPECIFYING OCCURRENCE INPUT ARRIVAL---------------------
===>

Please specify data below, and press ENTER or enter CANCEL command
to ignore the operation selection

Application name                : PAYDAILY
Operation number                : 30
Input arrival:
 DATE               ===> 03/07/01    Date in format YY/MM/DD
 TIME               ===> 08.00       Time in format HH.MM
Deadline:
 DATE               ===> 03/09/01    Date in format YY/MM/DD
 TIME               ===> 08.00       Time in format HH.MM
```

Figure 276. EQQHIPUP - Specifying occurrence input arrival

After you have selected an operation and specified data on the Specifying OCCURRENCE INPUT ARRIVAL panel, you return to the previous panel. The

input arrival time has been updated to reflect the time you specified, and the operation has been added to the current plan with the status AH (arriving, manually held).

You should note that no dependency information is stored in the history database. Operations that are added do not have any predecessors or successors even though these might be defined in the application description. Use the M command to add dependencies after you have selected an operation.

Select an operation before performing any of these row commands:

DS The DS command deletes the operation from the current plan.

L Browse the job log. The command retrieves and displays the job log if it exists for the selected operation.

M This command is the same as the M command on the Modifying operations in the current plan. It lets you change operation details. If you want to run the history operations that you add to the current plan in any certain order, you must add the dependencies here.

Informing the scheduler of unplanned changes in resources

Sometimes a vital resource suddenly becomes unavailable because:
- A hardware error occurs on a tape or disk drive
- A processor is down
- A link is down
- Important staff are not available
- Resources must suddenly be reallocated.

When a vital resource becomes unavailable, you usually change the workstation definitions to prevent IBM Workload Scheduler for z/OS from starting operations in the wrong order or producing inaccurate schedules. If the resource is a special resource, refer to Chapter 31, "Monitoring special resources," on page 647 for details of the RESOURCE MONITOR panel. But to change workstation parallel servers and the workstation fixed (R1 and R2) resources, use the MODIFYING THE CURRENT PLAN panel and select the WORK STATIONS option to display a list of all workstations. Enter the S row command beside the workstation you want to select. You can then change the reporting attributes and the open interval information for the workstation. You can also change the alternate workstation for a workstation in this panel.

Any changes to open intervals that you make here remain in effect until they elapse or until you change them again in the panel. These changes always override the information calculated from the workstation descriptions when you extend the current plan.

Note: If you assign no parallel servers to an interval and specify that IBM Workload Scheduler for z/OS should control on servers for the workstation, IBM Workload Scheduler for z/OS will not submit any jobs for that workstation during the interval.

Keeping plans up-to-date

About this task

When you have changed the current plan, or when the duration of some work has varied significantly from its schedule, the planned times in the current schedule might be inaccurate. To make IBM Workload Scheduler for z/OS recalculate these times, taking the current information into account, replan the current plan. You can do this in two ways:

1. Enter the Replan panel from the DAILY PLANNING panel, by selecting the 1 (REPLAN) option on the PRODUCING OPC DAILY PLANS panel. The scheduler will then submit the replan job.
2. Define the replan job as an application in IBM Workload Scheduler for z/OS so you can schedule the replan as you would any other application, and IBM Workload Scheduler for z/OS will submit it automatically.

The REPLAN job removes all completed occurrences from the current plan panels.

Fault-tolerant workstations and replanning

About this task

To replan, you can configure IBM Workload Scheduler for z/OS to automatically send the Symphony file to IBM Workload Scheduler after you modify the current plan. To send the new Symphony file automatically, set the CPUAUTOLNK parameter of the CPUREC initialization statement to ON.

Otherwise, you can control manually when the Symphony file is delivered to the distributed agent and set the CPUAUTOLNK parameter to OFF. You can improve scheduling performance in these ways:

- Reduce network congestion by controlling when the file is delivered
- Keep jobs from being scheduled on a workstation

For the syntax and description of CPUAUTOLNK, refer to *Scheduling End-to-end with Fault Tolerance Capabilities*.

When replanning, the distributed agent can receive and run the Symphony file and report job status back to IBM Workload Scheduler for z/OS only if the workstation is active and linked. From the MODIFYING WORK STATIONS IN THE CURRENT PLAN panel, you can view and modify the status of the fault-tolerant agent. Select option 5.5 from the main menu to display the panel:

```
EQQMWSLL -------- MODIFYING WORK STATIONS IN THE CURRENT PLAN  Row 1 to 8 of 8
Command ===>                                                  Scroll ===> CSR

Enter the row command S to select a work station for modification, or
I to browse system information for the destination. If the work station
is virtual enter the row command  V to vary the global status.

Row Work station               F V L S T R Completed     Active Remaining
cmd name text                  A           oper  dur.    oper   oper  dur.
'   CPUA Workstation 1           N   A C A     0    0.00      0     1    0.08
'   CPUV Workstation 2           N   A C A     0    0.00      0     0    0.00
S   CPU2 Workstation 3           N L A C A     0    0.00      0     0    0.00
'   VWS1 Virtual workstation   Y Y   A C A     0    0.00      0     0    0.00
'   PRT1 Printer pool            N     P A     0    0.00      0     0    0.00
'   SETP Used to prepare JCL     N     G S     0    0.00      0     0    0.00
'   STC1 Started task            N   O C A     1    0.00      0     0    0.00
'   WTO1 Messages                N   A G C     0    0.00      0     0    0.00
****************************** Bottom of data ********************************
```

Figure 277. EQQMWSLL - Modifying work stations in the current plan

In the S column, the possible values for status are the following:

A Active. The workstation is running and scheduling its own plan.

O Offline. The workstation is not running and scheduling its own plan.

The Fully Active (FA) column shows if all the destinations of the virtual workstation are active:

Y All the destinations are active.

N Some or all the destinations are not active.

In the L column, the possible values are the following:

F Fully linked. The workstation is fully linked through its primary connection (either the domain manager or the OPCMASTER, if the fault-tolerant agent is a domain manager) and all secondary connections (the full-status fault-tolerant agents that are in the same domain). You can define a fully linked workstation only if ENABLESWITCHFT is set to YES in the TOPOLOGY statement. Fully linked workstations can be only fault-tolerant agents, domain managers, and standard agents.

L Linked. Communication is established between IBM Workload Scheduler for z/OS and the workstation.

U Unlinked. There is not an established connection to send and exchange events.

Job status includes information such as job started, job run, and job completed. When the new plan is produced, the distributed agents are stopped, and the scheduling on the agents is interrupted. The scheduling is resumed only when the new Symphony file is delivered.

When you send the Symphony file (CPUAUTOLNK=OFF) manually, you must manually link the fault-tolerant agent. Perform the following steps:

1. In the MODIFYING WORK STATIONS IN THE CURRENT PLAN panel (Figure 277), use the S row command to select the fault-tolerant agent.
2. In the MODIFYING A WORK STATION IN THE CURRENT PLAN panel, enter one of the following commands:

```
EQQMWSTP ------- MODIFYING A WORK STATION IN THE CURRENT PLAN -----------------
Command ===>

Select one of the following command:
 L LINK             To send command link work station
 U UNLINK           To send command unlink work station
 S START            To send command start work station
 P STOP             To send command stop work station

Work station          : FMAX        COMPUTER AUTOMATIC FTW
Type                  : Computer    FT Work Station
Status                : Active
Status link           : Linked
```

Figure 278. EQQMWSTP - Modifying the status of a fault-tolerant workstation in the CP

L To link the workstation

U To unlink the workstation

S To start workstation

P To stop workstation

3. The MODIFYING WORK STATION STATUS IN THE CURRENT PLAN panel displays the change.

In some situations the Symphony file in IBM Workload Scheduler is not created. For example, there might be a recovery from a disaster situation. In this example, the new current plan is created, but the Symphony file is not. In this situation, you can keep the current plan up-to-date by selecting the 5 (SYMPHONY RENEW) option from the PRODUCING OPC DAILY PLANS panel.

The following are some other examples about the need of renewing the Symphony file:

- You change the TCP/IP port number on a workstation.
- You modify the CPUREC or DOMREC initialization statements.
- You make changes to the job in the script library EQQSCLIB.
- End-to-end scheduling with fault tolerance capabilities has configuration errors, for example the specified directories do not exist, the file system is full, or the workstation is not correctly defined.

Changing workstation availability

Before IBM Workload Scheduler for z/OS can start an operation, the workstation that it runs on must be available (open and active). If control on servers has been defined for the workstation, servers must be available, too. Select option 5.5 from the main menu to specify the times that a workstation is open for work.

Active and inactive computer workstations

To run work, a computer workstation must be active and open. A workstation is active if the controller can communicate with it. An active computer workstation can be open or closed. A closed computer workstation is not eligible to have work scheduled on it even if the controller can communicate with the workstation. Workstation status can be changed dynamically (either manually, using IBM Workload Scheduler for z/OS panels, or automatically, in response to changes in your systems).

An inactive workstation can have one of the following statuses:

FAILED
The operating system has detected a failure on the system that the workstation is defined on. The workstation status is automatically set to ACTIVE when the system is available again, provided that the controller and tracker stopped correctly and that the WSFAILURE and WSOFFLINE keywords were correctly defined in the JTOPTS initialization statement. You can manually set a computer workstation to status FAILED, using the panels. The WSSTAT command or the EQQUSIN subroutine can be used to report FAILED status for a workstation.

OFFLINE
Communication is lost between the controller and tracker on the system that the workstation represents. This might be because the tracker is not yet started or because it ended abnormally. The scheduler does not take any reroute or restart actions until the time specified for the OFFDELAY initialization statement elapses. The status is automatically set to ACTIVE status when the tracker is started. The WSSTAT command or the EQQUSIN subroutine can be used to report OFFLINE status for a workstation.

UNKNOWN
The scheduler has detected that the workstation is inactive, but no other diagnostic information is available. You can manually reset the workstation to ACTIVE, using the panels, the WSSTAT command, or the EQQUSIN subroutine, or IBM Workload Scheduler for z/OS can do this automatically. A workstation normally connected via XCF, NCF, or TCP/IP will be reported in UNKNOWN status, if the XCF, NCF, or TCP/IP task is not started for the controller. Workstations that specify a user-defined destination ID are set to UNKNOWN status when they are first added to the current plan.

In addition to the workstation status, text that describes the status value can be displayed by IBM Workload Scheduler for z/OS in the current plan panel. The possible status descriptions are:

Waiting for manual intervention
The controller has received an automatic online notification for a workstation previously in offline or failed status.The AVAIL action parameter value specified by the WSFAILURE or WSOFFLINE initialization statement specifies manual activation. If the workstation should be receiving work from the controller, vary the workstation status to ACTIVE from the MODIFYING THE CURRENT PLAN panel.

Waiting for connection
The status of the workstation has been set to ACTIVE, and the controller is waiting for the corresponding tracker to communicate. No operations are started on the workstation until the tracker and the controller synchronize the correct submit position. This condition can identify an error in IBM Workload Scheduler for z/OS configuration. Perhaps the tracker events are not being communicated to the controller. Check that the tracker has either EWSEQNO(n) specified in the EWTROPTS or that an event reader has been started by specifying ERDRTASK(n) in the OPCOPTS for the tracker.

Offline actions pending
An offline notification has been received. The time IBM Workload Scheduler for z/OS has been instructed to wait before performing offline actions has not yet been reached.

Status was set manually
The status of the workstation has been set by a panel user.

Status set by WSSTAT
The workstation status was set as the result of a workstation availability event generated by the WSSTAT TSO command or by the EQQUSIN subroutine.

Status set by EQQUX009
The workstation status was set to the current value from the return code issued by the operation-initiation exit, EQQUX009.

Redirecting work to alternate workstations

The scheduler supports the redirecting of work from one workstation to another. If a workstation becomes inactive, you can specify, for each of its open intervals, an alternate workstation where work will be redirected. At any time, you can manually redirect the work to the workstation by using the MODIFYING THE CURRENT PLAN panel (option 5.5 from the main menu). This function does not apply to either fault-tolerant or virtual workstations.

```
EQQMWSRP ------- MODIFYING A WORK STATION IN THE CURRENT PLAN -----------------
Command ===>

Enter/change data below:
Enter the O command above to modify open time intervals
Enter the V command above to vary workstation status

Work station          : CPU1        Computer Automatic
Type                  : Computer    JOB ability
Status                : Active


REPORTING ATTR     ===> A           A automatic, S manual start and complete
                                    C complete only or N non reporting

CONTROL ON SERVERS ===> Y           Control on parallel servers, Y or N
CONTROL ON R1      ===> N           Control on critical resource R1 , Y or N
CONTROL ON R2      ===> N           Control on critical resource R2 , Y or N
```

Figure 279. EQQMWSRP - Modifying a workstation in the current plan

When you select a workstation to be modified, the current status of the workstation is presented (see Figure 279). In most cases, the workstation is active and no further explanation is required. If the workstation status has been modified manually or if an exception has occurred, status text that describes the current state is also displayed.

If you make changes on the MODIFYING A WORK STATION IN THE CURRENT PLAN panel, the changes take effect when you press PF3 (End). Press PF12 (Cancel) if you do not want to make the typed modifications.

If you need to manually change the status of a workstation, enter V from the MODIFYING A WORK STATION IN THE CURRENT PLAN panel, and the following panel is displayed.

```
EQQMWSVP ----- MODIFYING WORK STATION STATUS IN THE CURRENT PLAN --------------
Command ===>

Enter data below, and issue END command to change the status:

Work station          : CPU1        Computer Automatic
Current Status        : Active

NEW STATUS         ===> _           A active, F failed
                                    O offline
Fail/offline options  :

STARTED OPERATIONS ===> _           R  restart,  L  leave,  E  set to error
                                   (Mandatory value  L  for SA, Dynamic and
                                    Remote Engine work stations)
REROUTE OPERATIONS ===> _           Y  to reroute,  N  to leave operations
                                   (Mandatory value  N  for SA work stations)

ALTERNATE WS NAME  ===> ____        Alternate Work station for reroute
```

Figure 280. EQQMWSVP - Modifying work station status in the current plan

The STARTED OPERATIONS field is always set to L for SA, dynamic, and remote engine work stations. The REROUTE OPERATIONS field is always set to N for SA work stations.

The values you enter on the MODIFYING WORK STATION STATUS IN THE CURRENT PLAN panel determine the effect on the workload. If you modify the workstation status to failed or offline, you must specify what should happen to operations that are already started on the workstation and whether IBM Workload Scheduler for z/OS should reroute operations to an alternate workstation.

Note:

1. Be careful if you specify that operations are to be restarted on an alternate workstation. They might still be running on the original workstation. The scheduler does not know this. You must decide if they can be safely started on the alternate workstation. If you set them to error, you can rerun them after taking any necessary recovery actions; this is a safer option.
2. When you issue END from this panel, the status change takes effect immediately, even if you subsequently issue CANCEL on panel EQQMWSRP.
3. When defining your operations, you can specify that a particular operation should not be redirected under any circumstances.

Figure 281 on page 630 shows how you can adjust the workstation fixed resources and parallel servers for a workstation, and specify an alternate workstation.

```
EQQMWSOL ---------- MODIFYING OPEN TIME INTERVALS IN THE CP -  ROW 1 TO 3 OF 3
Command ===>                                                  Scroll ===> PAGE

Change data in the rows, and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat,  D(nn),DD - Delete

Work station          : CPU1            Main JES processor
Control on servers    : Yes
Control on R1         : No
Control on R2         : No

Row     From             To                 Planned          Modified
cmd     YY/MM/DD HH.MM   YY/MM/DD HH.MM     ps R1 R2 AltWS   ps R1 R2 AltWS
''    03/03/14 00.00   03/03/14 05.59     120 99 99         20 99 99 ____
''    03/03/14 06.00   03/03/14 17.59     120 99 99         10 99 99 CPU2
''    03/03/14 18.00   03/03/14 23.59     120 99 99         20 99 99 ____
****************************** BOTTOM OF DATA ***************************
```

Figure 281. EQQMWSOL - Modifying open time intervals in the CP

You cannot use this panel to make the workstation unavailable: use the panel in Figure 280 on page 629 instead. In practice, setting the number of parallel servers to zero means that operations cannot run on the workstation.

If you add or modify an open interval, ensure that the begin time is the same or later than the current time, otherwise the update is not made.

If you alter the interval details, the altered interval is never replaced by daily planning extend and replan functions. Consider this sequence of events:

1. You modify the number the number of parallel servers between 18.00 and 23.59 on 03/03/14 to 25.
2. You change the database to close CPU1 at 20.00 on 03/03/14.
3. You extend the plan at 15.00.

The result is that the workstation stays open past 20.00, because there is a modified interval that lasts until 23.59. The scheduler considers that it is modified even if you change the number back to the original value.

Changing the status of a system automation workstation

System automation workstations (that is, General automatic workstations with the AUTOMATION option set to YES) can have their status changed similarly to computer automatic workstations. You can see the status of a system automation workstation from the MCP panels in ISPF or from the Dynamic Workload Console.

In ISPF you can see the status in the BROWSING WORK STATION ACTIVITY panel:

```
EQQSWS1L --------------- BROWSING WORK STATION ACTIVITY         Row 1 to 3 of 3
Command ===>                                                   Scroll ===> CSR

For more information, enter any of the row commands below:
 O Open intervals,  S Summary information, I System information

Row Work station               F V L S T R Completed     Active Remaining
cmd name text                  A           oper  dur.    oper   oper  dur.
'   SAUT                         N   O G A     0    0.00      5     3    0.30
'   SAU2                         N   A G A     0    0.00      2     0    0.00
'   SAU3                         N   A G A     0    0.00      2     0    0.00
*******************************Bottom of data*********************************
```

Figure 282. Example of Browsing work station activity panel (EQQSWS1L) with System automation workstations

The status of a System automation workstation can be:

Active Communication with the controller is on.

Failed There was a system failure on the workstation.

Offline
Communication with the controller was lost.

Unknown
The workstation is inactive and the communication with the controller was not started. No other diagnostic information is available.

You can change the status of a system automation workstation in the current plan in one of the following ways:

- With the VARY command from the ISPF MCP panels. For example:
  1. Starting with ISPF fast path 5.5, get to the MODIFYING WORK STATIONS IN THE CURRENT PLAN panel, where a system automation workstation named SAUT is listed among others.
  2. Enter the S row command next to SAUT to display the MODIFYING A WORK STATION IN THE CURRENT PLAN panel for this workstation.

```
EQQMWSLL -------- MODIFYING WORK STATIONS IN THE CURRENT PLAN  Row 1 to 3 of 3
Command ===>                                                  Scroll ===> CSR

Enter the row command S to select a work station for modification, or
I to browse system information for the destination. If the work station
is virtual enter the row command  V to vary the global status.

Row Work station               F V L S T R Completed     Active Remaining
cmd name text                  A           oper  dur.    oper   oper  dur.
S   SAUT SysAutWS               N   A G A     0    0.00      3     0    0.00
'   SETA                         N     G A     0    0.00      0     0    0.00
'   SPAN                         N   A C A     0    0.00      0     0    0.00
****************************** Bottom of data ********************************
```

Figure 283. The Modifying work stations in the current plan panel (EQQMWSLL) with system automation workstation listed

  3. Enter the V command to change the workstation status to OFFLINE.

```
EQQMWSRP ------- MODIFYING A WORK STATION IN THE CURRENT PLAN -----------------
Command ===>V

Enter/change data below:
Enter the O command above to modify open time intervals
Enter the V command above to vary workstation status

Work station          : SAUT
Type                  : General
Status                : Active


REPORTING ATTR     ===> A           A automatic, S manual start and complete
                                    C complete only or N non reporting

CONTROL ON SERVERS ===> Y           Control on parallel servers, Y or N
CONTROL ON R1      ===> N           Control on critical resource R1 , Y or N
CONTROL ON R2      ===> N           Control on critical resource R2 , Y or N
```

Figure 284. The Modifying a work station in the current plan panel (EQQMWSRP) for a system automation workstation

4. Put SAUT offline in the MODIFYING WORK STATION STATUS IN THE CURRENT PLAN panel.

```
EQQMWSVP ------- MODIFYING WORK STATION IN THE CURRENT PLAN -----------------
Command ===>

Enter data below, and issue END command to change the status:

Work station          : SAUT
Current Status        : Active

NEW STATUS:        ===> O           A active, F failed
                                    O offline

Fail/offline options  :

STARTED OPERATIONS ===> L           R restart, L leave, E set to error
                                   (Mandatory value  L  for SA, Dynamic and
                                    Remote Engine work stations)
REROUTE OPERATIONS ===> N           Y to reroute, N to leave operations
                                   (Mandatory value  N  for SA work stations)

ALTERNATE WS NAME  ===> ___         Alternate Work station for reroute
```

Figure 285. The Modifying work station status in the current plan panel (EQQMWSVP) for a system automation workstation

- From the Dynamic Workload Console.
- Using the WSSTAT TSO command.

Remember:

1. The EXECUTE command fails for the operations scheduled on the workstation when it is offline.
2. Rerouting work to alternate workstations is not possible for system automation workstations.

Changing the global status for a virtual workstation

If you need to manually change the global status of a virtual workstation, enter the V row command from the MODIFYING A WORK STATION IN THE CURRENT PLAN panel. The following panel is displayed:

```
EQQMWS1P ----- MODIFYING WORK STATION STATUS IN THE CURRENT PLAN --------------
Command ===>

Enter data below, and issue END command to change the status:

Work station          : VWS1
Current Global Status : Active

NEW STATUS         ===> _          A active, F failed
                                   O offline
Fail/offline options  :

STARTED OPERATIONS ===> _          R  set to ready,  L  leave,  E  set to error
```

Figure 286. EQQMWS1P - Modifying workstation status in the current plan

Changing availability for a virtual destination

About this task

If you need to manually change the status of a virtual destination, follow these steps:

1. Enter the S row command from the MODIFYING A WORK STATION IN THE CURRENT PLAN panel. The following panel is displayed:

```
EQQMWDES --- MODIFYING A VIRTUAL WORKSTATION DESTINATION IN TH Row 1 to 2 of 2
Command ===>                                                 Scroll ===> CSR

Enter the row command S to select a destination for modification, or
I to browse system information for the destination.

Row  Dest.     Status  Extended Status
cmd  Name
'''' ********  A
'''' VDEST2    O
****************************** Bottom of data ********************************
```

Figure 287. EQQMWDES - Modifying a virtual workstation destination status in the CP

2. Enter the S row command. The following panel is displayed:

```
EQQMWSRV --- MODIFYING A VIRTUAL WORKSTATION DESTINATION IN THE CP ------------
Command ===>

Enter/change data below:
Enter the O command above to modify open time intervals
Enter the V command above to vary work station status

Work station          : VWS1
Destination           : VDEST2
Status                : Offline     Waiting for connection


CONTROL ON SERVERS ===> Y           Control on parallel servers, Y or N
CONTROL ON K1      ===> Y           Control on critical resource K1 , Y or N
CONTROL ON K2      ===> Y           Control on critical resource K2 , Y or N
```

Figure 288. EQQMWSRV - Modifying a virtual workstation destination status in the CP

3. Enter the V command. The following panel is displayed:

```
 EQQMWS2P ----- MODIFYING WORK STATION STATUS IN THE CURRENT PLAN --------------
Command ===>

Enter data below, and issue END command to change the status:

Work station          : VWS1
Destination           : VDEST2
Current Status        : Offline

NEW STATUS         ===> _           A active, F failed
                                    O offline
Fail/offline options  :

STARTED OPERATIONS ===> _           R  restart,  L  leave,  E  set to error
```

Figure 289. EQQMWS2P - Modifying workstation status in the current plan

The values you enter on this panel affect the workload. If you change the destination status to F or O, specify also an action for the operations that are already started on the workstation, by using the STARTED OPERATIONS field.

A status change on a virtual destination might cause a change in the global status of the virtual workstation it refers to.

Use this panel to make the virtual destination unavailable. You can set the global status to:

Offline
All the destinations are offline, meaning that communication is lost between the controller and the tracker on the system that the destination represents.

Failed All the destinations are in failed status, meaning that the operating system detected a failure on the system that the destination represents.

Active At least one destination is active.

Inactive
Some destinations are offline and others are in failed status.

Note: When you enter the END command on this panel, the status change is effective immediately, even if you enter the CANCEL command on the EQQMWSRV panel.

To modify open time intervals and adjust the destination fixed resources and parallel servers, enter the O command on the EQQMWSRV panel. The following panel is displayed:

```
EQQMWS1L  MODIFYING OPEN INTERVALS OF A VIRTUAL WS DESTINATION Row 1 to 3 of 3
Command ===>                                                  Scroll ===> CSR

Change data in the rows, and/or enter any of the following row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat,  D(nn),DD - Delete

Virtual work station  : VWS1    Virtual destination  : VDEST2
Control on servers    : Yes
Control on K1         : Yes
Control on K2         : Yes

Row     From             To                 Modified
cmd     YY/MM/DD HH.MM   YY/MM/DD HH.MM     ps    K1 K2
''''    07/06/07 00.00   07/06/07 05.59     65000 99 99
''''    07/06/07 06.00   07/06/07 17.59     65000 99 99
''''    07/06/07 18.00   07/06/07 23.59     65000 99 99
****************************** Bottom of data ********************************
```

Figure 290. EQQMWS1L - Modifying open intervals of a virtual WS destination

To indicate that no operation can run on the selected destination, set the number of parallel servers to 0.

If you alter the interval details, the altered interval is never replaced by daily planning extend and re-plan functions. For example, consider the following sequence of events:

a. You modify the number of parallel servers between 18.00 and 23.59 on 07/06/07 to 25.
b. You change the database to close VDEST2 at 20.00 on 07/06/07.
c. You extend the plan at 15.00.

The result is that the destination stays open after 20.00, because there is a modified interval that lasts until 23.59. The scheduler considers that it is modified even if you change the number back to the original value.

Browsing system information

From the MODIFYING WORK STATIONS IN THE CURRENT PLAN panel, you can browse the system information for the destination of a computer workstation by entering the I row command. This option does not work for fault-tolerant or virtual workstations. However, a *non-local* workstation can be browsed only if it communicates through XCF, NCF, TCP/IP, or the submit/release data set. To browse the system information for the destinations of a virtual workstation, enter the S row command. A list of its destinations is shown. From this list, enter the I row command on the specific destination to retrieve system information.

Killing operations on standard agents

You can use the `kill` command in the MODIFYING WORK STATIONS IN THE CURRENT PLAN (EQQMOPRL) panel to kill jobs running on standard agents that are directly connected to the end-to-end server (`OPCMASTER`).

The same command can be used in the Operation Recovery Info panel (EQQREINP, accessible by using the RI row command in panel EQQMOPRL) to kill recovery jobs.

Note: If you are using the advanced panels, you can also kill jobs by selecting:

- Kill in the TABLE ROW COMMANDS panel (see Figure 264 on page 613).
- Kill in the Action menu in the OPERATIONS IN THE CURRENT PLAN panel (see Figure 268 on page 615).

The killcommand can be issued only on STARTED jobs or recovery jobs that are in the EXECUTING status, so that their JOBID is known. The JOBID is required to identify the operation that is to be killed.

You can issue the kill command on the same job as many times as you need to.

Chapter 30. Handling operations that end in error

This chapter explains how to handle failed operations. You use the ended-in-error list, which is part of the MODIFYING THE CURRENT PLAN (MCP) panel, which was introduced in Chapter 29, "Updating the current plan," on page 587.

When an operation that is under the control of IBM Workload Scheduler for z/OS does not complete successfully, it is reported as having ended in error. The scheduler automatically reports failures of jobs or started tasks, and you can manually report failures of manual operations via IBM Workload Scheduler for z/OS panels. The scheduler keeps a list of all operations that have ended in error. You can display this list using either the MODIFYING THE CURRENT PLAN panel, which lets you take some action on the operation, or the QCP panel, where you can only browse the operation.

When you are using the HANDLING OPERATIONS ENDED IN ERROR panel (the ended-in-error list), you have access to a wide range of options, which include the following:

- Restarting the operation
- Completing or deleting the operation or the occurrence
- Requesting automatic recovery for the operation
- Complete or delete an occurrence group
- Initiating, discarding, or displaying restart and cleanup actions

Note: Because in some cases EQQCLEAN might delete a data set by mistake, it is recommended that you protect critical data sets from deletion by using either the RCLOPTS parameters (DDPROT, DDPRMEM, DSNPROT, DSNPRMEM) or the EQQUXCAT exit.

Figure 291 shows an example of an ended-in-error list, showing the PAYDAILY job having ended with an abend.

```
EQQMEP1L ------ HANDLING OPERATIONS ENDED IN ERROR (left part)  ROW 1 TO 1 OF 1
Command ===>                                                  Scroll ===> PAGE

Scroll right or enter the EXTEND command to get extended row command
information, enter the HIST command to select operation history list, or
enter any of the row commands below:
I,O,J,L,LJ,RC,FSR,FJR,FSC,RI,C,MH,MR,SJR or RER,ARC,WOC,CMP,MOD,DEL,RG,DG,CG

LAYOUT ID          ===> OPCESA__    Change to switch layout id

Cmd Ended    time  Application      ws   no. Jobname  Errc
'' 95/05/01 19.30 PAYDAILY        CPU1  20 PAYDAILY S0C4
****************************** BOTTOM OF DATA ******************************
```

Figure 291. EQQMEP1L- Handling operations ended in error (left part)

Sometimes you might need to restart an operation even though it has completed successfully. See "Restarting an occurrence from the beginning" on page 602 for information on restarting operations that have not failed.

Displaying the ended-in-error list for action

To display the ended-in-error list for action, select option 4 (ERROR HANDLING) from the MODIFYING THE CURRENT PLAN panel. The SPECIFYING ENDED IN ERROR LIST CRITERIA panel is displayed. Specify selection criteria to display only the list items you want to examine.

You can customize the layout of the ended-in-error list to suit your needs, either by selecting one of the installation-defined layouts or by building your own layout. This is described in the following sections.

After you select an error list layout and display your error list, the list is updated with the latest information when you press Enter or any of the PF keys.

Selecting an ended-in-error list layout

When you select the ended-in-error list, you can also define a layout to use for the list. About 90 fields can be displayed in an ended-in-error list (see Appendix F, "Fields displayed in ready and error lists," on page 843). Not all of these can be presented at once in the same ended-in-error list. But you can specify two panels for your layout and switch between these panels using the LEFT and RIGHT commands. Information on the fields that are to be displayed, and the order in which they should be displayed, is kept in a named *ended-in-error list layout*. There might be many different layouts in your installation.

If you have not specified a layout, IBM Workload Scheduler for z/OS displays a list of existing layouts. You can then select a layout from this list. If you want to change the layout of the ended-in-error list, enter the name of another layout in the corresponding field in the ended-in-error list, and IBM Workload Scheduler for z/OS will display the ended-in-error list using the layout you specified. You can get a list of all the ended-in-error list layouts by entering an asterisk (*) in the LAYOUT ID field on the SPECIFYING ENDED IN ERROR LIST CRITERIA panel:

```
EQQMERRP ---------- SPECIFYING ENDED IN ERROR LIST CRITERIA -------------
Command ===>

Specify selection criteria below and press ENTER to create a list
of operations that have ended in error.

LAYOUT ID           ===> OPCESA__        Id of layout, * for a list

JOBNAME             ===> ________
APPLICATION ID      ===> ________________
OWNER ID            ===> ________________
AUTHORITY GROUP ID  ===> ________
WORK STATION NAME   ===> ____
ERROR CODE          ===> ____
GROUP DEFINITION    ===> ________________

CLEAN UP TYPE       ===> ____             Types  list: A M I N or blank
CLEAN UP RESULT     ===> _______        Result list: C E or blank
OP. EXTENDED NAME   ===> ________________________________________________
```

Figure 292. EQQMERRP - Specifying ended in error list criteria

Creating your own ended-in-error list layout

About this task

Ended-in-error list layouts are kept in two ISPF tables: one for your own use and one that contains the installation-defined layouts. Your own version of a layout

overrides the installation layout for your user ID. To change an ended-in-error list layout, select the DEFINE EL option on the MODIFYING THE CURRENT PLAN panel. The scheduler then displays a list of both your own layouts and any installation-defined layouts. From this list, you can create new layouts or select an existing layout to delete, copy, modify, or browse. Modified installation-defined layouts are stored in your own library. You can delete your own layout versions, but you cannot delete an installation-defined layout.

```
EQQELYLL -------------------- ERROR LIST LAYOUTS ------------  ROW 1 TO 2 OF
Command ===>                                                  Scroll ===> PAG

Enter the CREATE command above to create a new layout or
enter any of the row commands below:
B - Browse, C - Copy, D - Delete, M - Modify

Row Layout      Description                       Owner       Last update
cmd id                                                        date       time
'   OPCESA      OPC/ESA standard layout           CONNYL2     92/02/11   04.2
'   CMENH       cm enhancements                   XRAYNER     94/05/02   19.3
****************************** BOTTOM OF DATA ******************************
```

Figure 293. EQQELYLL - Selecting an error list layout

When you modify or create a layout, IBM Workload Scheduler for z/OS presents a list of the available ended-in-error list fields. See Appendix F, "Fields displayed in ready and error lists," on page 843. From this list, you select and order the fields to be contained in the ended-in-error list layout. You can also specify whether the field should be highlighted when IBM Workload Scheduler for z/OS displays it. All the items you select for display are placed as near the top of the selection list as possible.

```
EQQELYCL --------------- CREATING AN ERROR LIST LAYOUT ----  ROW 1 TO 10 OF 9
Command ===>                                                  Scroll ===> CSR

Enter RIGHT or LEFT primary command to switch layout create focus,
indicated by -> adjacent to the layout header.

LAYOUT ID          ===>             Identity of this layout
DESCRIPTION        ===>

Current layout below(Left/Right):
->


Enter S in the S column to select an item as column title.
Order selected items by numbering them 001-120 in the S column.
Enter Y in the H column to highlight a column in the error list.

S  H Column title          Lgth Description of column content
     PR£                    04  Number of predecessor operations
     PS£                    03  No. of parallel servers req. by the op.
     UPR£                   04  Number of uncompleted predecessor op.
     R1£                    03  No. of 1st WS resources req. by the op.
     R2£                    03  No. of 2nd WS resources req. by the op.
     SR£                    03  Special resources referenced by the op.
     SU£                    04  Number of successor operations
     Arrived                08  Operation arrival date actual if arrived
     Ard                    03  Operation arrival day, actual if arrived
     time                   05  Operation arrival time actual if arrived
```

Figure 294. EQQELYCL - Creating an error list layout

To make a set of private layouts available for your colleagues:

1. Create a complete set of layouts. If you want to include a supplied (or old) layout, edit and save it so that it becomes part of your private library.

2. Save (by renaming) the old EQQELDEF member in the common table library.
3. Copy the EQQELOUT member from your ISPF profile library to the common table library, renaming it to EQQELDEF.

Getting rerun or recovery instructions

When an operation fails, the person responsible for rerunning the operation often needs rerun instructions. These instructions can reside either in the job or in the operator instruction database.

To display the instructions for the failing operations, enter the O row command beside those operations on the HANDLING OPERATIONS ENDED IN ERROR panel. To see the job, enter J in the row command field.

Completing an ended-in-error operation

Sometimes you might consider that an operation has ended successfully, even though it is listed as ended-in-error. To set its status to C (complete), enter the C row command beside that operation in the HANDLING OPERATIONS ENDED IN ERROR panel.

Modifying a job that has failed

If the job or started task has failed, you might be able to correct the error by changing the job. You can do this from the panel by entering the J row command beside that operation in the HANDLING OPERATIONS ENDED IN ERROR panel. The scheduler uses the ISPF/PDF editor to display the job for you to edit. In the case of a fault-tolerant agent, you cannot edit the JCL.

The scheduler keeps a separate copy of the job for each run. The job you edit using the J row command is always the job that was used during the failing run of the job (unless you have edited it since). When you end the edit with the END command, IBM Workload Scheduler for z/OS saves the modified job in the JCL repository and re-displays the ended-in-error list.

If the job contained resolved variables and you want to use the same variables again with new values, perhaps from another JCL variable table, delete the job in the ISPF editor and enter the END command. This forces IBM Workload Scheduler for z/OS to use a new copy of the job from EQQJBLIB.

JCL variable values are stored in the JCL record and will be used again if referenced in the current copy of the job. This is useful in situations in which you want to set promptable variables in the READY LIST panel, and then refer to them during the submit phase, probably in a COMP statement. For more information about job tailoring, refer to Chapter 25, “Job tailoring,” on page 487.

Note: Editing and saving the job does not restart the operation.

Restarting ended-in-error operations

About this task

To restart an operation that ended in error:

1. Correct the cause of the error (by modifying the job, for example)

2. Enter the SJR (Simple Job Restart) row command beside the operation in the HANDLING OPERATIONS ENDED IN ERROR panel. Using SJR the operation status is set to Ready. You can use SJR if you do not need specific restart and cleanup actions, such as cleanup or step restart. In this way, you can avoid installing and customizing the data store.

Restarting ended-in-error operations managing cleanup action

About this task

To restart an operation that ended in error performing a cleanup action, enter the RC (restart and cleanup) row command beside that operation in the HANDLING OPERATIONS ENDED IN ERROR panel. The following panel is displayed:

```
EQQRCLSE-------------- OPERATION RESTART AND CLEANUP ------------------------
Option ===>

Application           : PAYDAILY        00/12/13  20.36
Operation             : CPUA 1
Jobname and jobid     : PAYDAILY        JOB01475
Expanded JCL          : N


Clean Up Result       :

Edit JCL              ===> N        Edit JCL before Restart (SR/JR only)


Select one of the following:

1 STEP RESTART                          Request a Step Restart
2 JOB RESTART                           Request a Job  Restart
3 START CLEANUP                         Request Cleanup
4 DISPLAY CLEANUP                       Display Cleanup result
```

Figure 295. EQQRCLSE - Operation restart and cleanup

Note: In the case of a fault-tolerant agent, you cannot restart the operation.

From this panel you choose among the restart and cleanup functions. For step restart, see "Restarting an operation from a certain step" on page 643. Also, refer to Chapter 20, "Restart and cleanup," on page 363 for more information about setting cleanup options.

For job restart or step restart, perform the following steps:

1. Select job restart or step restart for an operation. If cleanup is required, confirm that the cleanup type is other than none.
2. For step restart only, the Step RESTART SELECTION panel is displayed. Enter the GO command, and the MODIFYING THE CLEANUP ACTION panel is displayed.
3. In the MODIFYING THE CLEANUP ACTIONS panel, enter the GO command. If you specified Y (yes) for the Edit JCL option in the OPERATION RESTART AND CLEANUP panel, you can correct the JCL. The CONFIRM RESTART panel, shown in Figure 296 on page 642, is displayed.

The start cleanup options can be requested only for an operation with the cleanup type set to automatic, immediate, or manual. You can also issue a job restart or step restart to perform the cleanup together with the job run instead of separately before the run.

```
EQQMERTP ---------------------- CONFIRM RESTART ------------------------------

Enter Y  in the command field to restart the operation.
The operation status will be set to Ready.
Enter N  to reject the restart request.

Application            : PAYDAILY
Operation              : CPU1 20
Input arrival          : 97/02/13 12.00

Restart step             :
Expanded JCL will be used : N


Error code         ===> S806
User data          ===> ________________
Reason for restart ===> ____________________________________________________
                        ____________________________________________________
                        ____________________________________________________
                        ____________________________________________________
                        ____________________________________________________
Command ===>                                                Scroll ===> PAGE
```

Figure 296. EQQMERTP - Confirm restart

When you restart a job, you can give a reason, which is written to the track log for audit purposes.

When you confirm the restart, IBM Workload Scheduler for z/OS:
1. Resets the operation status to ready.
2. Initiates any cleanup actions.
3. Resubmits the operation when all conditions are met.

If you cancel out of restart and cleanup, the statuses are reset to their original values.

Taking action at the occurrence level

About this task

If the operation cannot be restarted because you need to change the application occurrence, perform the following steps:

1. In the MODIFYING OCCURRENCES IN THE CURRENT PLAN panel (option 5.2), enter the M row command beside the occurrence. The MODIFYING AN OCCURRENCE IN THE PLAN panel is displayed.
2. Change the occurrence, as necessary.
3. In the MODIFYING OCCURRENCES IN THE CURRENT PLAN panel, enter the R row command to rerun the occurrence. The RERUNNING AN OCCURRENCE IN THE CURRENT PLAN panel is displayed.
4. Enter the S row command to set the start point.
5. Issue the RC command, if needed.

Alternatively, you can directly rerun the occurrence without making modifications. Use the R row command in the MODIFYING OCCURRENCES IN THE CURRENT PLAN panel, performing steps 3 to 5.

Handling operations with the OSEQ error code

If IBM Workload Scheduler for z/OS detects the running of a job with the same name as one in the plan, but out of sequence, it gives the operation in the plan an

OSEQ error code, which prevents its running. If the planned operation should be run, use the SJR row command to reset it to waiting status. If the planned operation should not run, delete it.

Restarting an operation from a certain step

About this task

If the job log is available for the operation, you can view the STEP RESTART SELECTION LIST panel, shown in Figure 297.

```
EQQMERSL ---------------- STEP RESTART SELECTION LIST -------- Row 1 to 6 of 6

Primary commands:  GO  - to confirm the selection, END - to save it,
                   CANCEL - to exit without saving, STEP - to show Step
User Selection:    S - Start restart step     E - Last restart step
                   X - Step excluded (simulated flushed)
                   F - Step excluded (simulated with specified RC)
                   I - Step included if inside restart range,
                       otherwise simulated with specified RC.

Application           : APLICSIMONA       01/08/01 15.31
Operation             : CPU  30
Jobname and jobid     : JOBSAMP           JOB00283

Best Restart Step     :         S4       0004
Current selected Step :         S4       0004

Usr Act Rest Step StepName ProcStep PgmName  Step      Step       Compl.
Sel Sel      No                              Type      Status     Code
'   I   Y    0001          S1       MYPROG   Normal    Executed   0004
'   I   Y    0002          S2       IEFBR14  Normal    Executed   0000
'   I   Y    0003          S3       IEFBR14  Normal    Executed   0000
S   S   B    0004          S4       IEFBR15  Normal    Abended    S806
'   I   N    0005          S5       IEFBR14  Normal    Flushed    FLUSH
****************************** Bottom of data ********************************
```

Figure 297. EQQMERSL - Step restart selection list

To restart an operation from a certain step, select the steps that you want to include in the restart:

1. In the Step RESTART SELECTION LIST panel, use the S row command to specify the first step and the E row command for the last step to be executed in the rerun. S defaults to the best step.
2. To have only one step in the rerun, specify S for that step and exclude (X) all the other steps.
3. To include the step if it is inside the restart range, specify I for that step.
4. To set the step completion code to the value that you want, use the F row command. If the step is outside the restart range, use the I row command.

The codes shown in the Rest column (the ability to restart) indicate whether the related steps can be restarted and also can assist you in deciding which step is best. Their meanings are as follows:

Table 41. Codes for the ability to restart a step

Ability-to-Restart Code	**Meaning**
Y (yes)	The step can be selected as the start step
N (no)	The step cannot be selected as the start step
B (best)	The suggested best step to restart

If you decide a step-level restart is not needed after viewing the job, enter the CANCEL command and select option 2 (JOB RESTART) to initiate restart and cleanup actions at the job level.

When you have selected the steps, you see the CONFIRM RESTART panel, shown in Figure 296 on page 642.

Using cleanup options

The cleanup options help you recover z/OS jobs and started tasks by deleting or uncataloging data sets that were created in the failing job, and cataloging data sets that were uncataloged. Without cataloging or deleting data sets, a rerun will fail with an error message saying that a data set already exists, is already cataloged, or is not found.

The scheduler restores the catalog status of data sets from the restart step, up to and including the failing step. It cannot restore the data set itself. The scheduler deletes or uncatalogs the data set if it was created and catalogs it if it was uncataloged.

Restart and cleanup works like this:

1. The scheduler retrieves the job log. Refer to "Selecting a history operation" on page 622 for a full description of job log retrieval.
2. It makes a list of actions to restore the data set status. All data sets defined with DISP=NEW are marked as eligible for potential deletion. The operator can refuse the deletion if this action is not in line with the logic of the job to be restarted.
3. Depending on the kind of restart and cleanup requested (job restart, step restart, or standalone cleanup) and the cleanup type set (automatic, immediate, or manual), the cleanup is completed in one of the following ways:
   - At the time the job is submitted by the controller, a step is added to the JCL before the existing steps.

     The name of the added step is EQQCLEAN. It uses as input the list of data sets to be deleted, cataloged, or uncataloged. This list is obtained from the history of previous runs. To get this history, the controller requests the job log from the data store and then merges the history in the local repository of the controller.
   - A single-step job, created by the controller, is run before the job run.

You can modify or browse cleanup information from a number of places in IBM Workload Scheduler for z/OS. In most cases, you will probably be using the HANDLING OPERATIONS ENDED IN ERROR panel to browse, modify, execute, or discard cleanup actions. When you select a job restart, the MODIFYING CLEANUP ACTIONS panel, shown in Figure 298 on page 645, is displayed.

```
EQQMCMDL ----------------- MODIFYING CLEANUP ACTIONS --------- Row 1 to 1 of 1

Enter GO  to confirm the selection, DISCARD  to exclude all the actions,
      END  to save the selection, CANCEL  to exit without saving.
Row commands:   I  to include the data set in the actions
                X  to exclude the data set from the actions

Application           : PAYDAILY          00/12/13 20.36
Operation             : CPU 1
Jobname and jobid     : PAYDAILY          JOB01475

Row Sel Stepname Data Set name                                  Act Volser  Prot
cmd
''' I   S1       OPCSSD.RITAAUTO.DEC13                        D   OP2802  N
****************************** Bottom of data ********************************
```

Figure 298. EQQMCMDL - Modifying cleanup actions

The scheduler maintains status information to describe the progress of the cleanup action. If you use RC, include the CLN_Ty and CLN_Re status fields in your ended-in-error layout. After the request for cleanup, you also can view the cleanup status for processes not yet completed on the OPERATION RESTART AND CLEANUP panel. The panel displays the status, dynamically updated at each step of the pending process. The statuses can be summarized in the following way:

- Collecting job log data
- JCL tailoring in progress
- Process started

When the cleanup action ends, the Cleanup Result field displays `Completed` or `Ended in Error`.

To view the result of a cleanup action, select option 4 (DISPLAY CLEANUP) on the OPERATION AND RESTART CLEANUP panel. The VIEW CLEANUP RESULTS panel is displayed; it provides the following status information:

- Whether the data set cleanup was completed or ended-in-error
- The job name and job ID that performed the cleanup actions
- Whether IBM Workload Scheduler for z/OS removed the data set from the catalog, uncataloged the data set, or cataloged the data set

Specifying automatic restart for operations that fail

The automatic recovery function lets you specify, for each job or started task, automatic recovery actions for specific failures. You specify recovery actions by including IBM Workload Scheduler for z/OS recovery statements in the job. Automatic recovery parameters that refer to job steps are supported only for jobs that execute on z/OS systems. For detailed information, refer to “Rerunning operations in the history database” on page 620.

If automatic job recovery fails or if a job does not have recovery statements when it fails, you can modify the job and create or change the recovery statements. Use the J row command on the HANDLING OPERATIONS ENDED IN ERROR panel to edit the job. The EDITING JCL FOR AN MVS JOB panel in Figure 299 on page 646 shows some recovery statements (**1** to **3**). The beginning of the recovery statement **1** has been changed from //*% to //*> showing that action has already been taken on the statement.

```
EQQMJCLE ---------------- EDITING JCL FOR AN MVS JOB -------------------------
Command ===>                                                Scroll ===> PAGE

Edit JCL below and press END to finish or CANCEL to reject:

Application           : PAYW              weekly payroll jobs
Operation             : CPU1 20           pay07, pay10, and pay16
Status of operation   : Ended in error    S0C4
Jobname               : PAYWEEK           JCL last updated by: XRAYNER

****** **************************** TOP OF DATA ****************************
000001 //PAYWEEK  JOB  (890122,NOBO),'SAMPLE',
000002 //       MSGCLASS=H,NOTIFY=XRAYNER,CLASS=A
000003 //OUTPUT1  OUTPUT DEST=LAB21,DEFAULT=YES
000004 //*>OPC SCAN
000005 //*       PAYMORE PAYROLL SAMPLE -- PAYWEEK
000006 //*       THIS JOB RUNS PAY07, PAY10, AND PAY16
000007 //*>OPC RECOVER ERRSTEP=PAY07,RESTART=NO                 1
000008 //*%OPC RECOVER ERRSTEP=PAY10,STEPCODE=4,TIME=2000-0400  2
000009 //*%OPC RECOVER ERRSTEP=PAY16,ADDAPPL=PAYRECOV           3
000010 //*
000011 //* OPC MSG:
000012 //* OPC MSG: I  ***  R E C O V E R Y   A C T I O N S   T A K E N  * * *
000013 //PAY07    EXEC PGM=PAY07,PARM='4'
000014 //STEPLIB  DD DSN=XRAYNER.OPC.LOADLIB,DISP=SHR
```

Figure 299. An example of RECOVER statements

You can add further recovery directives to the job, save the job, and initiate recovery by entering the ARC row command beside the failing operation on the HANDLING OPERATIONS ENDED IN ERROR panel.

You can also use the ARC command to initiate recovery outside the hours specified for automatic recovery.

If a request to start automatic recovery is received while a restart and cleanup action is still in progress, the request is denied.

Chapter 31. Monitoring special resources

This chapter shows you how to monitor and change special resources. You can do this using option 7 (SPECRES) in the MODIFYING THE CURRENT PLAN (MCP) panel. This part of the MCP is called the SPECIAL RESOURCE MONITOR.

Understanding special resources

You can use special resources to represent any type of limited resource, such as tape drives, communication lines, or a database. The administrator defines resources using the SPECIAL RESOURCE DEFINITION panel. The SPECIAL RESOURCE DEFINITION panel updates the resource database, which has these details of each resource:

Name The resource name. It can be up to 44 characters.

Availability
Available (Y) or not available (N).

Connected workstations
A list of the workstations where operations can allocate the resource.

Quantity
It can be from 1 to 999999.

Used for
Specifies how IBM Workload Scheduler for z/OS is to use the special resource. Allowed values are:

P Planning

C Control

B Both control and planning

N Neither control nor planning

On-error action
Specifies the action to take if the operation that allocates this resource ends in error (and does not have an overriding keep-on-error specification in the operation definition). Possible values are:

F Free all

FX Free exclusively-held resources

FS Free shared resources

K Keep all

IBM Workload Scheduler for z/OS uses the attribute specified at operation level first. If this is blank, it uses the attribute specified in the resource database. If this is also blank, it uses the ONERROR keyword of the RESOPTS statement.

On Complete
Specifies the value to which the global availability is reset after the operation that uses the resource completes. It can be one of the following:

Y Sets the global availability to Yes.

N Sets the global availability to No.

R Sets the global availability to blank.

Blank Uses the system default, according to the following order:

1. The On Complete value set at operation definition level, if not blank.
2. The On Complete value set at special resource definition level, if not blank.
3. The ONCOMPLETE or DYNONCOMPLETE keyword value, respectively set for the not dynamically added resources or the dynamically added resources, in all the other cases.

Max Usage Limit

Specifies after how many allocations of the special resource, its availability is reset according to the value set for Max Usage Type. An internal usage counter is increased each time an operation allocates the resource. When the internal counter reaches the Max Usage Limit value, the global availability is reset to the value specified with Max Usage Type.

The default value is 0, meaning that no usage counter check is done.

Max Usage Type

Specifies the value to which the global availability is reset when the Max Usage Limit is reached. This value is valid only if the Max Usage Limit is different from 0. Possible values are:

Y Sets the global availability to Yes.

N Sets the global availability to No.

R Sets the global availability to blank.

The quantity, availability, and list of workstations can vary with time. The administrator can associate different *intervals* with the resource.

The administrator also specifies, for each operation, the special resources that it uses: how (shared or exclusive), how many (quantity), and the on-error attribute.

The long-term plan is built without taking the special resources into account, but when you extend the current plan, it schedules operations taking account of all the special resources that are used for planning though the daily planning program does not take manually changed availability, quantity, and deviation into account. This is because they are usually assumed to be temporary changes and the values will be reset to the normal values when, for example, an engineer has repaired a tape unit.

If a special resource is needed in the current plan, IBM Workload Scheduler for z/OS copies the details from the RD database and stores them in the current plan extension data set. These details include the information from the resource database, but also have these overriding (global) fields:

Quantity

1 through 999999 or blank. If you specify a quantity, this overrides the scheduled quantity from the database.

Availability

Y or N or blank. If you specify an availability, this overrides the scheduled availability from the database.

Deviation
-999999 through 999999 or blank. You use the deviation to make a temporary alteration to the scheduled quantity.

You can change the quantity and availability of a special resource, and the connected workstations, using the Special Resource Monitor, which is described in this chapter. You might need to make a resource unavailable (to prevent the submission of all jobs needing a database, if some corruption is suspected), alter the quantity by specifying a deviation (if a tape drive is broken), or change the list of connected workstations (to include a workstation that will take over processing from the normal one).

Other ways of changing resource attributes are:
EQQUSIN subroutine
See *Customization and Tuning*.
SRSTAT command
See "SRSTAT" on page 744.

If the availability of a resource is known to the Resource Object Data Manager (RODM), IBM Workload Scheduler for z/OS can, by subscribing to RODM for that resource, be notified automatically of any changes. This is the best alternative where RODM is installed.

Changes to special resources using any of these methods override the scheduled quantity and availability, but you can at any time reset the values to those specified for the current interval.

These are some examples of how you can use the Monitor:

- Browse the special resources in the current plan, and see how they are allocated.
- Deallocate resources from an operation that is running
- Change the resource requirements of an operation that has not yet run
- See what special resource an operation is waiting for, if its extended status is X (for example, status RX), and see what operations are using it

Example using data sets

The payroll application has many jobs that use the payroll database and therefore must not run together. You could let z/OS resolve the contention problem, using DISP=OLD in the JCL, but a job that waits in z/OS uses a JES initiator and other resources. This can reduce your batch throughput.

To prevent IBM Workload Scheduler for z/OS from scheduling or starting an operation that uses the payroll database when it is already being used, define a resource PAYROLL.DATABASE that represents the payroll database. Give each update job, such as PAYDAILY, exclusive control. Jobs that merely read the database, such as PAYQUERY, can have shared control.

In this case, the resource has a quantity of 1 (there is one database). Specify keep on error, because operators want to correct and resubmit a job without another job taking control of the database in the meantime.

When you extend the current plan, IBM Workload Scheduler for z/OS makes sure the jobs are not scheduled to run together or run at a time when the resources are unavailable. This is how IBM Workload Scheduler for z/OS makes use of the resource at the planning stage. When IBM Workload Scheduler for z/OS is ready

to submit each job, it checks that the resource is available. This is how IBM Workload Scheduler for z/OS makes use of the resource at the control stage.

Specify the resource like this:

Name PAYROLL.DATABASE. Make sure that all operations specify this name exactly.

Quantity
1

Used for
B (both planning and control).

On-error action
Keep all.

Workstations
Connect to all workstations that can use the data set.

Availability
The data set is always available, so no intervals are required.

Example using tape drives

Tape drives are usually owned by only one machine, but they can be used by a started task workstation and a computer workstation on the same machine, so you can, for example, allocate a tape pool to workstations CPU1 and STC1.

Operations that use tapes must allocate them exclusively. Do not let your operations keep this resource on error, because you normally want to release a tape drive for other work while you prepare a rerun of a failed job.

Specify the resource like this:

Name TAPES

Usage Give all operations exclusive allocation.

Quantity
10 (for example). You need not make all the drives available for automatic allocation.

Used for
B (both planning and control).

On-error action
Free all.

Workstations
Connect to all workstations that can use the tapes.

Intervals
Reduce the number available when online systems might need a tape and make the resource unavailable when the workstation is unattended.

Example using communication lines

Lines are often shared between processors and can even be shared between operations. Lines are never allocated by z/OS, because they are owned by a communication controller, but you might want to ration the number of file transfer jobs, for example. If you have a number of lines from New York to London, with a

total capacity of 256 kbaud, you can define a quantity of 256. If you give a file transfer operation exclusive use of 20 units, for example, that gives the lines a limit of 12 file transfers.

You can protect online and voice systems that use the same lines by giving them a shared allocation of, for example, 50 units each. Because they share units, they do not compete with each other; you can have an unlimited number of operations each sharing 50 units, but this limits the quantity available for file transfers to 206.

Specify the resource like this:

Name LINES.TO.LONDON

Quantity
256

Used for
B (both planning and control)

On-error action
Free all

Workstations
Connect to all workstations that can use the lines

Intervals
Reduce the number available at peak hours, which will keep more transfer jobs out and improve the performance of online systems.

How the scheduler uses special resources

The scheduler keeps a record of the state of each resource and its allocation. The scheduler does not know that PAYROLL.DATABASE is a database and it is unaware that TAPES resources are tape drives. Only you know this and you are responsible for making sure that IBM Workload Scheduler for z/OS knows the true availability of the objects that the resources represent.

VSAM will not tell IBM Workload Scheduler for z/OS when the payroll database is opened, and z/OS is not going to tell IBM Workload Scheduler for z/OS when you vary a tape drive offline. This is your responsibility.

The best way to tell IBM Workload Scheduler for z/OS about changes in special resources is through the RODM interface. System components such as AOC/MVS inform RODM about changes to their resources. You can subscribe to RODM updates by setting the RODMTASK keyword on the OPCOPTS initialization statement, and using the RODMOPTS initialization statement. For details about initialization statements, see *Customization and Tuning*.

If you do not have RODM installed, and for resources that RODM does not know about, you can automatically notify IBM Workload Scheduler for z/OS about changes in resources by intercepting messages (NetView can do this) and issuing IBM Workload Scheduler for z/OS SRSTAT command, or calling the EQQUSIN subroutine. If you cannot automatically notify IBM Workload Scheduler for z/OS of a change in resource status, use the Special Resource Monitor.

Using the special resource monitor

Operations hold and release special resources automatically according to their descriptions in the current plan and the resources are available and connected to workstations as scheduled in the current plan. So why do you need to monitor them?

Resources represent something, such as tape drives, and the current plan is built assuming that a certain number of tape drives will be available. If one breaks down and you do not use RODM or otherwise automatically notify IBM Workload Scheduler for z/OS, IBM Workload Scheduler for z/OS no longer has a true picture of the real world—IBM Workload Scheduler for z/OS continues to allocate the broken tape drive to a job that needs one. The job will wait, because z/OS knows that the tape drive is offline. To avoid IBM Workload Scheduler for z/OS starting a job that will only wait and use operating system resources, use the SPECIAL RESOURCE MONITOR panel to reduce the number of tape drives by one. You specify a *deviation* of -1 (minus one) to show that the quantity is reduced. When the engineer hands it back and you vary it online again, reset the deviation.

If a job is waiting with extended status X, it is waiting for a resource. Use the SPECIAL RESOURCE MONITOR panel to check its availability, and see what other operations are using the resource.

Understanding availability intervals

Before you use the Special Resource Monitor, be sure that you understand how availability intervals work. Table 42 shows how planned availability is affected by unplanned events such as input from the Special Resource Monitor, the SRSTAT command, and the EQQUSIN subroutine. Notice that manually altered attributes are honored across an interval boundary and batch planning EXTEND and REPLAN jobs; to make IBM Workload Scheduler for z/OS revert to the scheduled values after a manual alteration, you must reset the attribute, as at 11.20 in Table 42.

Table 42. How attributes are preserved across intervals

	Planned values		**Actual values**			
Start of interval / time of event	Planned quantity	Planned availability	Actual quantity	Actual availability	Deviation	Number available
08.00	8	N	Interval specifies quantity 8, not available			
			8	N	0	0
08.40	You set the availability to Y with the EQQUSIN subroutine					
			8	Y	0	8
09.00	8	N	A new interval specifies the resource unavailable			
			8	Y	0	8
09.40	You set a deviation of -1 with the SRSTAT command					
			8	Y	-1	7
09.41	You set a deviation of -1 with the SRSTAT command					
			8	Y	-2	6
09.42	You set the deviation to -1 with the Special Resource Monitor					
			8	Y	-1	7
10.00	9	Y	Extend CP, and interval specifies 9 available			

Table 42. How attributes are preserved across intervals (continued)

	Planned values		**Actual values**			
			9	Y	-1	8
10.20	You set the quantity to 6 with the SRSTAT command					
			6	Y	-1	5
11.00	8	Y	Interval specifies 8 available			
			6	Y	-1	5
11.20	You reset the quantity with the SRSTAT command					
			8	Y	-1	7

The number available (the last column) is the actual number available for allocation, taking into account the actual quantity, the deviation, and the actual availability.

The three events starting at 09.40 show the difference between altering the deviation with SRSTAT (or a subroutine) and with the Special Resource Monitor. SRSTAT adds the specified deviation to the current deviation, but the panel replaces the current deviation with the value you specify.

If you change values other than the overriding (global) quantity, availability, and deviation, or the values for an interval, you lose the changes at the next daily planning run, but the job issues a warning message about any manually changed values that will be lost. For example, if you change the default quantity (the quantity used where intervals are not specified) in the current plan, this is replaced at the next daily planning run with the value from the database.

Accessing the special resource monitor

About this task

Follow these steps to use the Special Resource Monitor to remove a resource from an operation:

1. From the MODIFYING THE CURRENT PLAN main menu, select option 7 (SPECRES). You see the SPECIFYING RESOURCE MONITOR LIST CRITERIA panel, shown in Figure 300.

```
EQQQMSEP --------- SPECIFYING RESOURCE MONITOR LIST CRITERIA ------------
Command ===>

Specify selection criteria below and press ENTER to create a list.

SPECIAL RESOURCE     ===> PAY*_____________________________________________
SPECRES GROUP ID     ===> ________

Enter either Y  N or leave blank below:

ALLOCATED SHARED     ===> _
WAITING              ===> _
AVAILABLE            ===> Y
```

Figure 300. EQQQMSEP - Specifying resource monitor list criteria

2. Use the panel to limit the resources displayed. The SPECIAL RESOURCE and SPECRES GROUP ID fields can have IBM Workload Scheduler for z/OS filter

characters such as * (asterisk) to specify a range of resources. Specify the values shown, for example, to show all available resources whose names begin with PAY.

3. Press Enter to list the resources. You see the SPECIAL RESOURCE MONITOR panel, shown in Figure 301.

```
EQQQMLSL ----------------- SPECIAL RESOURCE MONITOR ---------  ROW 1 TO 1 OF 1
Command ===>                                                  Scroll ===> PAGE

Enter any of the row commands below:
B - Browse, M - Modify, I - In use list, W - Waiting queue

R Special                                    A RDM Adjust  Used    Used    W
  Resource                                     AQD Qty     Shared  Excl
' PAYROLL.DATABASE                           Y NNN 1       0       0       N
****************************** BOTTOM OF DATA ********************************
```

Figure 301. EQQQMLSL - Special resource monitor

Each resource is described with these fields:

A Availability. Y or N. When a global availability has been set (for example, with the SRSTAT command), this is shown, rather than the value specified for the interval.

RDM RODM can update three resource fields:

- **A** Availability
- **D** Deviation
- **Q** Quantity

The panel shows a separate status for each of the RODM fields:

- **N** Not monitored. The scheduler does not subscribe to RODM for this field.
- **I** Inactive. RODM is inactive, or communication has been lost. The scheduler tries to reconnect every 5 minutes.
- **P** Pending. A status request has been sent to RODM, but no reply has yet been received.
- **A** Active. RODM monitoring is active and has updated the field.

Adjust Qty
The current quantity, taking any deviation into account. When a global quantity has been set (for example, with the SRSTAT command), this is used, rather than the value specified for the interval or the default value.

Used Shared
Quantity allocated as shared.

Used Excl
Quantity allocated as exclusive.

W Indicates that there are operations waiting to allocate the resource (Y), or no waiting operations (N).

The available row commands are:

- **B** Browse the resource.
- **M** Modify the resource.
- **I** Display the operations that have allocated this resource.
- **W** Display the operations that are waiting to allocate this resource.

4. Enter the I row command to see the operations that are using the resource. You see the SPECIAL RESOURCE MONITOR - IN USE LIST panel, shown in Figure 302.

```
EQQQMIML ----------- SPECIAL RESOURCE MONITOR - IN USE LIST -  ROW 1 TO 1 OF 1
Command ===>                                                  Scroll ===> PAGE

Enter any of the row commands below:
S - Select details, D - Delete from list

Special resource : PAYROLL.DATABASE
Text             : serializes access to the Paymore database

Row Actual Start    Operation Jobname  Est   S  Qty    Type
cmd Date     Time   ws    no.          Dur
'' 95/06/09 12.00  CPU1  020 PAYDAILY  0060.00  E  1       X
****************************** BOTTOM OF DATA ******************************
```

Figure 302. EQQQMIML - Special resource monitor - in use list

The operations at the top of the list have been using the resource for the longest time and are more likely to release their allocation soon. The duration helps you estimate when the operations will release their allocation of the resource.

The list has these columns:
- Actual start date and time
- Operation ws (workstation)
- Operation no. (operation number)
- Jobname
- Est Dur (the estimated operation duration)
- S (status of the operation)
- Qty (number allocated to this operation)
- Type (type of allocation: shared (S) or exclusive (X)).

5. Enter the D row command beside the operation to release the resources from the operation.

   Note: This is a *logical* release. In Figure 302, for example, the D command causes PAYDAILY to free IBM Workload Scheduler for z/OS resource PAYROLL.DATABASE, but if its status is S, it can still be writing to the real payroll database.
6. You see the CONFIRMING DELETION OF AN OPERATION FROM QUEUE OR LIST panel. Enter Y to deallocate the resource from the operation.

Looking at the operations waiting for a resource

To see the operations that are waiting for a resource, enter the W row command beside the resource in the SPECIAL RESOURCE MONITOR panel. The following panel is displayed:

```
EQQQMWML ---------- SPECIAL RESOURCE MONITOR - WAITING QUEUE   ROW 1 TO 1 OF 1
Command ===>                                                 Scroll ===> PAGE

Enter any of the row commands below:
S - Select details, D - Delete from queue

Special resource : PAYROLL.DATABASE
Text             : serializes access to the Paymore database

Row Latest Out     Operation Jobname  Pri Qty    Type Reason
cmd Date     Time  ws    no.                      Wait
'' 95/06/08 10.40 CPU1  050 PAYQUERY 5   1      S    *
****************************** BOTTOM OF DATA ******************************
```

Figure 303. EQQQMWML - Special resource monitor - waiting queue

The operations at the top of the list have earlier latest-out times and are therefore more likely to get the resource when a sufficient quantity becomes available. The list has these columns:

- Latest out date and time
- Operation ws (workstation)
- Operation no. (operation number)
- Jobname and priority
- Qty (the amount of the resource that the operation needs)
- Type (type of allocation—shared (S) or exclusive (X))
- Reason Wait (the reason that this operation must wait). It can have these codes:

Code Reason

FEWINF
: According to the values of the LOOKAHEAD initialization parameter and the planned job duration, there will not be enough quantity to satisfy the waiting operation.

INVRES
: The resource is not valid.

NOWSC
: No workstation is connected.

OTHRES
: The operation needs this resource, but is waiting for another special resource.

RODMP
: The scheduler is waiting for a status update from RODM.

TOOFEW
: There is not enough quantity to satisfy the operation that is waiting.

UNAVL
: The resource is not available.

UNAVLF
: According to the values of the LOOKAHEAD initialization parameter and the planned job duration, the resource will not be available for the required time.

*****
: An operation is taking all the resource.

Enter the D row command beside a row to remove the dependency of the operation on the resource so that it can start (but it might be waiting for other resources, too). Do this with care, because the operation might not have access to the resource that it needs to run successfully. In the PAYQUERY example, if you remove the dependency of PAYQUERY on the payroll database resource, the PAYQUERY job will start, but it will wait for the database if it is still allocated to

PAYDAILY. You see the CONFIRMING DELETION OF AN OPERATION FROM QUEUE OR LIST panel. Enter Y to remove the resource dependency from the operation.

Modifying a special resource

From the SPECIAL RESOURCE MONITOR panel (Figure 301 on page 654), you can browse or modify special resource details using the B or M row commands. To modify a resource, enter the M row command beside a resource. You see the MODIFYING A SPECIAL RESOURCE panel, shown in Figure 304.

```
EQQQMMOP --------------- MODIFYING A SPECIAL RESOURCE -------------------
Option ===>

Select one of the following:

1 INTERVALS  - Specify intervals
2 WS         - Modify default connected work stations

Special resource      : TAPES
Text                  : tape drives on CPU1 and STC1
Specres group id      : SAMPLE
Hiperbatch         ===> No                                Usage Counter :  1

USED FOR           ===> B       Planning and control C , P , B or N
ON ERROR           ===> F_      On error action F, FX, FS, K, or blank
DEVIATION          ===> _______ Number to deviate -999999 to 999999 or blank  1
AVAILABLE          ===> _       Global availability Y or N or blank           2
QUANTITY           ===> ______  Global quantity 1 to 999999 or blank          3
ON COMPLETE        ===> _       On Complete action Y, N, R, or blank
MAX USAGE LIMIT    ===> 0_____  Max number of allocations before usage reset
MAX USAGE TYPE     ===> R       Status change type Y, N or R

Defaults
  QUANTITY         ===> 8_____  Number available 1-999999
  AVAILABLE        ===> Y       Available Y or N

Active LIFESPAN:       Action=      Expiration Date=         ( 4 )
Last updated by XRAYNER  on 06/03/06 at 19.08  Event Change  ( 5 )
```

Figure 304. EQQQMMOP - Modifying a special resource

This is similar to the SPECIAL RESOURCE DEFINITION panel, except that here you are *not* updating the RESOURCE DESCRIPTION database. When you change resource details with the MCP Resource Monitor, you are updating the current plan resource information, which is stored in the current plan extension (CX) data set.

That is why this panel has extra fields that are not present in the SPECIAL RESOURCE DEFINITION panel:

- DEVIATION (**1**)
- AVAILABLE (**2**)
- QUANTITY (**3**)
- Active LIFESPAN (**4**)
- The reason that caused the global availability to be reset, Event Change in this example (**5**)

If no change has been made to the current plan, DEVIATION is zero or blank (no deviation) and AVAILABLE and QUANTITY are blank (they are specified in the current interval data, if any, or take the default value). If you have changed these fields, either with this panel, with the SRSTAT command, or with the EQQUSIN

subroutine, the deviation is added to the quantity to give the actual quantity available and the changed availability overrides the scheduled availability until it is reset (set to blank).

Note: The resource details are retained in the current plan as long as any of the fields **1** to **3** are set (QUANTITY or AVAILABILITY are non-blank, or DEVIATION is not zero or blank). If you set TAPES unavailable, for example, using field **2**, TAPES remains unavailable indefinitely, past daily planning EXTENDs and REPLANs, for weeks or even years. You must set them to blank (or, in the case of deviation, to zero) manually for the database values to take effect. When you change other fields on the panel, such as the default quantity, the value will be replaced by the value from the database the next time a daily planning EXTEND or REPLAN is run. Daily planning issues a warning message when it replaces a manually changed value with a value from the database.

The **Active LIFESPAN** line of the MODIFYING A SPECIAL RESOURCE panel in Figure 304 on page 657 indicates whether there is a pending action about the global availability of the resource. It has the following format:

```
Active LIFESPAN:  Action = ACTION_TYPE  Expiration Date= EXPIRATION_DATE
```

ACTION_TYPE
The action taken to set the global availability when the expiration time is reached. It can be one of the following values:

Y Sets the global availability to Yes.

N Sets the global availability to No.

R Sets the global availability to blank.

Blank No action taken.

EXPIRATION_DATE
The date and time when the global availability of the resource will be changed.

The last line of the MODIFYING A SPECIAL RESOURCE panel is **Last Updated by**, showing how the resource came to be in the current plan and the reason that caused the global availability to be reset. The **Last Updated by** line has the following format:

```
Last updated by: USERID at DATE on TIME   GlobalAvailChangeReason
```

USERID
Who or how the resource was added. The resource details might have been added during batch daily planning because a planned operation references the resource. If there have been no manual alterations to the resource, this shows who last updated the database record.

If the resource details have been changed with the SRSTAT command, this shows who issued the command.

If it is not possible to identify the user who changed the resource (for example, because the resource was added to the plan by a batch daily planning program), this shows the process that changed the occurrence:

DYNADD
Batch daily planning dynamically added the resource to the plan, because an operation referenced it, but the resource is not in the database.

DSPADD
Batch daily planning dynamically copied the resource to the plan, because an operation referenced it (the resource is in the database).

OPC
An internal process, generated for example by the On Complete action, changed the resource in the plan.

DATE and TIME
The date and time when the resource was last updated.

GLOBALAVAILCHANGEREASON
The reason that caused the global availability of the resource to be changed. Possible values are:

Event Change
A special resource event occurred. Events are generated when you issue an SRSTAT command or you invoke a program such as, for example, EQQUSIN or when data set triggering is active.

Max Usage Limit Change
The maximum usage limit was reached.

LIFESPAN Change
A LIFESPAN active condition expired. LIFESPAN active conditions are generated when you issue an SRSTAT command with the LIFESPAN parameter or when data set triggering table definitions use the LIFESPAN parameter.

Blank The global availability was either not changed or changed through a panel.

To change the intervals, select option 1 (Intervals). The following panel is displayed:

```
EQQQDIML -------- MODIFYING INTERVALS FOR A SPECIAL RESOURCE   ROW 1 TO 4 OF 4
Command ===>                                                  Scroll ===> PAGE

Enter any of the row commands below:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete, or,
S - Work stations

Special resource : TAPES
Text             : tape drives on CPU1 and STC1

Row Date           From  To    Qty    A
cmd                Time  Time
'' 95/06/10______ 00.00 07.59 8_____ Y
'' 95/06/10______ 08.00 22.00 6_____ Y
'' 95/06/10______ 22.01 23.59 8_____ Y
'' 95/06/11______ 00.00 07.59 8_____ Y

****************************** BOTTOM OF DATA ******************************
```

Figure 305. EQQQDIML - Modifying intervals for a special resource

When you change interval data in the current plan, this is not replaced by values from the database when you next run daily planning; a manually altered interval remains in the plan.

To change the workstations where operations can allocate the resource, enter the S row command beside the interval. You see the MODIFYING CONNECTED WORKSTATIONS FOR A SPECIAL RESOURCE panel, shown in Figure 306 on page 660

page 662.

```
EQQQDWML - MODIFYING CONNECTED WORK STATIONS FOR A SPECIAL RE  ROW 1 TO 2 OF 2
Command ===>                                                  Scroll ===> PAGE

Enter/Change data in the rows, and/or enter any of the following
row commands:
I(nn) - Insert, R(nn),RR(nn) - Repeat, D(nn),DD - Delete

Special resource : TAPES
Text             : tape drives on CPU1 and STC1
Interval         : 95/06/10 from 08.00 to 22.00

Row Ws
cmd
'' CPU1
'' STC1
****************************** BOTTOM OF DATA ******************************
```

Figure 306. EQQQDWML - Modifying connected workstations for a special resource

Change the connected workstations as required and press PF3 (End).

Chapter 32. Browsing a job log with IBM Tivoli Output Manager

If you run IBM Tivoli Output Manager Version 3.0 or later in your enterprise, you can use it to view the job logs of operations run with IBM Workload Scheduler for z/OS.

To do so, enter the `Browse joblog via ITOM (LJ)` command that is available in the ISPF panels where the `Browse joblog (L)` command is available. The panels are those related to browsing or modifying operations in the current plan; that is:

- MODIFYING OPERATIONS IN THE CURRENT PLAN (EQQMMOPL, EQQMOPRL, and EQQMOPRR)
- OPERATIONS HISTORY LIST (EQQHISTL)
- HANDLING OPERATIONS ENDED IN ERROR (EQQMEE1L, EQQMEE2L, EQQMEP1L, and EQQMEP2L)
- LIST DEPENDENCY STATUS CHANGE (EQQMOSTL)
- RERUNNING AN OCCURRENCE IN THE CURRENT PLAN (EQQMROCL)
- OPERATIONS IN THE CURRENT PLAN (EQQMOPRV or EQQSRCLP)
- OPERATION IN THE CURRENT PLAN (EQQSOPSD - Operation menu)

Attention: If Tivoli Output Manager is not installed in your system, or if it is incorrectly configured, the following message is displayed in the panel where you launched the LJ command:

`CALL OF ITOM INSTANCE` *`ITOMINST`* `HAS FAILED.`

where *ITOMINST* is the name of the command that starts Tivoli Output Manager in your environment.

To view a job log with Tivoli Output Manager:

1. Enter the LJ command next to an operation listed in one of the panels mentioned above.

   The following Tivoli Output Manager window is displayed.

```
 IBM Tivoli Output Manager - Search for Archived Sysouts

Command ===> _____________________________________________________________
                                                          More:          +
 Job Name  . . . __________
 Sysout Class  . _____________________________________________
 Archive Name  . DEVAPP 020 1311050201                        |
 User ID . . . . __________

 Exceptions  . . ___                  (Yes, No, or blank)

 After Date  . . _____________        (YYYY/MM/DD, Today, T-nnnn)
 Before Date . . _____________        (YYYY/MM/DD, Today, T-nnnn)

 After Time  . . __________           (HH:MM:SS)
 Before Time . . __________           (HH:MM:SS)

 Save criteria?  ___  (Yes/No)

 F1=Help       F3=Exit       F7=Bkwd       F8=Fwd       F10=Left
F11=Right     F12=Cancel
```

Figure 307. IBM Tivoli Output Manager - Search for Archived Sysouts.

where the Archive Name field shows the string that identifies the requested job log in the form *application_ID operation_number input_arrival* (for example, DEVAPP 020 1311050201).

2. Press Enter.

   The next window displays all the logs available for that operation.

```
 File    Options    Search    Help
------------------------------------------------------------------------------
               IBM Tivoli Output Manager - Archived sysouts           TOM301DB
 Command ===> _____________________________________________ SCROLL ===> PAGE
                                                                      1/2
 Cmd   Archive name                Job Name  Job ID    Archive Time
 ____  DEVAPP 020 1311050201       JOBSAMPL  JOB02686  2013 11/22 17:37:01
 ____  DEVAPP 020 1311050201       JOBSAMPL  JOB02685  2013 11/22 17:36:09

******************************************************************************
```

Figure 308. IBM Tivoli Output Manager - Archived Sysouts.

3. There are several options for viewing a job log. The B (Browse) command is used in this example:

```
 File    Options    Search    Help
------------------------------------------------------------------------------
               IBM Tivoli Output Manager - Archived sysouts           TOM301DB
 Command ===> _____________________________________________ SCROLL ===> PAGE
                                                                      1/2
 Cmd   Archive name                Job Name  Job ID    Archive Time
 _B__  DEVAPP 020 1311050201       JOBSAMPL  JOB02686  2013 11/22 17:37:01
 ____  DEVAPP 020 1311050201       JOBSAMPL  JOB02685  2013 11/22 17:36:09

******************************************************************************
```

Figure 309. Choosing an archived sysout for viewing.

Entering B next to the chosen archive name and pressing Enter displays the job log as shown here:

```
 File    Options    Help
-------------------------------------------------------------------------------
BROWSE    DEVAPP 020 1311050201 >  JOBSAMPL JOB02686 JES2 JESMSGLG    Page 1
Command ===> ____________________________________________ SCROLL ===> PAGE
************************************ Top of Data ****************************
1                    J E S 2  J O B  L O G  --  S Y S T E M  E S 5 4 -- N O D
0
 17.37.00 JOB02686 ---- FRIDAY,     22 NOV 2013 ----
 17.37.00 JOB02686  IRR010I  USERID RACFID2  IS ASSIGNED TO THIS JOB.
 17.37.01 JOB02686  ICH70001I RACFID2  LAST ACCESS AT 17:36:07 ON FRIDAY, NOVEM
 17.37.01 JOB02686  $HASP373 JOBSAMPL  STARTED - INIT 4   - CLASS X - SYS ES54
 17.37.01 JOB02686  IES403I JOBSAMPL - STARTED - TIME=17.37.01
 17.37.01 JOB02686  EQQCN00I START CLEANUP AND/OR RET-CODE SIMULATION PROCESS(E
 17.37.01 JOB02686  EQQCN18I SNUM STEPNAME PROCNAME RC
 17.37.01 JOB02686  EQQCN02I 002           S1       0000
 17.37.01 JOB02686  EQQCN99I CLEANUP AND/OR RET-CODE SIMULATION PROCESS(ES) END
 17.37.01 JOB02686  -                                          --TIMINGS (MINS.)
 17.37.01 JOB02686  -JOBNAME  STEPNAME PROCSTEP    RC   EXCP    CPU    SRB  CLO
 17.37.01 JOB02686  -JOBSAMPL EQQCLEAN EQQCLEAN    00     48    .00    .00    .
 17.37.01 JOB02686  -JOBSAMPL          S1       FLUSH      0    .00    .00    .
 17.37.01 JOB02686  CSV003I  REQUESTED MODULE IEFBR15  NOT FOUND
 17.37.01 JOB02686  CSV028I  ABEND806-04  JOBNAME=JOBSAMPL  STEPNAME=S2
 17.37.01 JOB02686  IEA995I  SYMPTOM DUMP OUTPUT  932
    932             SYSTEM COMPLETION CODE=806  REASON CODE=00000004
    932              TIME=17.37.01  SEQ=02429  CPU=0000  ASID=0032
    932              PSW AT TIME OF ERROR  070C1000   813D7120  ILC 2  INTC 0D
    932                NO ACTIVE MODULE FOUND
    932                NAME=UNKNOWN
    932                DATA AT PSW  013D711A - 8400181E  0A0D18FB  180C181D
    932                GR 0: 00001F00   1: 84806000
 F1=Help    F3=Exit    F4=Mark    F5=Rfind   F6=Goto    F7=Up      F8=Down
F10=Left   F11=Right  F12=Cancel
```

Figure 310. Viewing the selected job log.

The integration between IBM Workload Scheduler for z/OS and Tivoli Output Manager is based on a string made up by the following data that identify an operation in IBM Workload Scheduler for z/OS:

- Application ID
- Operation number
- Input arrival date and time

To set up the integration, you must complete the configuration steps described in the next sections.

Configuring IBM Workload Scheduler for z/OS

To enable IBM Workload Scheduler for z/OS to integrate with Tivoli Output Manager, run the following steps:

1. Set the ITOM keyword of the JTOPTS initialization statement to YES.

   With this configuration setup, IBM Workload Scheduler for z/OS inserts a particular string in the log of every operation. The string contains a `><IWS OCCURRENCE` heading followed by this information:

   - ID of the application
   - Number of the operation
   - Input arrival date and time

   For example:

```
//TWSEF020 JOB ACCT,IWS,CLASS=A,MSGCLASS=Q
//*><IWS OCCURRENCE-->DEVAPP 020 1311050201
```

Tivoli Output Manager then locates this string in the IBM Workload Scheduler for z/OS job log and uses the information (DEVAPP 020 1311050201) as an Output Manager archive name.

2. Locate the EQQTOMRU CLIST in the SEQQCLIST product library and check that the value of the ITOMINST keyword matches the name of the command used to start Tivoli Output Manager in your environment. The default value in the CLIST is BJTUI. If you use a different command to start Tivoli Output Manager, replace string BJTUI with that command.

```
ADDRESS "ISPEXEC"                       /* ISPF ENVIRONMENT          */
"CONTROL ERRORS RETURN"                 /* HANDLE ALL ERRORS MYSELF  */
/**/
ITOMINST='BJTUI'                        /* <---CUSTOMIZE             */
/**/
ADDRESS ISPEXEC 'VGET (ITOMOP ITOMADI ITOMOPN ITOMIAD ITOMIAT) SHARED'
ADDRESS ISPEXEC 'VGET (ZSCREEN '
TABLE = "$ITOMPR"!!ZSCREEN
TWSVARS = 'ITOMADI ITOMOPN ITOMIAD ITOMIAT'
```

Figure 311. The ITOMINST keyword of the EQQTOMRU CLIST.

Configuring the Job Completion Checker (JCC)

If you use the Job Completion Checker (JCC) subtask, you must make sure that, if the SYSOUTS are first processed by JCC, they are then passed on to Tivoli Output Manager.

To this effect, verify (and re-configure if necessary) the following two parameters of the JCCOPTS initialization statement (described in *IBM Workload Scheduler for z/OS: Customization and Tuning*):

CHKCLASS
Must not include the SYSOUT classes specified in the Tivoli Output Manager Selector Rule dialog.

SYSOUTDISP
Must be set to either H*x* or R*x*. After being processed by JCC, the SYSOUTS are requeued to one of the classes defined for Tivoli Output Manager.

For example:

```
JCCOPTS   CHKCLASS(ABF)
          ...
          SYSOUTDISP(RQ)
```

Configuring IBM Tivoli Output Manager to browse job logs for z/OS operations

To view the job logs for the z/OS operations that you run with IBM Workload Scheduler for z/OS, configure Tivoli Output Manager as described in:

- "Configuring by using the BJT@UX01 exit" on page 665
- "Configuring by using the TPL rules" on page 667

Configuring by using the BJT@UX01 exit

To enable the integration between IBM Workload Scheduler for z/OS and Tivoli Output Manager, make sure that PTF UI13683 for APAR PI07423: INTEGRATION ENHANCEMENTS FOR ISPF INTERFACE is installed on Tivoli Output Manager. This PTF provides enhancements to the Tivoli Output Manager ISPF interface to facilitate the passing of parameters by using ISPF variables.

To configure Tivoli Output Manager to capture the logs (sysouts in Tivoli Output Manager terminology) of z/OS operations run by IBM Workload Scheduler for z/OS, perform the following steps:

1. Use the BJTRXASM sample (supplied with Tivoli Output Manager) to linkedit exit BJT@UX01. The exit requires no additional customization.

   Exit BJT@UX01 drives the integration between Tivoli Output Manager and the scheduler (exit EQQUX001 is no longer used for this purpose). Its function is to locate the `><TWS OCCURRENCE` heading in the IBM Workload Scheduler for z/OS job log and use the string that follows (*application_ID*, *operation_number*, *input_arrival*) as an Output Manager archive name.
2. Concatenate the library that contains the load module for BJT@UX01 in the steplib of the Tivoli Output Manager started task
3. Start the Tivoli Output Manager `Administrative Functions` dialog in ISPF and enter A (Archive attributes).
4. Define an archive attribute by selecting `New` in the `File` action bar choice. Make sure that the Archive Mask allows the Tivoli Output Manager started task to WRITE these data set names and that your user ID has the ability to READ them. For example:

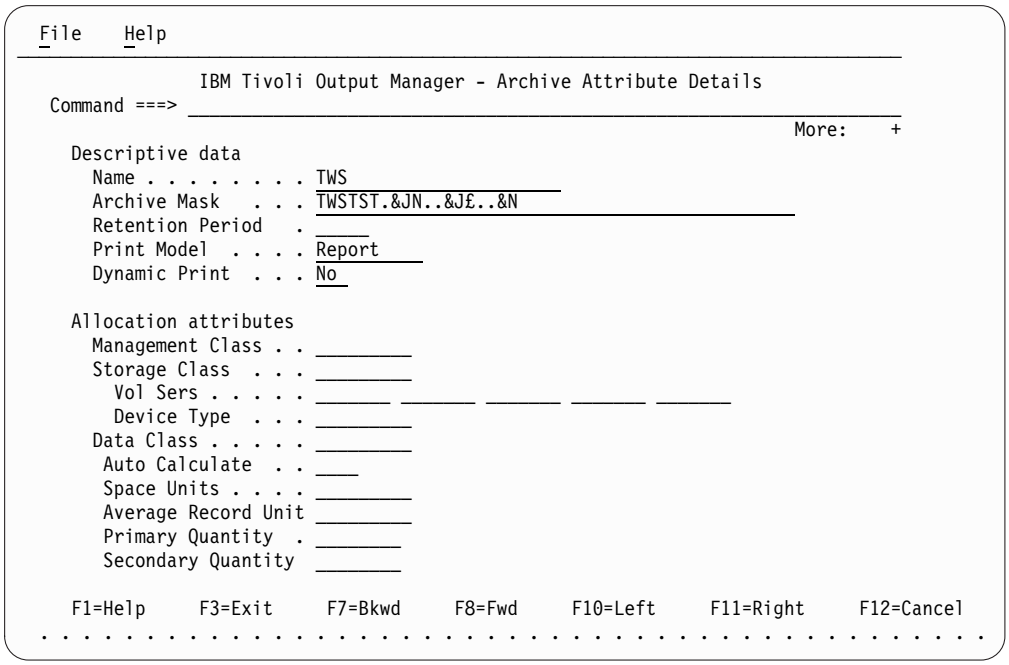


Figure 312. IBM Tivoli Output Manager - Defining an archive attribute.

5. Go back to the `Administrative Functions` dialog and enter `S` (Selector rules). Then:
   a. Define a selector rule and link it to the archive attribute by selecting the `Link` action bar choice.
   b. Set the status to `Enabled`.

c. Specify the IBM Workload Scheduler for z/OS SYSOUT classes that are to be processed by IBM Tivoli Output Manager.

d. Select (/) Processing Options.

For example:

```
File  Link   Help
──────────────────────────────────────────────────────────────────────────────
                    IBM Tivoli Output Manager - Selector Rule
 Command ===> ____________________________________________________________
                                                                    More:    +
    Selector Name . TWS________________
     Status . . . . Enabled
     Archive Attr:  TWS
    Selection criteria
     SYSOUT Class  . CDEQ_____________________________________
     Destination   . ________________________
     Writer  . . . . ___________
     Forms   . . . . ___________
     Job Type  . . . All
     JES Queue   . . All

    _   Advanced Selection criteria
    /   Processing Options
    _   TPL Rules

     F1=Help     F3=Exit     F7=Bkwd     F8=Fwd     F10=Left     F11=Right     F12=Cancel
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
```

Figure 313. IBM Tivoli Output Manager - Defining a selector rule and linking it to the archive attribute.

6. In the Processing options dialog, specify Yes in the Combine SYSOUT field and User exit in the Archive Name rule source field. For example:

```
File    Help
──────────────────────────────────────────────────────────────────────────────
                    IBM Tivoli Output Manager - Processing options
 Command ===> ____________________________________________________________
                                                                    More:    +
     Selector Name . TWS________________
    Processing Options
      Combine SYSOUT. Yes
      Exists . . . .  Extend
      Line Limit  . . 0
      Page length . . 0
      Archive Name rule source . . . . User exit  Escape Char .  $

                     Normal               Error                Line Limit
    Disposition . .  Delete               Hold                 Hold
    Class   . . . .  _                    _                    _
    Destination . .  ____________________ ____________________ ____________________
    Form. . . . . .  ________             ________             ________
    Writer. . . . .  ________             ________             ________


     F1=Help     F3=Exit     F7=Bkwd     F8=Fwd     F10=Left     F11=Right     F12=Cancel
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
```

Figure 314. IBM Tivoli Output Manager - Specifying processing options.

7. Save your changes and return to the list of selector rules. The top level selector rule you just defined is now eligible to process any job log generated for z/OS operations by IBM Workload Scheduler for z/OS.
8. If you want to continue to have the z/OS job logs processed into the IBM Workload Scheduler for z/OS data store, proceed to "Configuring IBM Tivoli Output Manager for data store" on page 672.

Otherwise, enter the ACT primary command to activate your changes. The Tivoli Output Manager started task is now ready to capture the z/OS job logs.

Configuring by using the TPL rules

To enable the integration between IBM Workload Scheduler for z/OS and Tivoli Output Manager, make sure that you have:

- Installed PTF UI13683 for APAR PI07423: INTEGRATION ENHANCEMENTS FOR ISPF INTERFACE on Tivoli Output Manager. This PTF provides enhancements to the Tivoli Output Manager ISPF interface to facilitate the passing of parameters by using ISPF variables.
- Installed PTF UI25172 for APAR PI21174 on Tivoli Output Manager.

To configure Tivoli Output Manager to capture the logs (sysouts in Tivoli Output Manager terminology) of z/OS operations run by IBM Workload Scheduler for z/OS, perform the following steps:

1. Start the Tivoli Output Manager Administrative Functions dialog in ISPF and enter A (Archive attributes).
2. Define an archive attribute by selecting New in the File action bar choice. Make sure that the Archive Mask allows the Tivoli Output Manager started task to WRITE these data set names and that your user ID has the ability to READ them. For example:

```
 File    Help
──────────────────────────────────────────────────────────────────────────────
               IBM Tivoli Output Manager - Archive Attribute Details
 Command ===> ____________________________________________________________
                                                                More:    +
   Descriptive data
     Name . . . . . . . . IWS
     Archive Mask   . . . TWSTST.&JN..&J£..&N
     Retention Period   . _____
     Print Model  . . . . Report
     Dynamic Print  . . . No

   Allocation attributes
     Management Class . . _________
     Storage Class  . . . _________
       Vol Sers . . . . . _______ _______ _______ _______ _______
       Device Type  . . . _________
     Data Class . . . . . _________
      Auto Calculate  . . ____
      Space Units . . . . _________
      Average Record Unit _________
      Primary Quantity  . ________
      Secondary Quantity  ________

   F1=Help     F3=Exit     F7=Bkwd     F8=Fwd     F10=Left     F11=Right     F12=Cancel
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
```

Figure 315. IBM Tivoli Output Manager - Defining an archive attribute.

3. Go back to the Administrative Functions dialog and enter T (TPL rules). Then, depending on the code page you are using, define a TPL rule as follows (in this example, the code page IBM-1144 is applied).

   Note: For detailed information about special characters and their code pages, see *IBM Tivoli Output Manager for z/OS: Administrator's Guide*

```
when
  match ".*>< IWS OCCURRENCE --> (ŸA-Z0-9§£$"à1,16⌂) (ççdà3⌂) (ççdà10⌂)
then
begin
  set arcname = "&1 &2 &3";
end
```

4. Go back to the Administrative Functions dialog and enter S (Selector rules). Then:
   a. Define a selector rule and link it to the archive attribute by selecting the Link action bar choice.
   b. Set the status to Enabled.
   c. Specify the IBM Workload Scheduler for z/OS SYSOUT classes that are to be processed by Tivoli Output Manager. For example:

```
File  Link   Help
──────────────────────────────────────────────────────────────────────────────
                    IBM Tivoli Output Manager - Selector Rule
 Command ===> ____________________________________________________________
                                                                    More:    +
    Selector Name . EQQ zOS Jobs______________
     Status . . . . Enabled___
     Archive Attr:  IWSz
    Selection criteria
     SYSOUT Class  . E_____________________________________
     Destination   . ____________________
     Writer  . . . . __________
     Forms   . . . . __________
     Job Type  . . . Batch___
     JES Queue   . . All____

  _   Advanced Selection criteria
  _   Processing Options
  _   TPL Rules

   F1=Help     F3=Exit     F7=Bkwd     F8=Fwd     F10=Left     F11=Right     F12=Cancel
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
```

Figure 316. IBM Tivoli Output Manager - Defining a selector rule.

   d. Define a sub-selector by entering the ss command next to the selector you have just defined, and link it to the archive attribute by selecting the Link action bar choice.
   e. Set the status to Enabled.
   f. Specify the IBM Workload Scheduler for z/OS SYSOUT classes that are to be processed by Tivoli Output Manager. For example:

```
File  Link   Help
──────────────────────────────────────────────────────────────────────────
                  IBM Tivoli Output Manager - Subselector Rule
 Command ===> ____________________________________________________________

 Subelector . . JESDS            Parent EQQ zOS Jobs
 Status . . . . Enabled                 Enabled
 Archive Attr . TWsz                    IWSz
 Selection criteria                  From parent
   Parent SYSOUT . E
   SYSOUT Class  . E
   Job Type  . . . Batch          Batch
   Job Name  . . . _________
   Destination   . ____________
   Form  . . . . . _________

   Writer  . . . . _________
   Archive name  . ____________________________

  _   Advanced Selection criteria
  _   Processing Options
  _   TPL Rules

   F1=Help     F3=Exit     F7=Bkwd     F8=Fwd     F10=Left     F11=Right     F12=Cancel
. . . . . .
```

Figure 317. IBM Tivoli Output Manager - Defining a sub-selector rule.

g. Select (/) `Advanced selection criteria` and set the Step Name to `JES2`, DD Name to `JES*`, and JES Queue to `All`, as follows:

```
File    Help
──────────────────────────────────────────────────────────────────────────
                  IBM Tivoli Output Manager - Advanced Selection
 Command ===> ____________________________________________________________
                                                                    More:    +
 Subselector . . JESDS            Parent EQQ zOS Jobs

 Selection criteria                          From parent
   Job Class  . .  ____________________________________
   Proc Step Name. ________
   Step Name . . . JES2____
   DDName. . . . . JES*____
   JES Queue  . .  All _____
   User Id . . . . ________
   Prmode  . . . . ________
   FCB  . ____
   UCS  . ____
   Flash . . . . . _____

   Account1 _________  Account2 _________  Account3 _________
   Account4 _________  Account5 _________  Account6 _________
   Account7 _________  Account8 _________
   Programmer Name ____________________

   F1=Help     F3=Exit     F7=Bkwd     F8=Fwd     F10=Left     F11=Right     F12=Cancel
. . . . . .
```

Figure 318. IBM Tivoli Output Manager - Specifying advanced options for the sub-selector.

h. Select (/) `TPL Rules` and add the TPL rule that you have defined.

5. Save your changes and return to the list of selector rules. The top level selector rule you just defined is now eligible to process any job log generated for z/OS operations by IBM Workload Scheduler for z/OS.
6. If you want to continue to have the z/OS job logs processed into the IBM Workload Scheduler for z/OS data store, proceed to "Configuring IBM Tivoli Output Manager for data store" on page 672.

Otherwise, enter the ACT primary command to activate your changes. The Tivoli Output Manager started task is now ready to capture the z/OS job logs.

Configuring IBM Tivoli Output Manager to browse job logs for z-centric operations

To enable the integration between IBM Workload Scheduler for z/OS and Tivoli Output Manager, make sure that you have:

- Installed PTF UI13683 for APAR PI07423: INTEGRATION ENHANCEMENTS FOR ISPF INTERFACE on Tivoli Output Manager. This PTF provides enhancements to the Tivoli Output Manager ISPF interface to facilitate the passing of parameters by using ISPF variables.
- Installed PTF UI25172 for APAR PI21174 on Tivoli Output Manager.
- Activated the IBM Workload Scheduler for z/OS Output Collector started task. For details about the description and configuration of the Output Collector, see *Scheduling End-to-end with z-centric Capabilities* and *Customization and Tuning*.

To configure Tivoli Output Manager to capture the logs (sysouts in Tivoli Output Manager terminology) of the operations performed by z-centric agents and dynamic domain managers, perform the following steps:

1. Start the Tivoli Output Manager Administrative Functions dialog in ISPF and enter A (Archive attributes).
2. Define an archive attribute by selecting New in the file action bar choice. Make sure that the Archive Mask allows the Tivoli Output Manager started task to WRITE these data set names and that your user ID has the ability to READ them. For example:

```
 File    Help
 ------------------------------------------------------------------------------
                IBM Tivoli Output Manager - Archive Attribute Details
  Command ===> ____________________________________________________________
                                                                More:    +
    Descriptive data
      Name . . . . . . . . TWS
      Archive Mask   . . . TWSTST.&JN..&J£..&N
      Retention Period   . _____
      Print Model  . . . . Report
      Dynamic Print  . . . No

    Allocation attributes
      Management Class . . _________
      Storage Class  . . . _________
        Vol Sers . . . . . _______ _______ _______ _______ _______
        Device Type  . . . _________
      Data Class . . . . . _________
       Auto Calculate  . . ____
       Space Units . . . . _________
       Average Record Unit _________
       Primary Quantity  . ________
       Secondary Quantity  ________

    F1=Help     F3=Exit     F7=Bkwd     F8=Fwd     F10=Left     F11=Right     F12=Cancel
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
```

Figure 319. IBM Tivoli Output Manager - Defining an archive attribute.

3. Go back to the Administrative Functions dialog and enter T (TPL rules). Then, depending on the code page you are using, define a TPL rule as follows (in this example, the code page IBM-1144 is applied).

Note: For detailed information about special characters and their code pages, see *IBM Tivoli Output Manager for z/OS: Administrator's Guide*

```
when
  before line 100
  match " = TWS OCCURRENCE --> (ŸA-Z0-9§£$"ã1,16⌂) (ççdã3⌂) (ççdã10⌂)
then
begin
  set arcname = "&1 &2 &3";
end
```

4. Go back to the `Administrative Functions` dialog and enter `S` (Selector rules). Then:
   a. Define a selector rule and link it to the archive attribute by selecting the `Link` action bar choice.
   b. Set the status to `Enabled`.
   c. Specify the IBM Workload Scheduler for z/OS SYSOUT class that is assigned to the started tasks, set the Job Type to `Stc`, and the JES Queue to `All`. For example:

```
 File  Link   Help
──────────────────────────────────────────────────────────────────────────────
                    IBM Tivoli Output Manager - Selector Rule
 Command ===> ____________________________________________________________
                                                                More:    +
    Selector Name . EQQ zCentric_____________
     Status . . . . Enabled___
     Archive Attr:  IWSz
    Selection criteria
     SYSOUT Class  . K_____________________________________
     Destination   . _____________________
     Writer  . . . . __________
     Forms   . . . . __________
     Job Type  . . . Stc___
     JES Queue   . . All___

   /   Advanced Selection criteria
   _   Processing Options
   _   TPL Rules

    F1=Help     F3=Exit     F7=Bkwd     F8=Fwd     F10=Left     F11=Right     F12=Cancel
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
```

Figure 320. IBM Tivoli Output Manager - Defining a selector rule.

   d. Select (/) `Advanced selection criteria` and set the Job Name to the name of the Output Collector started task and the User ID to the owner of the Output Collector started task. For example:

```
File    Help
──────────────────────────────────────────────────────────────────────────────
                    IBM Tivoli Output Manager - Advanced Selection
 Command ===> ____________________________________________________________

 Selector Name . EQQ zCentric___________

 Advanced Selection criteria
   Job Name TWSAOUC_  User Id . . . . RACFID2_
   FCB . . ._______  UCS . . . . . ____    Flash . . . . . ____

 In addition to the Forms field on the previous panel, you may specify an
 additional 7 values (for a total of 8). These are logically OR'd.
   Forms2  _________  Forms3 _________  Forms4 _________ Forms5 _________
   Forms6  _________  Forms7 _________  Forms8 _________

 You may specify up to 4 Prmode values (logically OR'd)
   Prmode1 _________  Prmode2 ________  Prmode3 ________ Prmode4 _________

   F1=Help     F3=Exit     F7=Bkwd     F8=Fwd     F10=Left     F11=Right     F12=Cancel
. . . . . .
```

Figure 321. IBM Tivoli Output Manager - Specifying advanced options for the sub-selector.

e. Select (/) `TPL Rules` and add the TPL rule that you have defined.

5. Save your changes and return to the list of selector rules. The top level selector rule you just defined is now eligible to process any job log generated for z/OS operations by IBM Workload Scheduler for z/OS.
6. Enter the `ACT` primary command to activate your changes. The Tivoli Output Manager started task is now ready to capture the z-centric job logs.

Configuring IBM Tivoli Output Manager for data store

To continue to save an IBM Workload Scheduler for z/OS copy of the sysouts in the data store, add a Tivoli Output Manager sub-selector to Tivoli Output Manager. In this way, you have sysouts captured in both Tivoli Output Manager and IBM Workload Scheduler for z/OS without impacting either product.

To add a sub-selector, perform the following steps:

1. From `Administrative Functions` go the `Search for Selector Rules` dialog to retrieve the selector rule you defined for the IBM Workload Scheduler for z/OS sysouts. Enter the `ss` command next to the selector name to add a sub-selector. For example:

```
File Options Search Help
──────────────────────────────────────────────────────────────────────────────
                    IBM Tivoli Output Manager - Selector Rules
 Command ===> ____________________________________________ SCROLL ===> PAGE
                                                                    1 / 1
 Cmd   Name               Status   Subselectors  Normal class  Normal  destination
 ********************************** Bottom of data ************************************
```

Figure 322. IBM Tivoli Output Manager - Adding a sub-selector.

The `Subselector Rule` dialog is displayed.

2. In the `Subselector Rule` dialog, set `Status` to `Skip` and specify the destination used for the job log data store in the `Destination` field. The value for `Destination` must be equal to the value defined for the DSTDEST keyword of the RCLOPTS initialization statement of IBM Workload Scheduler for z/OS.

   Also, select (/) `Advanced Selection criteria`. For example:

```
File  Link   Help
                    IBM Tivoli Output Manager - Subselector Rule
 Command ===> ____________________________________________________________

 Subelector . . EQQCV10_________        Parent TWS
 Status . . . . Skip___                        Enabled
 Archive Attr .                                      TWS
 Selection criteria                        From parent
   Parent SYSOUT .
   SYSOUT Class  . ____________________________________
   Job Type  . . . All             All
   Job Name  . . . ________
   Destination   . EQQCV10_____________
   Form  . . . . . _________

   Writer  . . . . _________
   Archive name  . ___________________________________

  /   Advanced Selection criteria
  _   Processing Options
  _   TPL Rules

   F1=Help     F3=Exit     F7=Bkwd     F8=Fwd     F10=Left     F11=Right     F12=Cancel
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
```

Figure 323. IBM Tivoli Output Manager - Defining a sub-selector rule to enable sysouts to be sent also to data store.

3. In the `Advanced Selection` dialog, specify the JES queue that works for your system. For example, if all the output classes on your system are set as HOLD,HOLD, specify `All` as shown next:

```
File    Help
                    IBM Tivoli Output Manager - Advanced Selection
 Command ===> ____________________________________________________________
                                                                      More:    +
 Subselector . . EQQCV10_____________      Parent TWS

 Selection criteria                            From parent
   Job Class  . .  ____________________________________
   Proc Step Name. ________
   Step Name . . . ________
   DDName. . . . . ________
   JES Queue  . .  All_____
   User Id . . . . TWSUSER
   Prmode  . . . . ________
   FCB  . ____
   UCS  . ____
   Flash . . . . . _____

   Account1 _________  Account2 _________  Account3 _________
   Account4 _________  Account5 _________  Account6 _________
   Account7 _________  Account8 _________
   Programmer Name ____________________

   F1=Help     F3=Exit     F7=Bkwd     F8=Fwd     F10=Left     F11=Right     F12=Cancel
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
```

Figure 324. IBM Tivoli Output Manager - Specifying advanced options for the sub-selector.

4. In the `Subselector Rules` dialog, move the sub-selector that you have just created as the first sub-selector in the list. In this way, IBM Tivoli Output Manager will skip all the sysouts with the destination that you specified in step 2 on page 672.

5. Save your changes and return to the list of selector rules. The top level selector rule you just defined is now eligible to process any job log generated by IBM Workload Scheduler for z/OS.
6. Save and enter the `ACT` primary command to activate your changes.

Chapter 33. Using Tivoli Business Service Manager

This chapter describes how to use IBM Workload Scheduler for z/OS with Tivoli Business Service Manager, Version 1.5 with APAR 0W50948 or later.

Tivoli Business Service Manager enables you to monitor and manage events related to resources, applications, and subsystems with the objective of providing continuous availability for the enterprise. The product receives events and inputs from z/OS systems and Tivoli managed distributed systems. It then calculates propagation rules and applies them according to the business rules of the enterprise so that you can determine immediately the overall impact of an outage.

Using Tivoli Business Service Manager with IBM Workload Scheduler for z/OS, you can manage strategic applications from a unique business systems perspective.

You can take advantage of this integration to monitor the following scheduling objects with Tivoli Business Service Manager:

- Operations in the current plan. This is described in "Using Tivoli Business Service Manager to monitor operations in the plan" and in its subsections.
- Applications, operations, and workstations in the data base. This is described in "Using Tivoli Business Service Manager to monitor objects in the database" on page 680 and in its subsections.

Using Tivoli Business Service Manager to monitor operations in the plan

Monitoring batch processes within Tivoli Business Service Manager provides quick determination of problems that threaten batch schedules from completing correctly and on time. You can immediately map and understand the impact of any outage in the system, thus facilitating a fast response for problem handling and resolution.

IBM Workload Scheduler for z/OS identifies jobs to be actively monitored in Tivoli Business Service Manager. IBM Workload Scheduler for z/OS then sends job events to Tivoli Business Service Manager for job status changes to started, completed, and alert conditions. IBM Workload Scheduler for z/OS also sends events to signal job additions in the plan.

This part contains the following subsections:

- "Enabling monitoring by Tivoli Business Service Manager"
- "How monitoring works" on page 678
- "Discovery of the IBM Workload Scheduler for z/OS objects" on page 678

Enabling monitoring by Tivoli Business Service Manager

The following steps are necessary to enable IBM Workload Scheduler for z/OS to be monitored by Tivoli Business Service Manager. If you used Tivoli Business Service Manager with previous versions of IBM Workload Scheduler for z/OS, it is no longer necessary to use the Tivoli Business Service Manager user exit 7 and to activate the WTO options in the ALERT initialization statement.

Scheduler start options

For Tivoli Business Systems Manager to monitor IBM Workload Scheduler for z/OS, you must configure IBM Workload Scheduler for z/OS start options. Specify the EXTMON parameter on the OPCOPTS statement. This statement defines the runtime options to IBM Workload Scheduler for z/OS and is used by the tracker, controller, or the standby controller.

Refer to *Customization and Tuning* for OPCOPTS parameters and syntax information.

At initialization time, if the EXTMON start option is set to YES, IBM Workload Scheduler for z/OS loads the Tivoli Business Systems Manager module AOPEDI. The module must be present in a library visible to the controller and tracker. If the load fails, the value of the EXTMON start option is automatically set to NO, and the message EQQZ232 appears in IBM Workload Scheduler for z/OS message log.

Identifying jobs for monitoring

In order to monitor a job using Tivoli Business Systems Manager, set the EXTERNAL MONITOR job option of an operation to YES. This option is modifiable in the application description database and in the current plan. You can use any of the following to set or browse the option:

- ISPF panels
- The Scheduler programming interface
- Dynamic Workload Console

By default, jobs are not monitored by Tivoli Business Systems Manager.

Monitoring can also be configured so that jobs are automatically selected. This is done by establishing a monitoring policy, using the MONPOL initialization statement. For further details on this initialization statement refer to *Customization and Tuning*.

Setting monitors from the ISPF panels

You can browse and set the EXTERNAL MONITOR job option of an operation from the JOB, WTO, AND PRINT OPTIONS panel (see Figure 325 on page 677 for an example).

```
EQQAMJBP ---------------- JOB, WTO, AND PRINT OPTIONS -------------------
Command ===>

Enter/Change data below:
Application            : VALE1
Operation              : CPU1 001
 JOB CLASS          ===> _            ERROR TRACKING     ===> Y
 HIGHEST RETURNCODE ===> ____         EXTERNAL MONITOR   ===> N
 CENTRALIZED SCRIPT ===> N            COND RECOVERY JOB  ===> N
 CRITICAL           ===> P            POLICY             ===> _
 CLASS              ===> WLMCLASS
Job release options:
 SUBMIT            ===> Y            HOLD/RELEASE      ===> Y
 TIME DEPENDENT    ===> N            SUPPRESS IF LATE  ===> N
 NOP               ===> _            MANUALLY HOLD     ===> _
 DEADLINE WTO      ===> N
WS fail options:
 RESTARTABLE       ===> _            REROUTEABLE       ===> _
Print options:
 FORM NUMBER       ===> ________     SYSOUT CLASS      ===> _
```

Figure 325. EQQAMJBP - Job, WTO, and print options

In the current plan, you can browse if a specific operation has an external monitor from the BROWSING OPERATIONS panel. The BROWSING DETAILED OPERATION INFORMATION panel in Figure 326 shows an operation that has an external monitor.

```
EQQSOPDP ---------- BROWSING DETAILED OPERATION INFORMATION -------------------
Command ===>
Application           : VALE1
Operation             : CPU1 1
Occurrence token      : B5D4F445E1B92646
Jobname and Jobid     : VPJOB1            JOB00505
Reader date and time  : 01/05/14 10.03
Status                : Ended in error    S806
 on Work Station      :
Job or Sysout class   :                   Auto submit: Yes  Hold/release : Yes
Form number           :                   Time depend: No   Suppress late: No
Priority              : 5                 Rerouteable:      Restartable  :
Deadline WTO          : No                Ext monitor: Yes  Centr cript  : Yes
Critical              : Path handling request
WLM Policy            :                   WLM CLASS  : WLMCLASS
Date and time for  :       Planned           Actual
 Input arrival        : 01/05/14 15.00    01/05/14 10.03
 Start                : 01/05/14 15.00    01/05/14 10.03    User data:
 End                  : 01/05/14 15.02    01/05/14 10.03
 Deadline             : 01/05/14 17.00                       Applied run cycle:
 Duration             : 00.02.00          00.00.01           RULE1
 Latest start         : 01/05/14 16.56
Resources          :   Parallel servers    R1      R2     Special resources
 Required number      :         1           0       0            0
```

Figure 326. EQQSOPDP - Browsing detailed operation information

In addition, you can use the mass update utility, in the application description, to update multiple operations with the EXTERNAL MONITOR job option.

Setting monitors from the programming interface

In addition to enabling Tivoli Business Systems Manager from the panels, you can also write special scripts with the programming interface to specify monitors for Tivoli Business Systems Manager.

With the programming interface, you can specify that one operation of an application or occurrence be monitored. You can also specify that all the operations of an occurrence be monitored. Moreover, you can use the MONITOR option as a filter for the following:

- Operations in the current plan
- Applications or occurrences

Refer to *Developer's Guide: Driving IBM Workload Scheduler for z/OS* for additional information about using the programming interface to set up monitors for Tivoli Business Systems Manager. In addition to using the programming interface, monitoring of operations can be enabled from the batch loader and the BCIT. Refer to *Developer's Guide: Driving IBM Workload Scheduler for z/OS* for information on how to use the batch loader.

How monitoring works

To monitor IBM Workload Scheduler for z/OS, Tivoli Business Service Manager scans the daily planning report in IBM Workload Scheduler for z/OS and discovers all batch objects in the scheduler plan. Events to signal job status changes and alert conditions are sent to Tivoli Business Service Manager only for jobs that have the external monitor job option set to YES.

Tivoli Business Service Manager receives the following events from IBM Workload Scheduler for z/OS for monitored jobs:

- Addition of an operation
- Operation in late
- Operation waiting for resource
- Start of an operation
- Long duration for an operation
- End of an operation

IBM Workload Scheduler for z/OS also sends to Tivoli Business Service Manager an event for the following alert conditions :

- Alert durations (monitored jobs only)
- Alerts for late operations (monitored jobs only)
- Alerts for operations that ended in error (all jobs)
- Alerts for the time out of a special resource (monitored jobs only)
- Alerts for IBM Workload Scheduler for z/OS subtasks or subsystems that ended in error
- Alerts for IBM Workload Scheduler for z/OS subtask queues that exceed the threshold value

Tivoli Business Service Manager is notified for all job error situations, such as job abended. When a non-monitored job abends, the EXTERNAL MONITOR job option is automatically set to YES, and Tivoli Business Service Manager begins to monitor it.

Discovery of the IBM Workload Scheduler for z/OS objects

To import the IBM Workload Scheduler for z/OS objects, such as jobs, job streams, and workstations, into the Tivoli Business Service Manager model, you can use the Discovery Library Toolkit.

The Discovery Library Toolkit allows you to provide resource information to the Change and Configuration Management Database (CCMDB) without the overhead of a Web Application Server, database, or any other component of middleware. To integrate IBM Workload Scheduler for z/OS with CCMDB through the Discovery Library toolkit, you are provided with the following samples that produces the input required to run the CCMDB Export tool. The sample JCL to run the EQQTBSWS and EQQTBSAD samples is EQQTBSJ.

EQQTBSWS
A PIF-based REXX EXEC that produces a list of the workstations in the data base. The output is a sequential data set with the following layout:

```
<subsystem_name>,<workstation_name>,<worstation_type>
```

EQQTBSAD
A PIF-based REXX EXEC that produces a list of the applications and their operations in the data base. To be listed, the applications must be active and with the validity range including the current date when the EXEC is run.

The output are two sequential data sets, one for the application and one for the operations, with the following layout:

```
ADOUTJS (Job Stream)
<subsystem_name>,<JS>,<appl_name>,<owner_type>

ADOUTJOB (Job)
<subsystem_name>,<JOB>,<appl_name>,<owner_name>,<job_name>,<op_num>,
<iscritical>,<wks_name>
```

To export the output data sets to CCMDB, complete the following procedure:

1. Create a local UNIX System Services (USS) directory and copy the following files from the USS bindir of the end-to-end with fault tolerance capabilities environment:
   - CCMDB.jar
   - CommonObjects.jar
   - CommonServices.jar
   - dl_core.jar
   - icu4j-50_1_1.jar
   - icu4j-52_1_1.jar
   - idml_schema_2.4.jar
   - idml_schema_2.5.jar
   - ModelObjects.jar
2. Send the output data sets created by the EQQTBSWS and EQQTBSAD samples to the local USS directory that you created.
3. From the local USS directory, enter the following command:

   ```
   java -jar CCMDB.jar
   ```
4. To import the data sets to CCMDB, enter the following command:

   ```
   java -jar CCMDB.jar <wks_file> <jobstream_file> <job_file> [<book_complete_path>]
   ```

   where:

   wks_file
   The output data set created by EQQTBSWS.

   jobsream_file
   The output data set created by EQQTBSAD.

   job_file
   The output data set created by EQQTBSAD.

book_complete_path
Optional. the complete path to the book file. If you do not specify a value, it is automatically created in the current directory with a name that includes the timestamp.

Using Tivoli Business Service Manager to monitor objects in the database

An additional type of integration of which you can take advantage is based on the Discovery Library Adapter (DLA) mechanism. A DLA can send resource information to Change and Configuration Management Database (CCMDB) without the overhead of a Web Application Server, database, or other middleware. To integrate with the CCMDB via the Discovery Library, all an application needs to do is produce an XML file containing the resource information.

The DLA provided with IBM Workload Scheduler is capable of processing snapshots of the Application and Workstation data bases sent by IBM Workload Scheduler for z/OS.

The overall procedure consists in the following steps:

1. On IBM Workload Scheduler for z/OS run the REXX execs that generate the lists of applications, operations, and workstations (in the form of data sets) from the data base. Samples of the execs are provided in the product and they are discussed later.
2. Copy or forward the data sets onto an IBM Workload Scheduler master domain manager where CCMDB is installed.
3. On the master domain manager, go to the `TWA_home/tws/CCMDB` directory and run the `dataxtract` command to create an XML file (also called Discovery Library book - IdML book) that includes the contents of the three data sets.

   The format of the XML file is:

   `ITWS930.<hostname>.<timestamp>.refresh.xml`
4. Copy or send the XML file on the computer running Tivoli Business Service Manager.

   Here, process the file as defined in "Processing the Discovery Library book file in Tivoli Business Service Manager" on page 683 to write it into the data base of Tivoli Business Service Manager.

   In Tivoli Business Service Manager this information can be catalogued as SERVICE OBJECTS based on LOB (lines of business) to complement the information received by the Event Integration Facility (EIF) probe from IBM Workload Scheduler for z/OS through the `event pump` mechanism (described in "Using Tivoli Business Service Manager to monitor operations in the plan" on page 675).

Generating the application, operation, and workstation data sets from the data base

IBM Workload Scheduler for z/OS includes two samples that help you generate the data sets that you will later process into the Discovery Library book XML file of Change and Configuration Management Database on the IBM Workload Scheduler master domain manager:

EQQTBMSW
Is a PIF-based REXX EXEC that extracts a list of workstations from the WS database. The output is a sequential data set with the following layout:

<*subsystem_name*>,<*workstation_name*>,<*workstation_type*>

where the workstation type is identified by a letter as follows:

Table 43. Identifiers for workstation types in the WS database

Identifier	Description
A	Agent (used for IBM Workload Scheduler only)
B	Broker
C	Computer
E	Remote engine (IBM Workload Scheduler for z/OS or IBM Workload Scheduler)
F	Fault-tolerant workstation
G	General
L	Pool
M	Manager (used for IBM Workload Scheduler master domain managers only)
P	Printer
S	System Automation
V	Virtual
X	Extended agent (used for IBM Workload Scheduler only)
Y	Dynamic pool
Z	zCentric

The name of the data set generated by the sample is WSOUT. For example, a list of workstations is:

```
CWSA,ALFA,C
CWSA,CPU1,C
CWSA,CPU2,C
CWSA,CPU3,C
CWSA,DYNA,B
CWSA,DYNB,B
CWSA,FTA1,F
CWSA,GENA,G
CWSA,GENN,G
CWSA,MTZ1,Z
CWSA,MYPO,L
CWSA,MYP2,B
CWSA,SAU3,S
CWSA,SPAN,Z
CWSA,STC1,C
CWSA,TWSA,C
CWSA,VIRT,V
CWSA,WAIT,G
CWSA,ZZZZ,V
```

EQQTBSMA

Is a PIF-based REXX EXEC that extracts a list of applications, including their operations, from the AD data base. The output is two sequential data sets - one with a list of applications, the other with one of operations - with the following layout:

- For applications:

  <*subsystem_name*>,JS,<*application_name*>,<*owner*>

- For operations:

```
<subsystem_name>,JOB,<application_name>,<owner>,<job_name>,
<operation_number>,<is_critical>,<workstation_name>
```

Only active applications (status=A), whose validity range includes the date when the EXEC is run, are added in the data set. Pending applications (status=P) are ignored.

The name of the data sets generated by the sample are ADSOUTJS and ADSOUTJB. For example, a list of applications (ADSOUTJS) is:

```
TW9P ,JS  ,APPLSA          , RUSSELL
TW9P ,JS  ,FCPCW01         , 9610
TW9P ,JS  ,FDPCW01         , 9610
TW9P ,JS  ,FEPCW01         , 9610
TW9P ,JS  ,FFPCW01         , 9610
TW9P ,JS  ,LOAF77BANK19    , DBT
TW9P ,JS  ,MYAPPLW2        , RUSSELL
TW9P ,JS  ,MYAPPLW3        , RUSSELL
TW9P ,JS  ,MYAPPL1         , RUSSELL
TW9P ,JS  ,MYAPPL3         , JKSON12
TW9P ,JS  ,MYAPPL4         , ACCNT0NE
TW9P ,JS  ,RFS000014       , FRANCIS
TW9P ,JS  ,TROMP24A        , FRANCIS
TW9P ,JS  ,CCRMOPUS        , 9610
TW9P ,JS  ,DADDSM0         , RUSSELL
```

A list of operations (ADSOUTJB) is:

```
TW9P ,JOB ,APPLSA          , RUSSELL         , JOB1    , 10, N, SAWS
TW9P ,JOB ,FCPCW01         , 9610            , DEPCW01H, 1, N, MYWS
TW9P ,JOB ,FDPCW01         , 9610            , DEPCW01H, 1, N, MYWS
TW9P ,JOB ,FEPCW01         , 9610            , DEPCW01H, 1, N, MYWS
TW9P ,JOB ,FFPCW01         , 9610            , DEPCW01H, 1, N, MYWS
TW9P ,JOB ,LOAF77BANK19    , DBT             , EUNUT000, 9, N, CPUS
TW9P ,JOB ,LOAF77BANK19    , DBT             , N1977U01, 10, N, UA19
TW9P ,JOB ,LOAF77BANK19    , DBT             , F1977L01, 11, N, UA19
TW9P ,JOB ,LOAF77BANK19    , DBT             , N1977U15, 38, N, UA19
TW9P ,JOB ,LOAF77BANK19    , DBT             , F1977L15, 39, N, UA19
TW9P ,JOB ,LOAF77BANK19    , DBT             , N1977U16, 40, N, UA19
TW9P ,JOB ,LOAF77BANK19    , DBT             , F1977L16, 41, N, UA19
...
TW9P ,JOB ,LOAF77BANK19    , DBT             , N1977U17, 42, N, UA19
TW9P ,JOB ,LOAF77BANK19    , DBT             , F1977L25, 59, N, UA19
TW9P ,JOB ,LOAF77BANK19    , DBT             , N1977U26, 60, N, UA19
TW9P ,JOB ,LOAF77BANK19    , DBT             , F1977L26, 61, N, UA19
TW9P ,JOB ,LOAF77BANK19    , DBT             , N1977U27, 62, N, UA19
TW9P ,JOB ,LOAF77BANK19    , DBT             , F1977L27, 63, N, UA19
TW9P ,JOB ,LOAF77BANK19    , DBT             , EUNUT999, 99, N, NULL
TW9P ,JOB ,MYAPPLW2        , RUSSELL         , JOBWAIT , 1, N, W2WS
TW9P ,JOB ,MYAPPLW3        , RUSSELL         , JOBWAIT , 1, N, W3WS
TW9P ,JOB ,MYAPPL1         , RUSSELL         , JOB1    , 1, P, MYWS
TW9P ,JOB ,MYAPPL1         , RUSSELL         , JOBICBC , 2, P, MYWS
TW9P ,JOB ,MYAPPL2         , RUSSELL         , JOB1    , 1, P, MYWS
TW9P ,JOB ,MYAPPL3         , JKSON12         , JOB1    , 1, N, MYWS
TW9P ,JOB ,MYAPPL4         , ACCNT0NE        , JOB1    , 1, N, MYWS
```

The samples include also a customizable JCL (EQQTBSJ) that you can use to run the EXECS. You can schedule the JCL to run and collect the data from the data bases on a regular basis at the best time to get a fresh picture of the data base contents.

Processing the Discovery Library book file in Tivoli Business Service Manager

After extracting the ITWS930.<*hostname*>.<*timestamp*>.refresh.xml file with the dataxtract command, run the following steps to copy the job stream, job, and workstation definitions in the Tivoli Business Service Manager data base:

1. Copy the file into the ../opt/IBM/tivoli/tbsm/discovery/dlbooks directory of the system running Tivoli Business Service Manager and allow it all permissions.
2. Copy the new NamingRules.xml file into ../opt/IBM/tivoli/tbsm/XMLtoolkit/xml and allow it all permissions.
3. Change directory to ../opt/IBM/tivoli/tbsm/XMLtoolkit/bin and run the following command to stop the XML toolkit:

   ```
   ./tbsmrdr_stop.sh
   ```

4. Check the log file in ../opt/IBM/tivoli/tbsm/XMLtoolkit/log/msgGTM_XT.log.0 to be sure the toolkit is stopped.
5. Go back to ../opt/IBM/tivoli/tbsm/XMLtoolkit/bin and run the following command to save the book file in the Tivoli Business Service Manager data base:

   ```
   ./putArtifact -U db_username -P db_userpw  -n /path_to_file/NamingRules.xml
    -c scrconfig
   ```

   The command should return the following messages:

   ```
   Command processing started: putArtifact
   GTMCL7120I The specified file or artifact has been written to the database.
   Command processing completed.
   *GTMCL7131I The specified file or artifact has a previous version that has
   been removed from the available configurations and has been maintained as
   a backup version.
   ```

   The same information is logged in ../opt/IBM/tivoli/tbsm/XMLtoolkit/log/msgGTM_CI.log.0
6. From ../opt/IBM/tivoli/tbsm/XMLtoolkit/bin run:

   ```
   ./tbsmrdr_start.sh
   ```

   and look in /opt/IBM/tivoli/tbsm/XMLtoolkit/log/msgGTM_XT.log.0 for the following message:

   ```
   GTMCL5290I: Book ITWS930.<hostname>.<timestamp>.refresh.xml processed
   successfully.
   ```

Follow these steps to view the object definitions in the Tivoli Business Service Manager console:

1. In the tree menu select **Administration** and then **Service Administration**.

   The Service Administration page is displayed.
2. In the Service Navigation portlet on the upper left click **Templates** and then click **Service Component Repository** in the drop down menu.
3. Expand **Component Registry**.
4. To view the IBM Workload Scheduler workstations, jobs and job streams, expand **Application Servers** > **Application Servers**.

   To view the computers defined as IBM Workload Scheduler workstations, expand **Servers** > **All**.

Chapter 34. Using IBM Tivoli Monitoring

This chapter describes how to use IBM Workload Scheduler for z/OS with IBM Tivoli Monitoring Version 6.2 with Fix Pack 1 installed. It describes how this integration works and the IBM Tivoli Monitoring components involved.

IBM Tivoli Monitoring monitors and manages system and network applications on a variety of platforms and can keep track of the availability and performance of your enterprise in its entirety. You can use the reports provided by IBM Tivoli Monitoring to track trends and troubleshoot problems.

IBM Workload Scheduler for z/OS uses an agent named IBM Tivoli Monitoring Agent for IBM Workload Scheduler for z/OS (called Tivoli Monitoring agent from now on) to send events and alerts to IBM Tivoli Monitoring (ITM). IBM Workload Scheduler for z/OS establishes an IP connection with the Socket Data Source of the Tivoli Monitoring agent which acts like a listener task. Every time one of the monitored operations changes its status, or an alert is issued, the related event is sent to the Tivoli Monitoring agent.

The data sent by IBM Workload Scheduler for z/OS is interpreted by the Tivoli Monitoring agent. The agent stores the event information in its cache and this information is later consolidated by the Tivoli Enterprise Monitoring Server. The collected data is then retrieved and displayed by a component named Tivoli Enterprise Portal.

The Tivoli Enterprise Portal is an interactive interface used for viewing and monitoring your enterprise network. The Tivoli Enterprise Portal client connects to the Tivoli Enterprise Portal server that enables retrieval, manipulation, and analysis of data collected by all existing IBM Tivoli Monitoring agents in your enterprise.

You can use the Tivoli Enterprise Portal to display and manage events related to IBM Workload Scheduler for z/OS operations such as operation start and end time. In the same way, you can configure the automatic selection of monitored operations and subtasks, providing a single point of management and control for the resources of your enterprise.

Because the Tivoli Enterprise Portal component provides the user interface for viewing and managing IBM Workload Scheduler for z/OS monitored objects, in this publication we refer to the integration with IBM Tivoli Monitoring by referring to Tivoli Enterprise Portal. For detailed information on IBM Tivoli Monitoring components refer to the IBM Tivoli Monitoring documentation.

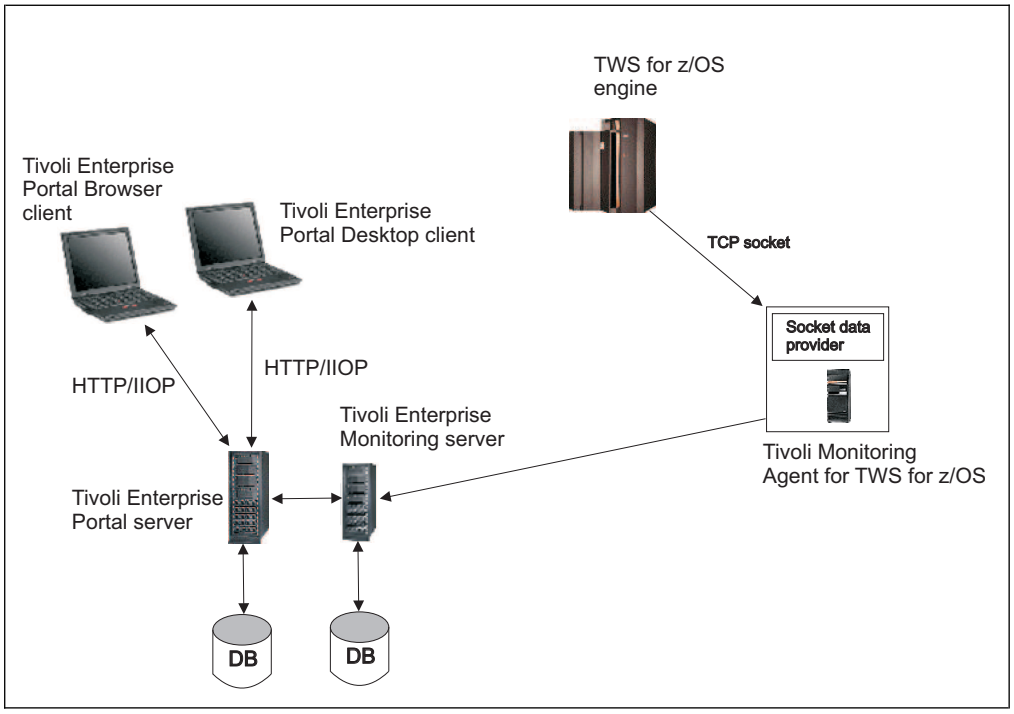


Figure 327. IBM Tivoli Monitoring architecture

This chapter contains the following sections:

- "Enabling monitoring on IBM Workload Scheduler for z/OS"
- "How monitoring works" on page 692
- "Identifying jobs for monitoring" on page 695
- "Uninstalling the Tivoli Monitoring agent" on page 697

Enabling monitoring on IBM Workload Scheduler for z/OS

You enable IBM Workload Scheduler for z/OS to be monitored by Tivoli Enterprise Portal by:

- "Installing and configuring the Tivoli Monitoring agent" on page 687.
- "Configuring the controller to work with Tivoli Enterprise Portal" on page 691.

To allow integration with IBM Workload Scheduler for z/OS, ensure that the following components are installed on one of the supported operating systems:

Tivoli Enterprise Monitoring Server (TEMS)
: Collects and controls the events received from the agents, using a proprietary database to store all the monitoring information. It is the core component of IBM Tivoli Monitoring.

Tivoli Enterprise Portal Server (TEPS)
: Enables retrieval, manipulation, and analysis of data from the agents.

Tivoli Enterprise Portal (TEP)
: The Java-based user interface of the Tivoli Enterprise Portal Server for viewing and monitoring your enterprise.

Tivoli Monitoring agent
: Forwards to TEMS the events captured on IBM Workload Scheduler for z/OS.

Note: For information on the supported operating systems for each of the above components, refer to the IBM Tivoli Monitoring documentation.

Installing and configuring the Tivoli Monitoring agent

How IBM Workload Scheduler for z/OS integrates with IBM Tivoli Monitoring.

Before you begin

Before installing the agent, ensure that the following IBM Tivoli Monitoring components are installed:

- Tivoli Enterprise Monitoring Server
- Tivoli Enterprise Portal Server
- Tivoli Enterprise Portal

About this task

You can install the agent:

- On the same workstation where the Tivoli Enterprise Monitoring Server and Tivoli Enterprise Portal Server are installed by Installing and configuring the Tivoli Monitoring agent in a local environment.
- On a workstation different from the Tivoli Enterprise Monitoring Server and Tivoli Enterprise Portal Server by Installing the Tivoli Monitoring agent in a remote environment.

Installing and configuring the Tivoli Monitoring agent in a local environment

About this task

To install and configure the Tivoli Monitoring agent on the same workstation where the Tivoli Enterprise Monitoring Server and Tivoli Enterprise Portal Server are installed, perform the procedure that applies to the operating system you are using.

Installing and configuring on Windows workstations:
Procedure

1. Extract the *TWA_home*\ITMZ\TWSzItmAgent.zip file on the Tivoli Enterprise Monitoring Server.
2. From the directory where you extracted the file, enter the following command to install the Tivoli Monitoring agent for IBM Workload Scheduler for z/OS:

   ```
   installIra.bat <TEMS_install_dir> [[-h <HUB_TEMS_hostname>]
      -u <HUB_TEMS_username> [-p <HUB_TEMS_password>]] [-r]"
   ```

   where:

   <TEMS_install_dir>
   The complete path to the Tivoli Enterprise Monitoring Server installation directory.

   -h <*HUB_TEMS_hostname*>
   The host name of theTivoli Enterprise Monitoring Server. The default value is the local host.

   -u <*HUB_TEMS_username*>
   The name of the user accessing the Tivoli Enterprise Monitoring Server. The default value is the local user name.

-p <*HUB_TEMS_password*>
The password for the user accessing the Tivoli Enterprise Monitoring Server. The default value is the password associated with the local user.

-r Restarts the Tivoli Enterprise Portal.

3. Log in to the Tivoli Enterprise Portal. The Monitoring Agent for IBM Workload Scheduler for z/OS is now listed in the Manage Tivoli Enterprise Monitoring Services window.
4. To create an instance of the agent, double-click **Monitoring Agent for IBM Workload Scheduler for z/OS**. The Monitoring Agent for IBM Workload Scheduler for z/OS window opens.
5. Specify a name for the instance and click **OK**. The Agent Configuration window opens.
6. Specify an available port number and click **OK**.
7. Configure IBM Workload Scheduler for z/OS to send events to the Tivoli Monitoring agent, as described in "Configuring the controller to work with Tivoli Enterprise Portal" on page 691.
8. Launch the Tivoli Enterprise Portal. The agent is displayed in the Navigator pane together with any agent configuration settings.

   You can create as many agent instances as you want by performing steps 5 to 7

Installing and configuring on UNIX and Linux workstations:
Procedure

1. Untar the *TWA_home*\ITMZ\TWSzItmAgent.tar file on the Tivoli Enterprise Monitoring Server.
2. From the directory where you untar the file, enter the following command to install the Tivoli Monitoring agent for IBM Workload Scheduler for z/OS:

   ```
   installIra.sh <TEMS_install_dir> [[-h <HUB_TEMS_hostname>]
      -u <HUB_TEMS_username> [-p <HUB_TEMS_password>]] [-r]"
   ```

   where:

   <TEMS_install_dir>
   The complete path to the Tivoli Enterprise Monitoring Server installation directory.

   -h <*HUB_TEMS_hostname*>
   The host name of theTivoli Enterprise Monitoring Server. The default value is the local host.

   -u <*HUB_TEMS_username*>
   The name of the user accessing the Tivoli Enterprise Monitoring Server. The default value is the local user name.

   -p <*HUB_TEMS_password*>
   The password for the user accessing the Tivoli Enterprise Monitoring Server. The default value is the password associated with the local user.

   -r Restarts the Tivoli Enterprise Portal.
3. To configure the Tivoli Monitoring agent, enter the following command from the *ITMagent_install_dir*/bin directory:

   ```
   ./itmcmd config –A 20
   ```

   where:

ITMagent_install_dir
The complete path to the Tivoli Monitoring agent for IBM Workload Scheduler for z/OS.

20 The product code of the Tivoli Monitoring agent for IBM Workload Scheduler for z/OS.

You are prompted to set the values for the agent configuration parameters.

4. Specify a name for the agent instance and press **Enter**.
5. Specify **1** to edit the Monitoring Agent for IBM Workload Scheduler for z/OS and press **Enter**.
6. Specify **1** to edit the Socket Settings and press **Enter**.
7. Specify an available Port Number and press **Enter**. The default is 6789.
8. Specify **1** to connect the agent to the Tivoli Enterprise Monitoring Server and press **Enter**.
9. Specify the name of the local host as the TEMS Host Name and press **Enter**.
10. Accept the default value **ip.pipe** as the Network Protocol by pressing **Enter**.
11. Accept the default value **0** as the Network Protocol 2 by pressing **Enter**.
12. Accept the default value **ip.pipe** as the Port Number by pressing **Enter**.
13. Accept the default value **null** as the KDC_PARTITION by pressing **Enter**.
    The Tivoli Monitoring agent is now installed and configured in the Tivoli Enterprise Portal.
14. To start the agent, enter the following command from *ITMagent_install_dir*\bin:
    ```
    ./itmcmd agent -o ITMagent_instance_name start 20
    ```
15. To stop the agent, enter the following command from *ITMagent_install_dir*\bin:
    ```
    ./itmcmd agent -o ITMagent_instance_name stop 20
    ```
16. To verify that the agent is running, enter the following command from *ITMagent_install_dir*\bin:
    ```
    ./cinfo agent -r
    ```

Installing the Tivoli Monitoring agent in a remote environment

Before you begin

Before installing the Tivoli Monitoring agent in a remote environment, where IBM Workload Scheduler for z/OS is installed on workstation different from theTivoli Enterprise Monitoring Server, you must first install the Tivoli Monitoring OS agent. When installing the OS agent, select the Tivoli Enterprise Monitoring Agent for your OS *and* all of its associated subcomponents.

About this task

To install and configure the Tivoli Monitoring agent on a workstation different from the Tivoli Enterprise Monitoring Server and Tivoli Enterprise Portal Server, perform the procedure that applies to the operating system you are using.

Installing and configuring on Windows workstations:
Procedure

1. Extract the *TWA_home*\ITMZ\TWSzItmAgent.zip file on the Tivoli Enterprise Monitoring Server.

2. From the directory where you extracted the file, enter the following command to install the Tivoli Monitoring agent for IBM Workload Scheduler for z/OS:
   `installIraAgent.bat <OS_Agent_install_dir>`

   where *OS_Agent_install_dir* is the complete path to the OS Agent installation directory.
3. Log in to the Tivoli Enterprise Portal. The Monitoring Agent for IBM Workload Scheduler for z/OS is now listed in the Manage Tivoli Enterprise Monitoring Services window.
4. To create an instance of the agent, double-click **Monitoring Agent for IBM Workload Scheduler for z/OS**. The Monitoring Agent for IBM Workload Scheduler for z/OS window opens.
5. Specify a name for the instance and click **OK**. The Agent Configuration window opens.
6. Specify an available port number nd click **OK**. You are returned to the Manage Tivoli Enterprise Monitoring Services window.
7. Right-click **Monitoring Agent for IBM Workload Scheduler for z/OS** and select **Reconfigure**. The Agent Advance Configuration window opens.
8. In the Protocol 1 field, specify the host name or IP address of the remote Tivoli Enterprise Monitoring Server and click **OK**. You are returned to the Manage Tivoli Enterprise Monitoring Services window.
9. To start the agent, right-click **Monitoring Agent for IBM Workload Scheduler for z/OS** and select **Start**.
10. Configure IBM Workload Scheduler for z/OS to send events to the Tivoli Monitoring agent, as described in "Configuring the controller to work with Tivoli Enterprise Portal" on page 691.
11. Launch the Tivoli Enterprise Portal. The agent is displayed in the Navigator pane together with any agent configuration settings.

Installing and configuring on UNIX and Linux workstations: Procedure

1. Untar the *TWA_home*`\ITMZ\TWSzItmAgent.tar` on the Tivoli Enterprise Monitoring Server.
2. From the directory where you untar the file, enter the following command to install the Tivoli Monitoring agent for IBM Workload Scheduler for z/OS:
   `installIraAgent.sh <OS_Agent_install_dir>`

   where *OS_Agent_install_dir* is the complete path to the OS Agent installation directory.
3. To configure the Tivoli Monitoring agent, enter the following command from the *OS_Agent_install_dir*`/bin` directory:
   `./itmcmd config –A 20`

   where 20 is the product code of the Tivoli Monitoring agent for IBM Workload Scheduler for z/OS.

   You are prompted to set the values for the agent configuration parameters.
4. Specify a name for the agent instance and press **Enter**.
5. Specify **1** to edit the Monitoring Agent for IBM Workload Scheduler for z/OS and press **Enter**.
6. Specify **1** to edit the Socket Settings and press **Enter**.
7. Specify an available Port Number and press **Enter**. The default is 6789.

8. Specify **1** to connect the agent to the Tivoli Enterprise Monitoring Server and press **Enter**.
9. Specify the host name of the remote Tivoli Enterprise Monitoring Server and press **Enter**.
10. Accept the default value **ip.pipe** as the Network Protocol by pressing **Enter**.
11. Accept the default value **0** as the Network Protocol 2 by pressing **Enter**.
12. Accept the default value **ip.pipe** as the Port Number by pressing **Enter**.
13. Accept the default value **null** as the KDC_PARTITION by pressing **Enter**.

    The Tivoli Monitoring agent is now installed and configured in the Tivoli Enterprise Portal.
14. To start the agent, enter the following command from *ITMagent_install_dir*\bin:

    ```
    ./itmcmd agent -o ITMagent_instance_name_remote start 20
    ```
15. To stop the agent, enter the following command from *ITMagent_install_dir*\bin:

    ```
    ./itmcmd agent -o ITMagent_instance_name_remote stop 20
    ```
16. To verify that the agent is running, enter the following command from *ITMagent_install_dir*\bin:

    ```
    ./cinfo agent -r
    ```

Configuring the controller to work with Tivoli Enterprise Portal

Perform the following steps to make the Tivoli Enterprise Portal work with IBM Workload Scheduler for z/OS:

- Include the data set used by the monitoring task in your JCL procedures and configure the `start` options of the controller.

  The DD Name of the data set used by the monitoring task to store events for IBM Tivoli Monitoring is EQQMONDS. EQQMONDS is not in the list of required data sets, so you must include it in your JCL procedures if you want to be able to monitor events with the Tivoli Enterprise Portal. Refer to *Planning and Installation* for information about creating JCL procedures and including optional data sets in the procedure.
- Configure the MONOPTS initialization statement to enable monitoring by Tivoli Enterprise Portal.

  This statement defines the runtime options to IBM Workload Scheduler for z/OS and is used by the controller and the standby controller.

  If the MONOPTS option is set, a specific controller subtask called `monitoring task` is started at initialization time. This subtask is dedicated to sending events to the Tivoli Enterprise Portal.
- Optionally, configure the OPCOPTS initialization statement to set the codepage used in the communication process between IBM Workload Scheduler for z/OS and Tivoli Enterprise Portal, and the MONALERT parameter of the ALERTS statement to define for what conditions alerts should be sent to the Tivoli Enterprise Portal monitoring agent.
- Optionally, configure the MONPOL initialization statement to define monitoring policies so that, for example, operations are automatically selected for monitoring.
- If you use a TCP/IP stack name different from TCPIP default value, code the TCPOPTS statement with the TCPIPJOBNAME parameter set to the TCP/IP stack name.

For a detailed description of the parameters and syntax of the ALERTS, MONOPTS, MONPOL, OPCOPTS, and TCPOPTS initialization statements, see *Customization and Tuning*.

How monitoring works

If the Tivoli Enterprise Portal Monitoring is activated, monitoring is performed only on those operations that have the EXTERNAL MONITOR option set to YES.

An IBM Workload Scheduler for z/OS event is sent to the Tivoli Enterprise Portal when the following situations occur:

- Addition of an operation
- Late operation
- Operation waiting for resource
- Start of an operation
- Long duration of an operation
- End of an operation
- Any subsequent status changes to operations that ended in error

All application occurrences containing monitored operations are also monitored. The Tivoli Enterprise Portal receives events from IBM Workload Scheduler for z/OS when the following situations occur:

- Addition of an application occurrence
- Start of an application occurrence
- End of an application occurrence
- Delete of an application occurrence

Discovery of monitored objects

You obtain the initial status of the monitored objects by running a bulk discovery either using the BULKDISC TSO command or a batch job. You can use the bulk discovery command each time an updated status of all monitored objects is required.

You can also configure the bulk discovery to start at every current plan creation, extension, or replan by using the MONOPTS initialization statement. If you set the BULKDISC parameter to YES in the MONOPTS statement, a bulk discovery is performed automatically, for example each time a status change occurs.

For more information about how to configure the bulk discovery with MONOPTS, see *Customization and Tuning*, and about the BULKDISC command see "BULKDISC" on page 732.

Identifying and displaying alerts

The scheduler also sends alerts to Tivoli Enterprise Portal based on the MONALERT and MONOPER parameters of the ALERTS statement. The types of alerts that are sent depend on the monitoring policy provided using the MONPOL statement. For example, to send alerts that can be viewed in the Tivoli Enterprise Portal pertaining to specific operation statuses (CRITICAL, ERROR, LATE, DURATION, MANUAL), use the MONPOL statement to specify the types of operations to be monitored. The alerts can be viewed from the Jobs view in the Tivoli Enterprise Portal.

The ALERTS statement instead, specifies the conditions under which an alert should be generated and an alert can be sent to the Tivoli Enterprise Portal as a consequence of the generated alert. This type of alert can be viewed from the Tivoli Monitoring agent view in the Tivoli Enterprise Portal.

For a detailed description of the ALERTS and MONPOL statements and their parameters, see the *Customization and Tuning*.

Alerts can be sent on the following conditions:

- For monitored jobs or for all jobs (in parentheses are the alert names that are displayed by the Tivoli Enterprise Portal interface):
  - Alerts for operations that ended in error (JobInError)
  - Alerts for late operations (LateJob)
  - Alerts for long durations (LongDurationJob)
  - Alerts for long time in the input queue (LongDurationJob)
  - Alerts for jobs promoted by WLM (WLMPromotedJob)
  - Alerts for the timeout of a special resource (ResourceTimeout). The timeout is specified in the RESOPTS CONTENTIONTIME parameter.
- For IBM Workload Scheduler for z/OS subtasks (in parentheses are the alert names that are displayed by the Tivoli Enterprise Portal interface):
  - Alerts for IBM Workload Scheduler for z/OS subtasks or subsystems that ended in error (TaskInError)
  - Alerts for IBM Workload Scheduler for z/OS subtask queues that exceed the threshold value (QueueThresholdExceeded)
  - Alerts for IBM Workload Scheduler for z/OS controllers that lose monitoring events
- Tivoli Enterprise Portal specific alerts:
  - Some events collected by the monitoring task are lost. A bulk discovery could be necessary to restore data consistency in the Tivoli Enterprise Portalinterface (QueueLostMonitorEvents).
  - An error occurred during a bulk discovery. A new bulk discovery could be necessary to restore data consistency in the Tivoli Enterprise Portal interface (ErrorDuringBulkDiscovery).

Note: If you recycle the Tivoli Monitoring agent, events are lost. If the Tivoli Monitoring agent is stopped for any reason, events are lost unless you have saved them using the history function. The Tivoli Monitoring agent can also be stopped as a result of a TCP/IP connection failure. In these cases, issue a bulk discovery to refresh the status of all monitored objects.

Positional event variables

The following tables describe the positional event variables for each group of events.

Table 44. Positional variables for operation events

Variable	Description
1	Schedule name
2	Schedule time
3	Operation number

Table 44. Positional variables for operation events (continued)

Variable	Description
4	Job external status
5	Job name or alias
6	Job status
7	Workstation
8	Job number
9	Error code
10	Job estimated duration
11	Job start time
12	Job end time
13	Deadline
14	Estimated start time
15	Job event timestamp
16	Schedule ID
17	Critical job ID
18	Event type

Table 45. Positional variables for job stream events

Variable	Description
1	Schedule name
2	Schedule time
3	Schedule state
4	Schedule event timestamp
5	Schedule ID
6	Event type
11	Event version

Table 46. Positional variables for alert events

Variable	Description
1	Alert type
2	Schedule name
3	Schedule time
4	Operation number
5	Job name
6	Job CPU
7	Operation error code
8	Job number
9	Special resource name
10	Special resource waiting, in minutes
11	Task name
12	Internal queue name

Table 46. Positional variables for alert events (continued)

Variable	Description
13	In use queue percentage
14	Schedule ID

Table 47. Positional variables for critical events

Variable	Description
1	Schedule name
2	Job name or alias
3	Workstation
4	Input arrival
5	Operation number
6	Job external status
7	Job delay
8	Job promotion
9	Job on hot list
10	Job critical
11	Job on critical path
12	Job risk level
13	Estimated end time
14	Latest start time
15	Dead line time
16	Actual start time
17	Actual end time
18	Estimated duration
19	Error code
20	Event type

Identifying jobs for monitoring

To monitor an operation using Tivoli Enterprise Portal, set the EXTERNAL MONITOR job option of an operation to YES. You can modify this option in the application description database and in the current plan. You can use one of the following interfaces to set or browse the option:

- ISPF panels
- The Scheduler programming interface
- Dynamic Workload Console

By default, jobs are not monitored.

You can also configure job monitoring so that jobs are automatically flagged as "monitored". You do this by establishing a monitoring policy. Use the MONPOL statement to automatically select jobs to be monitored. For further information, see *Customization and Tuning*.

Setting monitors from the ISPF panels

You can browse and set the EXTERNAL MONITOR job option of an operation from the JOB, WTO, AND PRINT OPTIONS panel (see Figure 328 for an example).

```
EQQAMJBP ---------------- JOB, WTO, AND PRINT OPTIONS -------------------
Command ===>

Enter/Change data below:
Application            : VALE1
Operation              : CPU1 001
 JOB CLASS          ===> _             ERROR TRACKING     ===> Y
 HIGHEST RETURNCODE ===> ____          EXTERNAL MONITOR   ===> N
 CENTRALIZED SCRIPT ===> N             COND RECOVERY JOB  ===> N
 CRITICAL           ===> P             POLICY             ===> _
 CLASS              ===> WLMCLASS
Job release options:
 SUBMIT             ===> Y             HOLD/RELEASE       ===> Y
 TIME DEPENDENT     ===> N             SUPPRESS IF LATE   ===> N
 NOP                ===> _             MANUALLY HOLD      ===> _
 DEADLINE WTO       ===> N
WS fail options:
 RESTARTABLE        ===> _             REROUTEABLE        ===> _
Print options:
 FORM NUMBER        ===> ________      SYSOUT CLASS       ===> _
```

Figure 328. EQQAMJBP - Job, WTO, and print options

In the current plan, you can browse if a specific operation has an external monitor from the BROWSING OPERATIONS panel. The BROWSING DETAILED OPERATION INFORMATION panel in Figure 329 shows an operation that has an external monitor.

```
EQQSOPDP ---------- BROWSING DETAILED OPERATION INFORMATION -------------------
Command ===>
Application           : VALE1
Operation             : CPU1 1
Occurrence token      : B5D4F445E1B92646
Jobname and Jobid     : VPJOB1            JOB00505
Reader date and time  : 01/05/14 10.03
Status                : Ended in error    S806
 on Work Station      :
Job or Sysout class   :                   Auto submit: Yes  Hold/release : Yes
Form number           :                   Time depend: No   Suppress late: No
Priority              : 5                 Rerouteable:      Restartable  :
Deadline WTO          : No                Ext monitor: Yes  Centr cript  : Yes
Critical              : Path handling request
WLM Policy            :                   WLM CLASS  : WLMCLASS
Date and time for  :       Planned           Actual
 Input arrival        : 01/05/14 15.00    01/05/14 10.03
 Start                : 01/05/14 15.00    01/05/14 10.03    User data:
 End                  : 01/05/14 15.02    01/05/14 10.03
 Deadline             : 01/05/14 17.00                       Applied run cycle:
 Duration             : 00.02.00          00.00.01           RULE1
 Latest start         : 01/05/14 16.56
Resources          :   Parallel servers    R1      R2     Special resources
 Required number      :         1            0       0            0
```

Figure 329. EQQSOPDP - Browsing detailed operation information

In addition, you can use the mass update utility, in the application description, to update multiple operations with the EXTERNAL MONITOR job option. For more information about mass update, see “Mass update or batch loader?” on page 203.

Setting monitors from the programming interface

In addition to enabling monitoring by Tivoli Enterprise Portal from the panels, you can also write special scripts with the programming interface to specify monitors for Tivoli Enterprise Portal.

With the programming interface, you can specify that one operation of an application or occurrence be monitored. You can also specify that all the operations of an occurrence be monitored. Moreover, you can use the MONITOR option as a filter for the following:

- Operations in the current plan
- Applications or occurrences

For additional information about using the programming interface to set up monitors for Tivoli Enterprise Portal, see *Developer's Guide: Driving IBM Workload Scheduler for z/OS*. In addition to using the programming interface, monitoring of operations can be enabled from the batch loader and the BCIT.

Setting monitors from the graphical user interfaces

Using the Dynamic Workload Console, you can specify that one operation of an application or occurrence be monitored. You can also specify that all the operations of an occurrence be monitored. Moreover, you can use the MONITOR option as a filter for the following:

- Operations in the current plan
- Applications or occurrences

For additional information, refer to the Dynamic Workload Console documentation.

Uninstalling the Tivoli Monitoring agent

About this task

To uninstall the agent, perform the following procedure.

Procedure

1. Run the following script:

   On Windows

   From *ITM_install_dir*/TMAITM6, enter:

   ```
   k20_uninstall.vbs ITM_install_dir
   ```

   where *ITM_install_dir* is the directory where you installed the Tivoli Monitoring agent.

   On UNIX and Linux

   From *ITM_install_dir*/bin, enter:

   ```
   uninstall.sh [-f] [-i] [-h ITM_install_dir] [product platformCode]
   ```

   For example, `uninstall.sh -f -I -h /opt/IBM/ITM 36 lx8266`

2. After removing the agent, delete any offline entry from the Tivoli Enterprise Portal by performing the following steps:
   a. Ensure that your Tivoli Enterprise Monitoring Server and Tivoli Enterprise Portal Server are up and running.
   b. Log in to the Tivoli Enterprise Portal client.

c. From the Physical Navigator views, right-click **Enterprise** and select **Workspace** > **Managed System Status**. The Managed System Status workspace opens.

d. Right-click the IBM Tivoli Managed Systems for your agent and select **Clear off-line entry**. All the entries from the table are deleted.

Chapter 35. Using Open Services for Lifecycle Collaboration

IBM Workload Scheduler uses Open Services for Lifecycle Collaboration to work with products that provide you with an OSLC interface. For example, you can use OSLC to work with SmartCloud Control Desk version 7.5.1.1 and later to create incident reports about jobs ended in error.

To configure IBM Workload Scheduler to integrate with OSLC, set the OSLCOPTS statement (for details, see *Customization and Tuning*).

Encrypting the password in OSLCOPTS statement

About this task

To make the password set in the PASSWORD parameter of the OSLCOPTS statement not readable, write the password in plaintext in the PASSWORD parameter, then encrypt it by submitting the EQQBENCO JCL. EQQBENCO runs a stand-alone application that checks the validity of the statement and encrypts the password.

After running EQQBENCO, set the OSLCPARM parameter in the OPCOPTS statement to the name of the member containing the OSLCOPTS statement with the encrypted password.

To make the changes effective, restart the controller.

Setting long description in SmartCloud Control Desk

To create a detailed description for your incidents, you set the TKTDESC parameter of the OSLCOPTS statement. For this parameter to be effective, ensure that you have selected the `DESCRIPTION_LONGDESCRIPTION` check box in your SmartCloud Control Desk, as described hereafter.

About this task

From the SmartCloud Control Desk console:

1. In the left-hand pane, select **Integration > Object Structures**.
2. In the Object Structures field, enter **OSLCINCIDENT**.
3. Click **OSLCINCIDENT**.
4. In the left-hand pane, click the **Exclude/Include Fields** action.
5. In the Exclude/Include Fields window, from the Non-Persistent Fields tab select the **DESCRIPTION_LONGDESCRIPTION** check box and click **OK**.

Note that currently the integration does not create a SmartCloud Control Desk ticket for the following jobs:

- Jobs that are set to the `ended in error` state manually (from interfaces)
- Jobs that are set to the `ended in error` state by OPSTAT commands
- Recovery jobs in an end-to-end with fault tolerance capabilities (FTA) environment

Chapter 36. Reporting with IBM Workload Scheduler for z/OS

This chapter describes how the product supports the Dynamic Workload Console reporting feature, collecting historical workload data and archiving it in dedicated tables in a DB2 database. The console process retrieves the archived data and returns it to you by using the Business Intelligent Report Tool (BIRT) Report Viewer and Tivoli Common Reporting. The same reports can also be generated using a command line interface.

Tivoli Common Reporting is an optional integration service of Jazz for Service Management extension for WebSphere, which is installed with WebSphere Application Server. Tivoli Common Reporting provides a web user interface functioning as a portal for IBM Cognos and allows you to administer, run, customize, and create reports on IBM DB2. It provides web-based, launch-in-context report administration and editing.

Using reporting with IBM Workload Scheduler for z/OS, you archive historical data about jobs and workstation workloads in the DB2 database. The historical data consist of old current plan data collected at daily planning time.

For example, you can extend or replan your current plan more than once a day but decide to run the archiving process only once, selecting the new ARCHIVE option from the daily planning dialog. This triggers the submission of a batch job that archives the historical data in the DB2 database, by Java Data Base Connectivity (JDBC) services.

To use these capabilities, some customization actions are required on the following sides:

Host system

- Ensure that you have added the fault-tolerant end-to-end feature using SMP/E on your IBM Workload Scheduler for z/OS installation.
- In the BATCHOPT statement, specify JRUNHISTORY(YES); in the parameter library, create the DBOPT statement to connect to DB2; in the SERVOPTS statement, set DBOPTPRM(DBOPT). For details about these statement, see *Customization and Tuning*.
- Run the required sample jobs (EQQPCS08 and EQQPCS09) to create feature-specific files. For a detailed description about how to run these jobs, see "Configuring your environment for BIRT" on page 707 or "Configuring your environment for Tivoli Common Reporting" on page 713.
- If the DB2 is installed on the z/OS system, setup the database for reporting on the Dynamic Workload Console and create the dedicated tables.

Distributed system with the DB2 database installed

If the DB2 is installed on a distributed system, setup the database for reporting on the Dynamic Workload Console and create the dedicated tables.

The following sections provide detailed information about the reporting feature. They include setting up the environment and the database for running reports from both the Dynamic Workload Console and the command line interface. They

also explain how you customize the security support to protect access to your historical run data using a RACF fixed resource and sub-resource and an encryption utility for the password used when archiving data on DB2.

Before you can generate reports with BIRT, you need to complete the operations described in "Configuring your environment for BIRT" on page 707.

Before you can generate reports with Tivoli Common Reporting, you need to complete the following operations:

1. "Configuring your environment for Tivoli Common Reporting" on page 713
2. "Configuring Tivoli Common Reporting" on page 718
3. "Importing IBM Workload Scheduler reports" on page 719

Archiving historical data

The Dynamic Workload Console is a web-based user interface for IBM Workload Scheduler. By connecting Dynamic Workload Console with a scheduler, you can view and control scheduling activities, and display historical run data and generate reports. Following is a list of the reports that are provided:

Job run statistics
It shows, based on the selection criteria, information about one or more jobs and runtime statistics for each job. You can use it, for example, to detect success or error rates, minimum, maximum, and average durations, late and long duration statistics.

Job run history
It shows historical data about jobs that already ran. This report is usually requested for a specific time frame. You can use it, for example, to detect jobs that ended in error or late jobs, missed deadlines, long durations.

Workstation workload runtimes
It displays the time periods related to job runs. This report provides information about the actual jobs that ran on a specific workstation, along with their actual start times and duration. You can also list the job instances that caused job workload on a workstation, in a specific interval of time. You can use it to make necessary capacity planning adjustments, such as workload modeling and workstation tuning.

Workstation workload summary
It collects data about the workload on the workstations. It shows the number of jobs that actually ran on a specific workstation in a specific interval of time. You can use it to make necessary capacity planning adjustments, such as workload modeling and workstation tuning.

Depending on the interface from where you run the report or the operating system of the engine, the following output formats are available:

Table 48. Supported report output formats

Name of the report	Output formats supported by the Dynamic Workload Console	Output formats supported by batch reports
Job Run History Report	HTML, CSV Only table format	HTML, CSV, PDF Only table format

Table 48. Supported report output formats (continued)

Name of the report	Output formats supported by the Dynamic Workload Console	Output formats supported by batch reports
Job Run Statistics Report	HTML, CSV Table and chart formats	HTML, CSV, PDF Table and chart formats
Workstation Workload Summary Report	HTML, CSV Table and chart formats	HTML, CSV, PDF Table and chart formats
Workstation Workload Runtimes Report	HTML, CSV Table and chart formats	HTML, CSV, PDF Table and chart formats

For more information about how to create and run reports from the Dynamic Workload Console, see the Reporting chapter of the *Dynamic Workload Console User's Guide*.

Reports

Table 49 on page 704 summarizes the historical reports in terms of their:

- Functionality
- Selection criteria
- Output content options

Table 49. Summary of historical reports

Report name	Description	Selection criteria	Output content options
Job run history	Collects historical job execution data during a time interval. Helps you find: • Jobs ended in error • Jobs that ended in error and were rerun or manually set to complete • Late jobs • Missed deadlines • Long duration • Rerun indicators for reruns • Other historical information. **Note:** a job run is not archived by the reporting feature if it terminated with one of the following error codes: • OSEQ, OSUF, OSUB, OSUP, OJCV, JCLI, JCL, MCP, OSSI, OSSQ, OSSS, OSSC, OFSI, OFSQ, OFSS, OFSC, SERC, SEUN, CATE, CLNO, CLNA, CLNC, or FAIL.	• Job name, job stream name, workstation name, and workstation name (job stream). Each field can be specified using a wildcard. • Submission destination • Execution destination • Status (Success, Error). • Delay indicators • Job execution interval • Include/Exclude rerun iterations	You can select from the following: • Actual start time • Estimated duration • Actual duration • Job identifier • Started late (delay) • Ended late (delay) • Status • Iteration number • Long duration • Error code • Submission destination • Execution destination • Report format: – Table view – Include table of contents
Job run statistics	Collects job execution statistics. Helps you find: • Success/error rates • Minimum and maximum elapsed and CPU times • Average duration • Late and long duration statistics	• Job name. The field can be specified using a wildcard. • Percentage of jobs in Success, Error, Started late, Ended late, and Long duration • Total runs and total reruns	You can select from the following: • Job statistics: – Total runs (divided in Successful and Error) – Total of runtime exceptions (Started late, Ended late, Long duration) – Minimum, average and maximum duration • Report format: – Charts view (pie, bar) – Table view – Include table of contents

Table 49. Summary of historical reports (continued)

Report name	Description	Selection criteria	Output content options
Workstation workload summary	Provides data on the workload in terms of the number of jobs that have run on each workstation. Helps making the necessary capacity planning adjustments (workload modeling, and workstation tuning).	• Workstation names. Fields can be specified using a wildcard. • Submission destination • Execution destination • Date ranges or specific days for workload filtering. • Relative time intervals (allows to reuse the same report task for running each day and getting the report of the production of the day before)	You can select from the following: • Workstation information granularity arranged by: – Hour – Day • Information aggregation options: – Workstation – Run date – Submission destination – Execution destination • Report format: – Charts view (bar, line) – Table view – Include table of contents by date or by workstation
Workstation workload runtimes	Provides data on the job runs (time and duration) on the workstations. Helps making the necessary capacity planning adjustments (workload modeling, and workstation tuning).	• Job and workstation names. Each field can be specified using a wildcard. • Workload execution period • Daily time intervals	You can select from the following: • Job information: – Workstation name – Actual duration – Status – Iteration number – Submission destination – Execution destination – Job number • Information grouped by: – Workstation – Run date – Submission destination – Execution destination • Report format: – Charts view – Table view – Include table of contents
Custom SQL	A wizard helps you define your custom SQL query (only on the database views which you are authorized to access). The resulting report has a table with the column name as specified in the SELECT part of the SQL statement.	You can either write an SQL query statement to be run, or import a file containing the SQL statement that you want to use.	You can select from the following: • Report format: – Table view – Include SQL statement

Table 50 on page 706 shows the available reports, both for BIRT and Tivoli Common Reporting, and their details.

Table 50. Report types

Report Name	Description	Supported environment	Supported by
Job Run History	Collects the historical job run data during a specified time interval. Use it to detect which jobs ended in error or were late. It also shows which jobs missed their deadline, long duration jobs, and rerun indicators for reruns.	Distributed and z/OS	Tivoli Common Reporting and BIRT
Job Run Statistics Chart	Collects the job run statistics. Use it to detect success, error rates; minimum, maximum, and average duration; late and long duration statistics.	Distributed	Tivoli Common Reporting and BIRT
Job Run Statistics Table	A report collecting the job run statistics, which returns output in table format. It is useful to detect success, error rates; minimum, maximum, and average duration; late and long duration statistics.	Distributed	Tivoli Common Reporting and BIRT
Job Run Statistics	A report collecting the job run statistics, which returns output in table format. It is useful to detect success, error rates; minimum, maximum, and average duration; late and long duration statistics.	z/OS	BIRT
Workstation Workload Summary	Shows the workload on the specified workstations. The workload is expressed in terms of number of jobs that ran on them. It helps for capacity planning adjustments (workload modelling and workstation tuning).	Distributed and z/OS	BIRT
Workstation Workload Runtimes	Shows job run times and duration on the specified workstations. It helps for capacity planning adjustments (workload modelling and workstation tuning).	Distributed and z/OS	BIRT
Custom SQL	Allows you to create reports that best fit your business needs. You can specify an SQL query or import SQL scripts.	Distributed	BIRT

Table 50. Report types (continued)

Report Name	Description	Supported environment	Supported by
Planned Production Details	Extracts information about planned production plans into either an XML or a CSV format, to be used respectively, with Microsoft Project and Microsoft Excel. This also allows users who do not know IBM Workload Scheduler to access plan information in a familiar format.	Distributed	BIRT
Actual Production Details	Extracts current plan information into either an XML or a CSV format, to be used, respectively, with Microsoft Project and Microsoft Excel. This also allows users who do not know IBM Workload Scheduler to access plan information in a familiar format.	Distributed	BIRT
Analysis Job Duration Estimation Error	A report that shows the average estimation error. It is useful to detect whether a job ends in frequent errors, ends in error, or if the jobs have unsatisfactory accuracy rates. You can then drill down to display all the jobs that are in that threshold and finally you can visualize charts that will help you to identify the jobs that have a high estimated error rate allowing you to intervene beforehand on those jobs.	Distributed and z/OS	Tivoli Common Reporting
Analysis Job Duration Standard Deviation	A report showing variances in job duration. The variance is calculated as a percentage and according to which variance level the jobs are they will be presented as follows: **High variability**, **Medium variability** or a **Low variability**. You can drill down to display all the jobs that are in that threshold which then returns output in a chart format. This report is useful to identify the run that had a greater duration.	Distributed and z/OS	Tivoli Common Reporting

Configuring your environment for BIRT

About this task

To create your reports with BIRT, configure the environment as described in the following sections:

- "Setting up the environment"
- "Setting up the database in the distributed environment" on page 710
- "Creating the database in the z/OS environment" on page 710
- "Creating the database in the distributed environment" on page 711
- "Encrypting the password in DBOPT statement" on page 712
- "Setting up RACF authorization" on page 713

Setting up the environment

About this task

To use the archiving capabilities of the host system and to be able to archive and run historical reports, set up the environment on the controller by performing the following steps:

1. Run EQQJOBS to create or modify the following skeletons:

   EQQDBARS
   Historical data archiver.

   EQQDPEXS
   Daily plan extend skeleton.

   EQQDPRCS
   Daily plan replan skeleton.

   and samples:

   EQQPCS08
   To set up the working directory.

   EQQPCS09
   To allocate VSAM and GDG files.

   EQQDBOPT
   To set DBOPT parameters.

   EQQDBENC
   To encrypt the password specified in the DBOPT statement.

   EQQSERP
   To set server parameters.

   EQQCONP
   To set batch options, if controller and tracker run in the same address space.

   EQQCONOP
   To set batch options, if controller and tracker run in separate address spaces.

2. Run EQQPCS09 to allocate a VSAM data set and a Generation Data Group (GDG) root, used by the archiving process, with the following characteristics:

   NOEMPTY
   Specifies that only the oldest GDG generation is to be deleted and uncataloged when the generation number reaches the maximum limit.

   SCRATCH
   Specifies that all the control information, related to a GDG generation, is to be deleted when the system deletes that generation.

LIMIT(255)

Specify how many versions will be kept in the generation data group.

3. Run EQQPCS08 to customize the working directory.

   For details about steps 1-3, see *Planning and Installation*.

4. Customize the parameter library as follows. For details about the BATCHOPT, DBOPT, SERVOPTS, and AUTHDEF statements, see *Customization and Tuning*.
   - In the BATCHOPT initialization statement, set the JRUNHISTORY parameter to YES.
   - In the parameter library, add a member that contains only the DBOPT statement, specifying the parameters to connect to the database and manage the historical data archiving process.
   - In the SERVOPTS statement, set the DBOPTPRM parameter to the name of the member containing the DBOPT statement.
   - Optionally, in the AUTHDEF statement set SUBRESOURCES (RP.REPTYPE) to include the RP.REPTYPE subresource. For details, refer to section "Setting up RACF authorization" on page 713.
   - Encrypt the password to access the database. For details, refer to section "Encrypting the password in DBOPT statement" on page 712.
5. Set up the relational database. For details, refer to section "Setting up the database in the distributed environment" on page 710 or "Creating the database in the z/OS environment" on page 710.
6. Set up the RACF definitions. For details, refer to section "Setting up RACF authorization" on page 713.
7. Make sure you installed the REXX Compiler and you defined the TSO Compiler Programming Table, IRXCMPTM.

To populate the relational database with historical data, perform the following steps:

1. Run a daily planning EXTEND or REPLAN. During this step, the old current plan is copied into a Generation Data Grouping (GDG) entry data set by using a REPRO command. The GDG data set is identified in the daily planning EXTEND or REPLAN batch job by the EQQOCPBK ddname.
2. Periodically, archive the old current plans. Select option 3 (DAILY PLANNING) from the main menu. The following panel is displayed:

```
EQQDPLNP ----------------- PRODUCING IWSz DAILY PLANS -------------------------
Option ===>

Select one of the following :

1 REPLAN           -  Replan current planning period
2 EXTEND           -  Extend the current planning period
3 TRIAL            -  Produce a trial plan
4 PRINT CURRENT    -  Print statistics for current planning period
5 SYMPHONY RENEW   -  Create Symphony file starting from Current Plan
6 ARCHIVE          -  Archive old current plans
```

3. Select option 6 (ARCHIVE) to display the following panel:

```
EQQXSUBP -------------- GENERATING JCL FOR A BATCH JOB ------------------------
Command ===>

Enter/change data below and press ENTER to submit/edit the JCL.

JCL to be generated for: Archive old current plans

SYSOUT CLASS       ===> _           (Used only if output to system printer)
LOCAL PRINTER NAME ===> ________    (Used only if output on local printer)
                                    (Used only if CLASS is blank)
DATASET NAME       ===> ____________________________________________
                                    (Used only if CLASS and LOCAL PRINTER
                                    are both blank). If blank default name
                                    used is TWSIDD1.TWSI.ARCCP.LIST

SUBMIT/EDIT JOB    ===> E           S to submit JOB, E to edit

Job statement    :
 ===> //TWSIDP  JOB (880000),'TWSCWSB SYS',MSGCLASS=D,_____________________
 ===> //  CLASS=D,MSGLEVEL=(1,1)_____________________________________________
 ===> _______________________________________________________________________
 ===> _______________________________________________________________________
```

4. Press Enter to generate a JCL that, for each GDG entry related to the root you specified, will start a program that:
   - Converts the sequential GDG data set to the predefined VSAM using REPRO.
   - Reads the records from the VSAM and archives the historical data in the database.
   - Deletes the processed GDG, if the process is successful.

   Note: You obtain a JCL tailored according to the EQQDBARS skeleton JCL, generated by the EQQJOBS dialog. Before submitting the JCL, specify at least 128 MB as region value.

Creating the database in the z/OS environment

To set up the DB2 database installed on your z/OS system for creating reports with the Dynamic Workload Console, customize the EQQINIRE JCL contained in the IBM Workload Scheduler for z/OS SAMPLE libraries. Specify the following:

- The storage group volumes and VCAT
- The names of the database and of the SAMPLE library (the default name is SEQQSAMP)

EQQINIRE triggers member EQQDBREP, supplied in the SEQQSAMP library, which contains the SQL statements required to create the database and the following DB2 tables, including the constraints, indexes, and views related to these tables:

MDL.JOS_JOB_STATISTICS
Used to store statistics run data

MDL.JHR_JOB_HISTORY_RUNS
Used to store job run data

Setting up the database in the distributed environment

To set up the database in the distributed environment, use the product CD that contains the TWSZ* files:

TWSZDB2.zip
To be used with Windows operating system.

TWSZDB2.tar
To be used with UNIX and Linux operating systems.

For a description of the product CD, refer to *Memo to Users*.

The previous files contain the script and SQL files you need to create the database. For a procedure to create the database, refer to "Creating the database in the distributed environment" section.

Extract the correct file content on the workstation where the DB2 server is installed.

Creating the database in the distributed environment

About this task

To create the database where historical run data is stored, you can run the following scripts, depending on the operating system you use:

- dbsetup.bat for Windows.
- dbsetup.sh UNIX and Linux.

In the same directory, the following files are also located:

- create_database.sql
- create_tables.sql
- create_constraints.sql
- create_indexes.sql

To set up the database, perform the following steps:

1. Save the script and SQL files locally on your workstation. The DB2 user needs read and write privileges on the directory where you save these files.
2. Depending on the operating system you are using, do the following:
   - If you use Windows, open a DB2 command window and access the directory where you saved the files.
   - If you use UNIX or Linux, log on as DB2 administrator and access the directory where you saved the files.
3. Before you activate the reporting feature for the first time, run **dbsetup** as follows:

   dbsetup ***dbName dbTableSpace dbDataDir port db2Admin db2AdminPwd***

   where the parameters are positional and indicate the following:

   dbName
   The name of the database to be created.

   dbTableSpace
   The name of the user table space.

   dbDataDir
   The name of the directory where DB2 is to store the data.

   port The port number.

   db2Admin
   The DB2 administrator user ID.

   db2AdminPwd
   The DB2 administrator password.

Example:

```
dbsetup dbweb tsdbweb twsdbweb_data 50000 db2inst1 mypwd
```

4. The **dbsetup** command triggers the SQL definitions to create the database, the following DB2 tables, and the constraints, indexes, and views related to those tables:

   MDL.JOS_JOB_STATISTICS
   To store statistics run data.

   MDL.JHR_JOB_HISTORY_RUNS
   To store job run data.

5. To grant a user access to the views created in the previous step, use the **dbgrant** script. From a DB2 command prompt, enter the following command:

   dbgrant *dbName dbUser db2Admin db2AdminPwd*

   where the parameters are positional and indicate the following:

   dbName
   The name of the database to be used for the reporting feature.

   dbUser The name of the user to be granted.

   db2Admin
   The DB2 administrator user ID.

   db2AdminPwd
   The DB2 administrator password.

   Example:

   ```
   dbgrant dbweb webuser goofy goofypwd
   ```

Encrypting the password in DBOPT statement

About this task

To make the password set in the DBPSW parameter of the DBOPT statement not readable you can use either one of these three encrypting methods:

- Write the password in plaintext in the DBPSW parameter. The first time you run the archiving process, the password is automatically encrypted.
- Write the password in plaintext in the DBPSW parameter, and then encrypt it by submitting the EQQBENC JCL, which in turn runs a stand-alone application that checks the validity of the statement and encrypts the password.
- If you do not want to write the password in plaintext, you can set it already encrypted by running the shell command **RunChangeEncryptPwd** as follows:

  sh RunChangeEncryptPwd -c *jarpath* -d *dataset* -m *membername* -p *pwd* [-j *javapath*]

  where the parameters indicate the following:

  jarpath The complete path where the jar files are stored.

  dataset The data set name of the parameter library.

  membername
  The member where the DBOPT statement is located.

  pwd The password you are setting

  javapath
  The complete path where IBM SDK for z/OS is stored.

Setting up RACF authorization

About this task

Before IBM Workload Scheduler for z/OS executes any your request, a security verification check is passed to the System Authorization Facility (SAF) to ensure that you are authorized to access all the resources required to perform the request. You can use fixed resources and subresources to protect IBM Workload Scheduler for z/OS functions and data. When a console user requires a report, fixed resources (RP) are checked. Subresources (RP.REPTYPE) are checked only if they are defined in the AUTHDEF statement, for this reason you are required to add subresource RP.RETYPE in the AUTHDEF statement.

Allowed report types are RUNSTATS, RUNHIST, WWR, WWS, and SQL. Define these reports to RACF with the following command:

```
RDEF ibmopc RPT.reptype UACC(read)
```

Then authorize the reports to RACF with the following command:

```
PE RPT.reptype ID(userid) ACCESS(read) CLASS(ibmopc)
```

For detailed information about how to protect resources through RACF, refer to the *Customization and Tuning* manual.

Configuring your environment for Tivoli Common Reporting

About this task

To create your reports with Tivoli Common Reporting, configure the environment as described in the following sections:

- "Setting up the environment" on page 708
- "Setting up the database in the distributed environment" on page 710
- "Creating the database in the distributed environment" on page 711
- "Encrypting the password in DBOPT statement" on page 712

Setting up the environment

About this task

To use the archiving capabilities of the host system and to be able to archive and run historical reports, set up the environment on the controller by performing the following steps:

1. Run EQQJOBS to create or modify the following skeletons:

   EQQDBARS
   Historical data archiver.

   EQQDPEXS
   Daily plan extend skeleton.

   EQQDPRCS
   Daily plan replan skeleton.

   and samples:

   EQQPCS08
   To set up the working directory.

EQQPCS09
To allocate VSAM and GDG files.

EQQDBOPT
To set DBOPT parameters.

EQQDBENC
To encrypt the password specified in the DBOPT statement.

EQQSERP
To set server parameters.

EQQCONP
To set batch options, if controller and tracker run in the same address space.

EQQCONOP
To set batch options, if controller and tracker run in separate address spaces.

2. Run EQQPCS09 to allocate a VSAM data set and a Generation Data Group (GDG) root, used by the archiving process, with the following characteristics:

   NOEMPTY
   Specifies that only the oldest GDG generation is to be deleted and uncataloged when the generation number reaches the maximum limit.

   SCRATCH
   Specifies that all the control information, related to a GDG generation, is to be deleted when the system deletes that generation.

   LIMIT(255)
   Specify how many versions will be kept in the generation data group.
3. Run EQQPCS08 to customize the working directory.

   For details about steps 1-3, see *Planning and Installation*.
4. Customize the parameter library as follows. For details about the BATCHOPT, DBOPT, SERVOPTS, and AUTHDEF statements, see *Customization and Tuning*.
   - In the BATCHOPT initialization statement, set the JRUNHISTORY parameter to YES.
   - In the parameter library, add a member that contains only the DBOPT statement, specifying the parameters to connect to the database and manage the historical data archiving process.
   - In the SERVOPTS statement, set the DBOPTPRM parameter to the name of the member containing the DBOPT statement.
   - Optionally, in the AUTHDEF statement set SUBRESOURCES (RP.REPTYPE) to include the RP.REPTYPE subresource. For details, refer to section "Setting up RACF authorization" on page 713.
   - Encrypt the password to access the database. For details, refer to section "Encrypting the password in DBOPT statement" on page 712.
5. Set up the relational database. For details, refer to section "Setting up the database in the distributed environment" on page 710 or "Creating the database in the z/OS environment" on page 710.
6. Set up the RACF definitions. For details, refer to section "Setting up RACF authorization" on page 713.
7. Make sure you installed the REXX Compiler and you defined the TSO Compiler Programming Table, IRXCMPTM.

To populate the relational database with historical data, perform the following steps:

1. Run a daily planning EXTEND or REPLAN. During this step, the old current plan is copied into a Generation Data Grouping (GDG) entry data set by using a REPRO command. The GDG data set is identified in the daily planning EXTEND or REPLAN batch job by the EQQOCPBK ddname.
2. Periodically, archive the old current plans. Select option 3 (DAILY PLANNING) from the main menu. The following panel is displayed:

```
EQQDPLNP ----------------- PRODUCING IWSz DAILY PLANS -------------------------
Option ===>

Select one of the following :

1 REPLAN           -  Replan current planning period
2 EXTEND           -  Extend the current planning period
3 TRIAL            -  Produce a trial plan
4 PRINT CURRENT    -  Print statistics for current planning period
5 SYMPHONY RENEW   -  Create Symphony file starting from Current Plan
6 ARCHIVE          -  Archive old current plans
```

3. Select option 6 (ARCHIVE) to display the following panel:

```
EQQXSUBP -------------- GENERATING JCL FOR A BATCH JOB ------------------------
Command ===>

Enter/change data below and press ENTER to submit/edit the JCL.

JCL to be generated for: Archive old current plans

SYSOUT CLASS       ===> _           (Used only if output to system printer)
LOCAL PRINTER NAME ===> ________    (Used only if output on local printer)
                                    (Used only if CLASS is blank)
DATASET NAME       ===> ____________________________________________
                                    (Used only if CLASS and LOCAL PRINTER
                                    are both blank). If blank default name
                                    used is TWSIDD1.TWSI.ARCCP.LIST

SUBMIT/EDIT JOB    ===> E           S to submit JOB, E to edit

Job statement    :
 ===> //TWSIDP  JOB (880000),'TWSCWSB SYS',MSGCLASS=D,_____________________
 ===> //  CLASS=D,MSGLEVEL=(1,1)_____________________________________________
 ===> _______________________________________________________________________
 ===> _______________________________________________________________________
```

4. Press Enter to generate a JCL that, for each GDG entry related to the root you specified, will start a program that:
   - Converts the sequential GDG data set to the predefined VSAM using REPRO.
   - Reads the records from the VSAM and archives the historical data in the database.
   - Deletes the processed GDG, if the process is successful.

   Note: You obtain a JCL tailored according to the EQQDBARS skeleton JCL, generated by the EQQJOBS dialog. Before submitting the JCL, specify at least 128 MB as region value.

Setting up the database in the distributed environment

To set up the database in the distributed environment, use the product CD that contains the TWSZ* files:

TWSZDB2.zip
To be used with Windows operating system.

TWSZDB2.tar
To be used with UNIX and Linux operating systems.

For a description of the product CD, refer to *Memo to Users*.

The previous files contain the script and SQL files you need to create the database. For a procedure to create the database, refer to "Creating the database in the distributed environment" on page 711 section.

Extract the correct file content on the workstation where the DB2 server is installed.

Creating the database in the distributed environment

About this task

To create the database where historical run data is stored, you can run the following scripts, depending on the operating system you use:

- dbsetup.bat for Windows.
- dbsetup.sh UNIX and Linux.

In the same directory, the following files are also located:

- create_database.sql
- create_tables.sql
- create_constraints.sql
- create_indexes.sql

To set up the database, perform the following steps:

1. Save the script and SQL files locally on your workstation. The DB2 user needs read and write privileges on the directory where you save these files.
2. Depending on the operating system you are using, do the following:
   - If you use Windows, open a DB2 command window and access the directory where you saved the files.
   - If you use UNIX or Linux, log on as DB2 administrator and access the directory where you saved the files.
3. Before you activate the reporting feature for the first time, run **dbsetup** as follows:

   ```
   dbsetup dbName dbTableSpace dbDataDir port db2Admin db2AdminPwd
   ```

   where the parameters are positional and indicate the following:

   dbName
   The name of the database to be created.

   dbTableSpace
   The name of the user table space.

   dbDataDir
   The name of the directory where DB2 is to store the data.

port The port number.

db2Admin
The DB2 administrator user ID.

db2AdminPwd
The DB2 administrator password.

Example:

```
dbsetup dbweb tsdbweb twsdbweb_data 50000 db2inst1 mypwd
```

4. The **dbsetup** command triggers the SQL definitions to create the database, the following DB2 tables, and the constraints, indexes, and views related to those tables:

   MDL.JOS_JOB_STATISTICS
   To store statistics run data.

   MDL.JHR_JOB_HISTORY_RUNS
   To store job run data.

5. To grant a user access to the views created in the previous step, use the **dbgrant** script. From a DB2 command prompt, enter the following command:

   ```
   dbgrant dbName dbUser db2Admin db2AdminPwd
   ```

   where the parameters are positional and indicate the following:

   dbName
   The name of the database to be used for the reporting feature.

   dbUser The name of the user to be granted.

   db2Admin
   The DB2 administrator user ID.

   db2AdminPwd
   The DB2 administrator password.

   Example:

   ```
   dbgrant dbweb webuser goofy goofypwd
   ```

Encrypting the password in DBOPT statement

About this task

To make the password set in the DBPSW parameter of the DBOPT statement not readable you can use either one of these three encrypting methods:

- Write the password in plaintext in the DBPSW parameter. The first time you run the archiving process, the password is automatically encrypted.
- Write the password in plaintext in the DBPSW parameter, and then encrypt it by submitting the EQQBENC JCL, which in turn runs a stand-alone application that checks the validity of the statement and encrypts the password.
- If you do not want to write the password in plaintext, you can set it already encrypted by running the shell command **RunChangeEncryptPwd** as follows:

  ```
  sh RunChangeEncryptPwd -c jarpath -d dataset -m membername -p pwd [-j javapath]
  ```

  where the parameters indicate the following:

  jarpath The complete path where the jar files are stored.

  dataset The data set name of the parameter library.

  membername
  The member where the DBOPT statement is located.

pwd The password you are setting

javapath
The complete path where IBM SDK for z/OS is stored.

Configuring Tivoli Common Reporting

Configure Tivoli Common Reporting.

About this task

Tivoli Common Reporting provides a portal for IBM Cognos. After you have installed and configured Tivoli Common Reporting, you can launch and operate on IBM Cognos from the Dynamic Workload Console.

For more information about installing Tivoli Common Reporting, see the section about the Dynamic Workload Console prerequisites in the *Planning and Installation Guide*.

To configure Tivoli Common Reporting, perform the following steps:

Procedure

1. Ensure you have installed Jazz for Service Management and Tivoli Common Reporting.
2. From the navigation toolbar, click **Reporting** > **Common Reporting**. The IBM Cognos Connection interface is displayed.
3. Click **Launch** > **Administration**.
4. Select the **Configuration** tab.
5. Click the **New Data Source** icon. The **New Data Source** wizard is displayed.
6. Specify the name of the alias of the IBM Workload Scheduler database. The name of the database alias is as follows:

   On distributed environments
   `TWS`

   On z/OS environments
   `TWS_ZOS`
7. In the **Type** list, select either **IBM DB2** or the appropriate **Microsoft SQL Server** selection. Do not modify the other default values on this wizard page and click **Next**.
8. Specify the database name. This is the name of the database where your data is stored.
9. In the **Signon** section, select the **Password** checkbox and specify the user ID and password of the IBM Workload Scheduler database. Click **Next**.
10. In the **Server name** field, specify the server name or IP address of the database, the port number, the JDBC connection properties, and the database name. Click **Test Connection**, if successful, click **Finish**. If the connection test is not successful, correct the information and retry.

Results

You have defined the connection to the IBM Workload Scheduler database. You can now use IBM Cognos to create and customize reports on the IBM Workload Scheduler database. For more information, see the IBM Cognos documentation.

To import the reports provided with IBM Workload Scheduler, follow the import procedure, as described in "Importing IBM Workload Scheduler reports."

Importing IBM Workload Scheduler reports

This topic describes the Tivoli Common Reporting sample and historical reports available with IBM Workload Scheduler

About this task

IBM Workload Scheduler installation media provide the following packages in the **reports** folder:

The following packages are available for the **distributed environment**:

Historical_Report.zip
This package contains the following analytical reports:
- Analysis Job Duration Estimation Error
- Analysis Job Duration Standard Deviation

IWSReportsSamples_for_TCR.zip
This compressed file contains two packages, one for IBM DB2 databases (IWS_DB2) and one for Microsoft SQL Server databases (IWS_MSSQL), with the following sample reports:
- Job Run History
- Job Run Statistics Chart
- Job Run Statistics Table

The following packages are available for the **z/OS environment**:

Historical_Report_for_zOS.zip
This package contains the following analytical reports:
- Analysis Job Duration Estimation Error
- Analysis Job Duration Standard Deviation

TWSReportsSamples_for_TCR_93_for_zOS.zip
This package contains the following report:
- Job Run History

To import IBM Workload Scheduler packages in Tivoli Common Reporting, perform the following steps:

Procedure

1. Copy the packages from the installation media to the following path:

   On Windows operating systems:
   `<JAZZSM_INSTALL_DIR>\reporting\cognos\deployment`

   On UNIX and Linux operating systems:
   `<JAZZSM_INSTALL_DIR>/reporting/cognos/deployment`
2. From the navigation toolbar, click **Reporting** > **Common Reporting**. The IBM Cognos Connection interface is displayed.
3. Click **Launch** > **Administration**.
4. Select the **Configuration** tab.
5. Click **Content Administration** in the left-side pane.

6. Click the **New Import** icon and select one or more packages depending on which reports you want to import.
7. You can optionally select the reports to be imported for each package.
8. Maintain all the default values and follow the wizard.
9. Click **Run** to run the imported reports immediately.

Results

If you imported the historical reports, they are displayed in the **Public Folders**.

If you imported the sample reports, they are displayed in the **Public Folders** in the **TWA** entry.

The following sample reports are available:

Table 51. Sample report types

Report Name	Description	Supported environment	Available in package
Job Run History	A report collecting the historical job run data during a specified time interval. It is useful to detect which jobs ended in error or were late, as well as critical and promoted jobs and the latest time within which the job can start without causing the critical job miss its deadline. It also shows which jobs missed their deadline, long duration jobs, and rerun indicators for reruns.	Distributed and z/OS	• `IWSReportsSamples_for_TCR.zip` • `TWSReportsSamples_for_TCR_93_for_zOS.zip`
Job Run Statistics Chart	A report collecting the job run statistics, which returns output in chart format. It is useful to detect success, error rates; minimum, maximum, and average duration; late and long duration statistics; however, it might take some time to generate.	Distributed	`IWSReportsSamples_for_TCR.zip`
Job Run Statistics Table	A report collecting the job run statistics, which returns output in table format. It is useful to detect success, error rates; minimum, maximum, and average duration; late and long duration statistics.	Distributed	`IWSReportsSamples_for_TCR.zip`

The following analytical reports are available:

Table 52. Analytical report types

Report Name	Description	Supported environment	Available in package
Analysis Job Duration Estimation Error	A report that shows the average estimation error. It is useful to detect whether a job ends in frequent errors, ends in error, or if the jobs have unsatisfactory accuracy rates. You can then drill down to display all the jobs that are in that threshold and finally you can visualize charts that will help you to identify the jobs that have a high estimated error rate allowing you to intervene beforehand on those jobs. **Note:** When specifying the filter criteria for the Thresholds of this report, consider that the "Correct interval" threshold cannot be higher than the "Wrong interval".	Distributed and z/OS	• `Historical_Report.zip` • `Historical_Report_for_zOS.zip`

Table 52. Analytical report types (continued)

Report Name	Description	Supported environment	Available in package
Analysis Job Duration Standard Deviation	A report showing variances in job duration. The variance is calculated as a percentage and according to which variance level the jobs are they will be presented as follows: **High variability**, **Medium variability** or a **Low variability**. You can drill down to display all the jobs that are in that threshold which then returns output in a chart format. This report is useful to identify the run that had a greater duration.	Distributed and z/OS	• Historical_Report.zip • Historical_Report_for_zOS.zip

Note: Jobs contained in the report are those that had a higher planned duration than 0 and have ran successfully.

You can now use IBM Cognos to create and customize reports on the IBM Workload Scheduler database. For more information, see the IBM Cognos documentation.

Running batch reports from the command line interface

This section describes how you can run from the command line the reports listed in "Reports" on page 703.

The ability to run such reports from a command line interface allows you to schedule your reports so that you can trigger them on a timely basis.

A sample business scenario

To avoid unexpected slowing down in the workload processing, the analyst of a big company needs weekly reports collecting historical information about the processed workload to determine and analyze any workload peaks that might occur.

To satisfy this request, the Administrator creates *Workload Workstation Summary Reports* (WWS) and *Workload Workstation Runtimes Reports* (WWR).

To accomplish his task, he runs the following steps:

1. He customizes the property files related to the Workload Workstation Summary and Workload Workstation Runtimes reports, specifying the format and content of the report output.
2. He schedules jobs to obtain WWS and WWR reports:
   - The first job generates a WWS report to be saved locally
   - The second job runs a WWR report overnight on expected workload peaks time frames. The report output is sent using an mail to the analyst. The information collected are used to optimize the workload balance on the systems.
3. He adds the two jobs to a job stream scheduled to run weekly and generates the plan.

Setting up for command line batch reporting

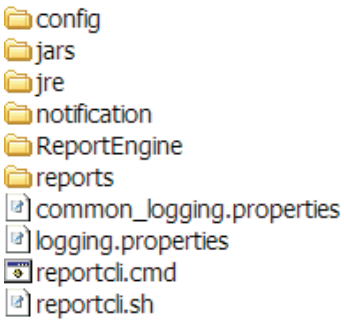
About this task

Before running batch reports you must run a few setup steps:

Procedure

1. The software needed to run batch reports is contained in a package included in the IBM Workload Scheduler installation image. If you plan to run batch reports from within a scheduled job, extract the package file on one of the operating systems listed in http://www-01.ibm.com/support/docview.wss?rs=672&uid=swg24039471.

   After extracting the file, the following file structure is created:

   Because the native UNIX tar utility does not support long file names, if you are extracting the files on AIX®, Solaris, or HP-UX systems, ensure that the latest GNU version of tar (gtar) is installed to extract the files successfully.

   Note:

   a. Make sure you run the following commands in the directory where you extracted the files:

      On UNIX

      ```
      chmod -R +x *
      chown -R username *
      ```

      On Windows

      Make sure IBM Workload Scheduler is installed.

      ```
      setown -u username *
      ```

      where *username* is the user that will run the reports.

   b. If you plan to schedule jobs that run batch reports, the system where you extract the package must be accessible as network file system from an IBM Workload Scheduler for z/OS defined in the local scheduling environment.

   c. If you will be using a DB2 database installed in the Z/OS environment, you must copy the DB2 license file locally to be able to connect to the data server:

      - If you are connecting directly to the data server and using DB2 Connect Unlimited Edition for System z, perform the activation step by running the activation program in the license activation kit.
      - If you are using any other edition of DB2 Connect, obtain the `db2jcc_license_cisuz.jar` license file from the license activation kit, and follow the installation directions to include the license file in the class path. Copy the license file to the following directories:
        – ./jars

- ./ReportEngine/lib
- ./ReportEngine/plugins/
  org.eclipse.birt.report.data.oda.jdbc_4.2.1.v20120820/drivers

2. Configure the template file `.\config\common.properties` specifying the information to:
   a. Connect to the database where the historical data are stored.
   b. Set the date and time format, including the time zone. The file `.\config\timezone.txt` contains a list of time zones supported by IBM Workload Scheduler and the information on how to set them. The time zone names are case sensitive.
   c. Make available the report output on the URL specified in **ContextRootUrl** field. This is an example of configuration settings:

```
######################################################################
 # HTTP Server information
 ######################################################################

 #Specify the context root where the report will be available
 #To leverage this possibility it needs to specify in the report output dir
 #the directory that is referred by your HTTP Server with this contect root

 ContextRootUrl=http://myserver/reportoutput
```

   In this case make sure that the *output_report_dir* specified when running the batch reports command points to the same directory specified in the **ContextRootUrl** field.
   d. Send the report output using a mail. This is an example of configuration settings:

```
######################################################################
 # Email Server configuration
 ######################################################################
 PARAM_SendReportByEmail=true

 #SMTP server
 mail.smtp.host=myhost.mydomain.com
 #IMAP provider
 mail.imap.socketFactory.fallback=false
 mail.imap.port=993
 mail.imap.socketFactory.port=993
 #POP3 provider
 mail.pop3.socketFactory.fallback=false
 mail.pop3.port=995
 mail.pop3.socketFactory.port=995

 ######################################################################
 # Email properties
 ######################################################################
 PARAM_EmailFrom=user1@your_company.com
 PARAM_EmailTo=user2@your_company.com,user3@your_company.com
 PARAM_EmailCC=user4@your_company.com
 PARAM_EmailBCC=user5@your_company.com
 PARAM_EmailSubject=Test send report by email
 PARAM_EmailBody=This is the report attached
```

   An explanation of all the customizable fields is contained in the template file.

Results

Note: If you plan to run Workstation Workload Runtime reports ensure that the file system where database is installed has enough free space. If a shortage of disk space occurs, an SQL exception similar to the following example is triggered:

```
DB2 SQL error: SQLCODE: -968, SQLSTATE: 57011
```

Running batch reports

About this task

The `\reports\templates` directory contains a sample template file for each type of report.

Before running any of these reports make sure you customize the corresponding template file.

In that file, named *report_name.properties*, you can specify:

- The information to display in the report header.
- How to filter the information to display the expected result.
- The format and content of the report output.

For more information about the specific settings see the explanation provided in the template file beside each field.

If you are using DBCS characters to specify the parameters in the template .properties files, ensure you save the file in UTF-8 encoding

After you set up the environment as it is described in "Setting up for command line batch reporting" on page 722, and you configured report template file, use the following syntax to run the report:

reportcli -p *report_name.property*
[**-o** *output_report_dir*]
[**-r** *report_output_name*]
[**-k** *key=value*]
[**-k** *key=value*]
.....

where

-p *report_name.property*
Specifies the path name to the report template file.

-o *output_report_dir*
Specifies the output directory for the report output.

-r *report_output_name*
Specifies the name of the report output.

-k key= *value*
Specifies the value of a settings. This value override the corresponding value, if defined, in the `common.properties` file or in the `report_name.properties` file.

Examples

1. In this example the `reportcli.cmd` is run with the default parameter and produces the report `jrh1`:

   ```
   reportcli.cmd -p D:\ReportCLI\TWSReportCli\reports\templates\jrh.properties
   -r jrh1
   ```

2. In this example the `reportcli.cmd` is run using the `-k` parameter to override the values set for **PARAM_DateFormat** in the `.\config\common.properties` file and produces the report `jrh2`:

```
reportcli.cmd -p D:\ReportCLI\TWSReportCli\reports\templates\jrh.properties
-r jrh2 -k PARAM_DateFormat=short
```

3. In this example the `reportcli.cmd` is run using the `-k` parameter to override the format specified for the report output in the PROPERTIES file and produces the report `wwr3`:

```
 ./reportcli.sh -p /TWSReportCli/REPCLI/reports/templates/wwr.properties
-r wwr3 -k REPORT_OUTPUT_FORMAT=html -k OutputView=charts
```

4. Do the following if you want to run a Custom SQL report and make available the output of the report at the following URL as `http://myserver/reportoutput/report1.html`:
   a. Configure the `ContextRootUrl` parameter in the common.properties files as follows:

```
######################################################################
 # HTTP Server information
 ######################################################################

 #Specify the context root where the report will be available
 #To leverage this possibility it needs to specify in the report output dir
 #the directory that is referred by your HTTP Server with this contect root

 ContextRootUrl=http://myserver/reportoutput
```

   b. When you run a command specify as *output_report_dir* a directory that points to the same HTTP directory specified in the *ContextRootUrl*. For example, if you mapped locally the `http://myserver/` as `R:` driver, you can run the following command:

```
reportclibat
   -p REPORT_CLI_DIR\reports\TWS\historical\templates\sql.properties
   -r report1
   -o R:\reportoutput
```

   c. As a confirmation for the successful run of the report, the following message is displayed:

```
AWSBRC0106I Report available on: http://myserver/reportoutput/report1.html
```

      This URL shows where the report output is available.

Note: If the report is run through an IBM Workload Scheduler job, the output of the command is displayed in the job output.

Logs and traces for batch reports

The file `./common_logging.properties` contains the parameters you can use to configure tracing and logging.

The file contains the following settings:

```
logFileName=reportcli.log
traceFileName=trace.log
trace=off
birt_trace=off
```

where

logFileName
: Specifies the name of the file containing generic information, warning about potential problems, and information about errors. This file is store under `./log`.

traceFileName
Specifies the name of the file containing traces. If you set trace=on the trace file is store under `./log`.

trace Specifies whether to enable or not traces. Enable the traces by setting `trace=on` if you want to investigate further about an error,

birt_trace
Specifies whether to enable or not traces to diagnose errors in BIRT engine. If you set `birt_trace=on` a file containing the trace and named `ReportEngine_aaaa_mm_dd_hh_mm_ss.log` is stored in the `/ReportEngine/logs` folder

Keeping historical data in the database

The data stored in the database is kept according to the clean up policy you specified with the CLEANUPPOLICY parameter of the DBOPT initialization statement. With this parameter you can specify the number of days you want to keep the data in the tables. The default value is 10.

For details about the DBOPT statement, refer to *Customization and Tuning*.

Part 3. Appendixes

Appendix A. TSO commands

This appendix describes the TSO commands and how you can use them in batch mode, using the event-generating batch program, EQQEVPGM. See "EQQEVPGM - Issue commands in batch" on page 773 for an example of the JCL that you need for EQQEVPGM. Examples of these commands are provided for both online and batch invocation.

To invoke these as TSO commands from a system where a controller is not running, they must first be defined as authorized TSO commands on that system. Your system programmer can do this by adding the commands to the list defined by the NAMES keyword of the AUTHCMD statement in member IKJTSO*xx* of SYS1.PARMLIB. For more information about updating SYS1.PARMLIB, see *IBM Workload Scheduler for z/OS: Planning and Installation*.

Note: When EQQEVPGM is used to issue TSO commands, statement data must be in columns 1 through 72. Information in columns 73 through 80 is ignored. You can abbreviate keywords to their shortest unambiguous form. For example, you can shorten the AVAIL keyword to an 'A'.

If you plan to issue the TSO commands many times per day from a long-running non-TSO address space (for example, NetView) it is recommended that you use an IBM Workload Scheduler for z/OS subroutine instead. If you plan to run PIF applications many times per day from a long-running non-TSO address space (for example, NetView), it is recommended that you do not specify the EQQYPARM ddname. When you either do one of the following:

- Issue the commands from TSO or as input to the EQQEVPGM program
- Run a PIF application by specifying the EQQYPARM ddname

a TSO environment must be established each time and some of the resources remain allocated until the task ends, which might lead to a storage shortage if the commands are issued many times.

For detailed information about the subroutines, see *Customization and Tuning*.

Important considerations for using the TSO commands

Consider these points when using the TSO commands:

- The parameters that you pass to the TSO commands are checked only for the correct format; that is, numeric fields must contain only numbers within a valid range, date fields must contain valid dates, and so on. The parameters are *not* checked for their validity for a particular IBM Workload Scheduler for z/OS address space. For example, the workstation name that you specify for OPSTAT is not verified against the actual workstations that exist in a particular current plan. In addition, a single event record can be generated to be used in two or more IBM Workload Scheduler for z/OS address spaces. A particular parameter (for example, the application description ID) might be valid for one address space and not another.

  As long as the minimum parameter requirements are met and the parameters are in the correct format, the TSO commands will execute successfully and generate an event record.

When the event is processed by the controller, it is checked for validity. If any errors are found, an error message is written to the controller message log (EQQMLOG).

- You can use the TSO commands even if IBM Workload Scheduler for z/OS (in particular, the event writer subtask) is not active. Event records are still generated and placed in the event writer queue. When the event writer starts, the event records are removed from the queue and written to the event data set.

For a description of the TSO commands and their usage, refer to the following sections. The commands are listed alphabetically.

BACKUP

Purpose

The BACKUP command is used to initiate a backup of the current plan (CP) or the JCL repository (JS) on request. You can request the backup process by issuing the BACKUP command from your TSO session or from within a batch job. You can schedule current plan or JS backups by defining the job as an operation in the current plan.

The JS and current plan files are managed by the controller. A request generated by the BACKUP command is communicated to the controller as an event record processed by the event writer task of a tracker. The BACKUP command can be issued from any z/OS system that runs a tracker from IBM Workload Scheduler for z/OS Release 2 or a later release. If you request a BACKUP on multiple systems at the same time, you will cause multiple file backups to occur when the events reach the controller.

A current plan backup is performed automatically under these circumstances:

- During normal shutdown of the controller.
- At the beginning and end of the daily planning process.
- When the number of new job-tracking records is greater than the value specified by the JTOPTS keyword BACKUP. But if the JTOPTS BACKUP keyword specifies NO, these regular backups of the current plan are not taken.

You can also request an immediate current plan backup at any time by issuing the BACKUP command for the current plan resource. You might do this to:

- Request a backup at a predefined time for disaster recovery purposes.
- Ensure regular backups are taken when IBM Workload Scheduler for z/OS activity is low.
- Take backups only at set times, in which case the JTOPTS BACKUP keyword is probably set to NO.

When the JTOPTS BACKUP keyword specifies a numeric value, a counter increases by one every time a new job-tracking record is written. The counter is reset to zero after every current plan backup.

Backup of the JS file is performed automatically at regular intervals based on the value defined in the MAXJSFILE keyword of the JTOPTS initialization statement. You can also issue the BACKUP command for the JS resource at any time to schedule an immediate backup of the JS file. If the value of the MAXJSFILE keyword is specified as NO, regular backups of the JS file are not taken. You might do this to ensure that backups are only taken at a time when the disruption is minimized. During a JS file backup, the current plan resource is locked to prevent

panel users and other IBM Workload Scheduler for z/OS tasks from updating the JCL for operations in the current plan.

Usage Notes

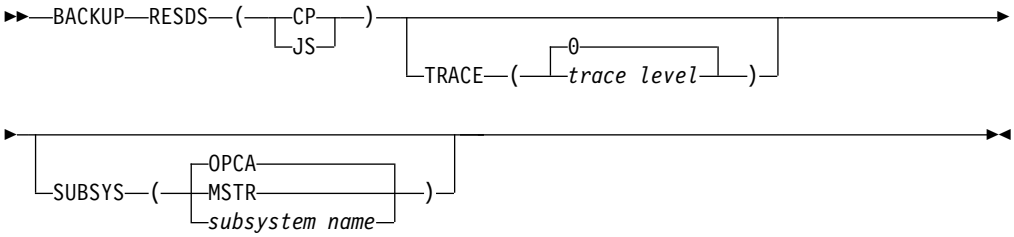
You can invoke the BACKUP command as a TSO command or by using a batch job that executes program EQQEVPGM. If you invoke BACKUP as a TSO command, you must allocate the EQQMLIB data set to the address space of the TSO user, either by adding DD statements to the logon procedure, or by using the ALLOC command after TSO logon. In the TSO environment, error messages and trace records are sent directly to the terminal user. Messages are not delivered to indicate successful command execution.

Use of the BACKUP command can be restricted with the fixed resource code BKP. The authority of the requester is verified by the subsystem name identified in the command if an AUTHDEF statement is defined for that subsystem. When SUBSYS(MSTR) is specified, all subsystems defined on the z/OS system to which the command is directed will attempt to verify the authority of the requester before an event is generated. It is possible to be rejected by one subsystem and accepted by another.

You must be defined with update authority to the BKP resource to use the BACKUP command. Resource codes are documented in *Customization and Tuning*. Check with your administrator to confirm that you have this authority before you use BACKUP.

The subsystem to which you direct the command does not have to be active when the command is issued. An event will be generated and queued in CSA along with other job-tracking events. If the subsystem is not active when the command is issued, the authority of the requester is verified using the class name specified in the AUTHDEF statement when the subsystem was last started. If the subsystem has not been started since a z/OS IPL, no authority verification can be performed.

Syntax



Parameters

RESDS (CP | JS)
The RESDS keyword specifies which data set the backup will be performed on. If you specify CP as the keyword value, a current plan backup will be performed. If you specify JS as the value for this keyword, the JCL repository data set will be copied to the alternate JS file.

The RESDS keyword must be specified.

SUBSYS (MSTR | *subsystem name* | OPCA)
The name of the tracker subsystem that the BACKUP command is directed to. The name can be up to four characters long. The first character must be

alphabetic; the remaining characters must be alphanumeric. All lowercase characters are converted to uppercase. If the SUBSYS keyword is omitted the on-request backup command will be directed to a subsystem called OPCA.

If you specify **MSTR**, the BACKUP command is directed to all tracker subsystems on the z/OS system that the BACKUP command was directed to.

Attention: This will cause multiple backups to occur if more than one tracker subsystem is active on the system.

Subsystem name is the name of the subsystem that the BACKUP command will be directed to. If the tracker and controller run in separate address spaces in your IBM Workload Scheduler for z/OS configuration, specify the name of the tracker subsystem in this parameter.

TRACE (*level* **| 0)**
Event tracing indicator. When a positive number is specified, a trace entry is created for each event generated by the BACKUP command. The trace record is written to the message log file identified by ddname EQQMLOG. The record identifies the name of each receiving subsystem. The default value 0 will not generate trace records.

Examples

These two examples demonstrate how you can use the BACKUP command in TSO, or in a batch job (using the batch program EQQEVPGM).

BACKUP

Example 1 - TSO command

```
ALLOC F(EQQMLIB) DA('OPC.MESSAGE.LIBRARY') SHR REUSE

BACKUP RESDS(CP) SUBSYS(OPCA)
```

Example 2 - Batch job

```
//CPBACKUP JOB (ACCOUNT),'Backup CP',CLASS=A
//STEP1    EXEC PGM=EQQEVPGM
//STEPLIB  DD DSN=OPC.LOAD.MODULE.LIBRARY,DISP=SHR
//EQQMLIB  DD DSN=OPC.MESSAGE.LIBRARY,DISP=SHR
//EQQMLOG  DD SYSOUT=A
//SYSIN    DD *
BACKUP RESDS(CP) SUBSYS(OPCA)
/*
```

In both of these examples, the current plan data set will be copied to the old current plan data set, on a subsystem called OPCA.

BULKDISC

Purpose

The BULKDISC command is used to initiate a bulk discovery request. You can request a bulk discovery by issuing the BULKDISC command from your TSO session or from within a batch job. You can run a complete job discovery manually or each time a planning activity is performed (create, extend or replan), by setting the MONOPTS runtime option for the controller.

A request generated by the BULKDISC command is communicated to the controller as an event record processed by the event writer task of a tracker. The BULKDISC command can be issued from any z/OS system that runs a controller from IBM Workload Scheduler for z/OS Release 3, or later. The command initiates a bulk discovery. While the bulk discovery is in progress, the current plan backup resource is locked to prevent other IBM Workload Scheduler for z/OS tasks from updating the same file concurrently.

Usage

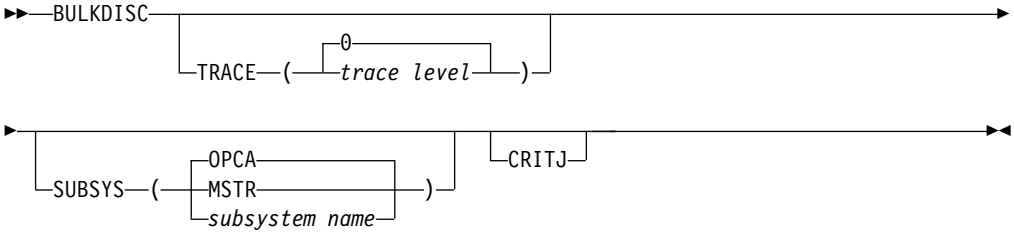
You can invoke the BULKDISC command as a TSO command or by using a batch job that runs program EQQEVPGM. If you invoke BULKDISC as a TSO command, you must allocate the EQQMLIB data set to the address space of the TSO user, either by adding DD statements to the logon procedure, or by using the ALLOC command after TSO logon. In the TSO environment, error messages and trace records are sent directly to the terminal user. Messages are not delivered to indicate successful command completion.

Use of the BULKDISC command can be restricted with the fixed resource code BUL. The authority of the requester is verified by the subsystem name identified in the command if an AUTHDEF statement is defined for that subsystem. When SUBSYS(MSTR) is specified, all subsystems defined on the z/OS system to which the command is directed attempt to verify the authority of the requester before an event is generated. It is possible to be rejected by one subsystem and accepted by another.

You must be defined with update authority to the BUL resource to use the BULKDISC command. Resource codes are described in *Customization and Tuning*. Check with your administrator to confirm that you have this authority before you use BULKDISC.

If the subsystem to which you direct the command is not active when the command is issued, an event is generated and queued in CSA together with other job-tracking events. In this case, the authority of the requester is verified using the class name specified in the AUTHDEF statement when the subsystem was last started. If the subsystem has not been started since a z/OS IPL, no authority verification can be performed. For the bulk discovery to run successfully, the monitoring task must be active when the BULKDISC command is issued.

Format



Parameters

CRITJ If you work with IBM Tivoli Monitoring and specified the CRITICAL value in the MONPOL initialization statement, use this parameter to obtain all the available information about the critical jobs or the jobs in a critical path.

SUBSYS (MSTR | *subsystem name* | OPCA)
The name of the controller that the BULKDISC command is directed to. The name can be up to four characters long. The first character must be alphabetic; the remaining characters must be alphanumeric. All lowercase characters are converted to uppercase. If the SUBSYS keyword is omitted, the on-request BULKDISC command is directed to a subsystem called OPCA.

If you specify **MSTR**, the BULKDISC command is directed to all controller subsystems on the z/OS system that the BULKDISC command was directed to.

Note: Specifying **MSTR** causes multiple bulk discoveries to occur, if more than one controller subsystem is active on the system.

Subsystem name is the name of the subsystem that the BULKDISC command is directed to. If the tracker and controller run in separate address spaces in your IBM Workload Scheduler for z/OS configuration, specify the name of the tracker subsystem in this parameter.

TRACE (*level* | 0)
Event tracing indicator. When a positive number is specified, a trace entry is created for each event generated by the BULKDISC command. The trace record is written to the message log file identified by ddname EQQMLOG. The record identifies the name of each receiving subsystem. The default value 0 does not generate trace records.

Examples

These two examples demonstrate how you can use the BULKDISC command in TSO, or in a batch job (using the batch program EQQEVPGM).

BULKDISC

Example 1 - TSO command

```
ALLOC F(EQQMLIB) DA('OPC.MESSAGE.LIBRARY') SHR REUSE

BULKDISC SUBSYS(OPCA)
```

Example 2 - Batch job

```
//BULKJOB  JOB (ACCOUNT),'Bulkdisc',CLASS=A
//STEP1    EXEC PGM=EQQEVPGM
//STEPLIB  DD DSN=OPC.LOAD.MODULE.LIBRARY,DISP=SHR
//EQQMLIB  DD DSN=OPC.MESSAGE.LIBRARY,DISP=SHR
//EQQMLOG  DD SYSOUT=A
//SYSIN    DD *
BULKDISC SUBSYS(OPCA)
/*
```

JSUACT

Purpose

The JSUACT command is used to activate or inactivate the job submission function.

Usage

You can invoke the JSUACT command as a TSO command or by using a batch job that executes program EQQEVPGM. If you invoke JSUACT as a TSO command, you must allocate the EQQMLIB data set to the TSO user address apace, either by adding DD statements to the logon procedure, or by using the ALLOC command after TSO logon. In the TSO environment, error messages and trace records are sent directly to the terminal user. Messages are not delivered to indicate successful command execution.

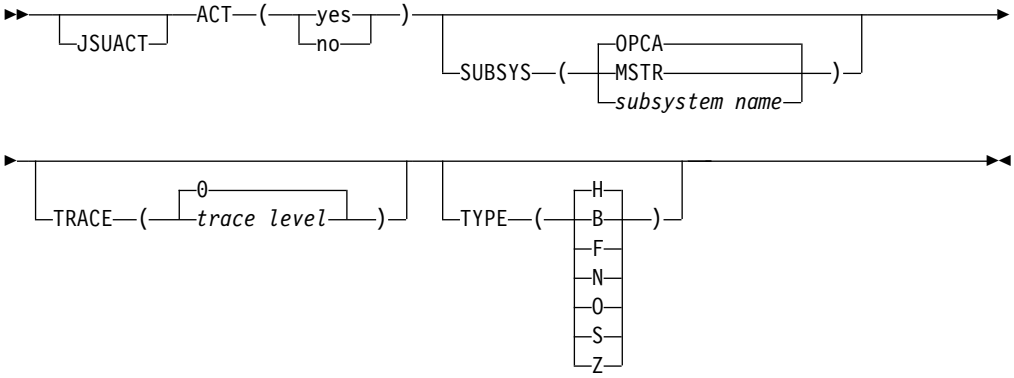
In any case, appropriate messages are issued in the controller log to indicate whether or not job submission has been activated.

Use of the JSUACT command can be restricted using the fixed resource JSUB. The authority of the requester is verified by the subsystem name identified in the command if an AUTHDEF statement is defined for that subsystem. When SUBSYS(MSTR) is specified, all subsystems defined on the z/OS system to which the command is directed will attempt to verify the authorization. It is possible to be rejected by one subsystem and accepted by another.

You must be defined with update authority to the JSUB resource to be able to use the JSUACT command. Resource codes are described in *Customization and Tuning*. Check with your scheduler administrator to confirm that you have this authority before trying to use JSUACT.

The subsystem to which you direct the command does not have to be active when the command is issued. An event will be generated and queued in CSA along with other job-tracking events. If a subsystem is not active when the command is issued, the authorization of the requester is verified by using the class name specified in the AUTHDEF statement when the subsystem was started. If the subsystem has not been started since a z/OS IPL, no authorization verification can be performed.

Format



Parameters

ACT (Y | N)
If you want to activate the job submission function specify Y, otherwise N.

SUBSYS (MSTR | *subsystem name* | OPCA)
The name of the tracker the JSUACT is directed to.

This parameter can be four characters in length. The first character must be alphabetic; the remaining characters must be alphanumeric. All lowercase characters are converted to uppercase.

If you specify **MSTR**, the JSUACT command is directed to all scheduler subsystems on the z/OS system where the JSUACT command was issued.

TRACE (*level* **|** **0)**
Event tracing indicator. When a nonzero positive number is specified, a trace entry is created for each event generated by the JSUACT command. The trace record is written to the message log file identified by ddname EQQMLOG. The record identifies the name of each receiving subsystem. The default value 0 will not generate trace records.

TYPE (B | F | H | N | O | S | Z)
Indicates whether the job submission must be deactivated for:

- all the workload (B)
- fault-tolerant workstations (F)
- z-centric and host workstations (H)
- fault-tolerant and host workstations (N)
- fault-tolerant and z-centric workstations (O)
- host workstations (S)
- z-centric workstations (Z)

Examples

These two examples demonstrate how you can use the JSUACT command in TSO, or in a batch job (using the batch program EQQEVPGM).

JSUACT

Example 1 - TSO command

```
ALLOC F(EQQMLIB) DA('OPC.MESSAGE.LIBRARY') SHR REUSE

JSUACT ACT(YES) SUBSYS(OPCB)
```

Example 2 - Batch job

```
//JSUACT   JOB (ACCOUNT),'Deactivate',CLASS=A
//STEP1    EXEC PGM=EQQEVPGM
//STEPLIB  DD DSN=OPC.LOAD.MODULE.LIBRARY,DISP=SHR
//EQQMLIB  DD DSN=OPC.MESSAGE.LIBRARY,DISP=SHR
//EQQMLOG  DD SYSOUT=A
//SYSIN    DD *
JSUACT ACT(N) SUBSYS(OPCB)
/*
```

OPINFO

Purpose

Use the OPINFO command to set the *user data* of an operation in the current plan. The user data can contain any data you require. In many installations, the field is used to record the problem record number for operations that have ended in error. OPINFO can be incorporated into your Information Management interface to enable immediate feedback of the problem report to IBM Workload Scheduler for z/OS.

Usage

You can invoke OPINFO as a TSO command or by using a batch job which executes program EQQEVPGM. If you invoke OPINFO as a TSO command, allocate the EQQMLIB data set to the address space of the TSO user, either by adding DD statements to the logon procedure, or by using the ALLOC command after TSO logon. In the TSO environment, error messages and trace records are sent directly to the terminal user. Messages are not delivered to indicate successful command execution.

You use the OPINFOSCOPE keyword of the JTOPTS to specify the scope of the command. If OPINFOSCOPE is set to (or defaults to) IP, IBM Workload Scheduler for z/OS considers only in-progress operations (where the current status is `R`, `A`, `*`, `S`, `I`, or `E`), and will not action OPINFO events for operations in any other status. If OPINFOSCOPE is set to ALL, IBM Workload Scheduler for z/OS also considers operations with `W` and `C` status.

With the OPINFO command, you specify the WSNAME, ADID, IA, OPNUM, or JOBNAME parameters to identify the operation whose user data is to be updated. If the OPINFOSCOPE keyword is IP, which is the default, WSNAME is a required parameter. If OPINFOSCOPE is ALL, the ADID or JOBNAME parameter is required. Also, for printer workstations, you can specify the CLASS and FORM parameters to identify the operation.

If you do not provide enough information to uniquely identify the operation, and IBM Workload Scheduler for z/OS finds more than one operation that matches your parameters, IBM Workload Scheduler for z/OS chooses the best operation. If OPINFOSCOPE is IP, IBM Workload Scheduler for z/OS uses this list, taking each item until it gets a single operation:

1. Priority 9
2. Earliest latest start time
3. Highest priority, if lower than 9
4. Earliest operation input arrival time, or occurrence input arrival time if the operation does not have input arrival specifically defined
5. Longest in Ready status

That is, if IBM Workload Scheduler for z/OS determines that there is more than one in-progress operation in the current plan, the operation with priority 9 is updated. If more than one operation specifies priority 9, or there are no priority 9 operations, the operation with the earliest latest start time is updated. The latest start is blank if the operation is added using the MCP panel. If the latest start time is equal, the operation with the highest priority is updated, and so on.

If OPINFOSCOPE is ALL, IBM Workload Scheduler for z/OS uses the same list as for OPINFOSCOPE(IP) to find a single operation. If no in-progress operation that matches your parameters is found, IBM Workload Scheduler for z/OS also searches operations with status `C` and `W` in the current plan. The operation with the earliest latest start time is selected.

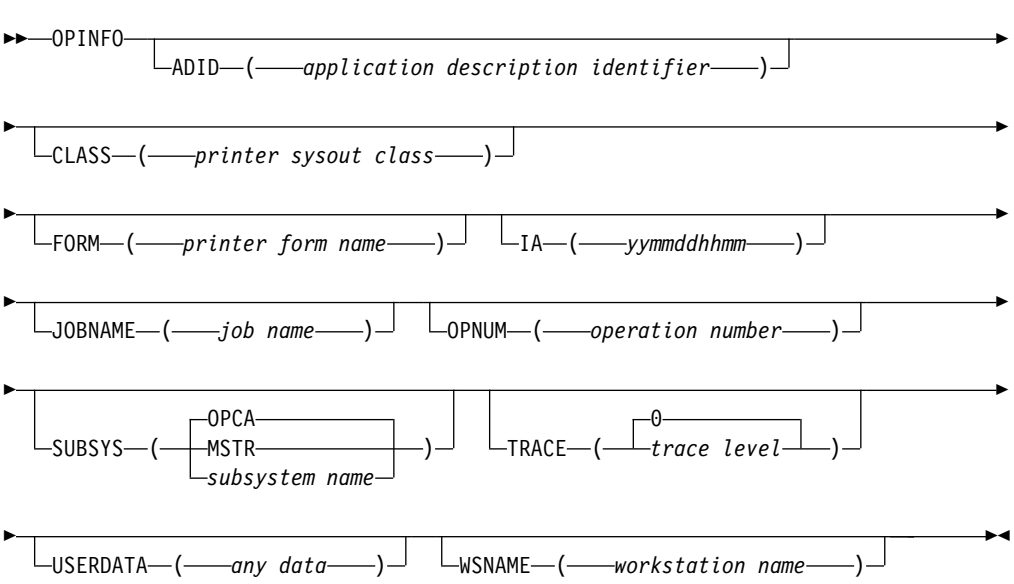
Use of the OPINFO command can be restricted with the fixed resource code CP. The authority of the requester is verified by the subsystem name identified in the command if an AUTHDEF statement is defined for that subsystem. When SUBSYS(MSTR) is specified, all tracker subsystems defined on the z/OS system

where the OPINFO command is issued will attempt to verify the authority of the requester before data will be passed. You might be rejected by one subsystem and accepted by another.

You need update authority to resource code CP to use this command. Resource codes are described in *Customization and Tuning*.

The subsystem to which you direct the command does not have to be active when the command is issued. An event will be generated and queued in CSA along with other job-tracking events. If the subsystem is not active when the command is issued, the authority of the requester is verified using the class name specified in the AUTHDEF statement when the subsystem was last started. If the subsystem has not been started since a z/OS IPL, no authority verification can be performed.

Format



Parameters

ADID (*application description identifier***)**
The application identifier of the operation whose user data is to be updated. If the OPINFOSCOPE keyword of the JTOPTS statement is ALL, ADID is a required parameter.

CLASS (*printer sysout class***)**
For a printer workstation, specifies the printer SYSOUT class of the operation whose user data is to be updated.

FORM (*printer form name***)**
For a printer workstation, specifies the printer FORM name of the operation whose user data is to be updated.

IA (*yymmddhhmm***)**
The input arrival date and time of the occurrence containing the operation whose user data is to be updated. You must specify this in the format *yymmddhhmm*.

Note: IBM Workload Scheduler for z/OS interprets the *yy* part as follows:

YY Year

72 - 99 1972 - 1999
00 - 71 2000 - 2071

JOBNAME (*job name***)**
The job name associated with the operation whose user data is to be updated. If the OPINFOSCOPE keyword of the JTOPTS statement is ALL, JOBNAME is a required parameter.

OPNUM (*operation number***)**
The operation number of the operation whose user data is to be updated.

SUBSYS (MSTR | *subsystem name* | OPCA)
Name of the tracker subsystem that the OPINFO command is directed to. The name can be up to 4 characters long. The first character must be alphabetic; the remaining characters must be alphanumeric. All lowercase characters are converted to uppercase.

If you specify **MSTR**, the OPINFO command is directed to all tracker subsystems on the z/OS system where the OPINFO command is issued.

Note: If the trackers and controller run on different subsystems in your configuration, specify the name of the tracker subsystem in this parameter.

TRACE (*level* **| 0)**
Event tracing indicator. When a positive number is specified, a trace entry is created for each event generated by the OPINFO command. The trace record is written to the message log file identified by ddname EQQMLOG. The record identifies the name of each receiving subsystem. The default value 0 will not generate trace records.

USERDATA (*any data***)**
You can use this 16-character parameter to pass information about an operation to the current plan in the *operation user data*. The USERDATA field cannot contain any blanks.

WSNAME (*workstation name***)**
The name of the workstation for the operation whose user data is to be updated. If the OPINFOSCOPE keyword of the JTOPTS statement is IP, WSNAME is a required parameter.

Examples

These two examples demonstrate how you can use the OPINFO command in TSO, or in a batch job (using the batch program EQQEVPGM).

OPINFO

Example 1 - TSO command

```
ALLOC F(EQQMLIB) DA('OPC.MESSAGE.LIBRARY') SHR REUSE

OPINFO W(BDEC) J(DNCD3000) A(ACLMSDLY) U(USER£DATA£HERE)
```

Example 2 - Batch job

```
//OPINFOUS JOB (ACCOUNT),'Set completed',CLASS=A
//STEP1    EXEC PGM=EQQEVPGM
//STEPLIB  DD DSN=OPC.LOAD.MODULE.LIBRARY,DISP=SHR
//EQQMLIB  DD DSN=OPC.MESSAGE.LIBRARY,DISP=SHR
//EQQMLOG  DD SYSOUT=A
//SYSIN    DD *
OPINFO W(BDEC) J(DNCD3000) A(ACLMSDLY) U(PROBREC£01234567)
/*
```

In both of these examples, an operation for application ACLMSDLY at workstation BDEC will have the data fed back to it.

OPSTAT

Purpose

The OPSTAT command lets you set the status of an operation at any workstation, except workstations that have the nonreporting attribute. Events generated by OPSTAT are matched against operations on the ready list. Events received for operations in waiting (W), suppressed by condition (X), or complete (C) status are ignored. Jobs and started tasks that are running are always allowed to finish; for rules governing the changing of operation status, see the READY LIST panel description in "Using the ready list" on page 565.

You need update authority to resource code RL to use this command. Resource codes are described in *Customization and Tuning*.

The OPSTAT command gives you a portable method of using automatic event reporting (AER) facility. AER can help you coordinate many tasks that are not normally seen by IBM Workload Scheduler for z/OS. For example, you can use AER to trigger the start of an operation when a particular step in a job is complete, or as acknowledgment that a file has been received across the network.

The OPSTAT command also gives you the facility to automatically report the status of work executing in operating environments that do not support a tracker.

Usage

You can invoke OPSTAT as a TSO command or by using a batch job that executes program EQQEVPGM. If you invoke OPSTAT as a TSO command, allocate the EQQMLIB data set to the address space of the TSO user, either by adding DD statements to the logon procedure, or by using the ALLOC command after TSO logon. In the TSO environment, error messages and trace records are sent directly to the terminal user. Messages are not delivered to indicate successful command execution.

OPSTAT is an alternative to the EQQUSIN subroutine for implementing automatic event reporting for general workstations.

With the OPSTAT command, you must specify the WSNAME parameter to identify the workstation at which the operation is changing status. IBM Workload Scheduler for z/OS then changes the status of the operation at that workstation to the status you have specified.

If there is more than one operation at the workstation, you can optionally specify the ADID, IA, OPNUM, or JOBNAME parameters to identify the particular operation whose status is to be changed. Also, for printer workstations, you can specify the CLASS and FORM parameters to identify an operation.

If you do not provide enough information to uniquely identify the operation and IBM Workload Scheduler for z/OS finds more than one operation which matches the criteria you specified, IBM Workload Scheduler for z/OS determines the most appropriate operation to update. IBM Workload Scheduler for z/OS chooses the most appropriate operation by investigating its characteristics in this order:

1. The operation has priority 9.

2. Earliest latest start time.
3. Priority 8-1.
4. Input arrival time specified for the operation, or the occurrence input arrival if the operation does not have input arrival specifically defined.

Therefore, if you define only the WSNAME parameter and IBM Workload Scheduler for z/OS determines that there is more than one operation in the current plan for that workstation in status R, A, *, S, I, or E, the operation with priority 9 is updated. If more than one operation specifies priority 9, or there are no priority 9 operations, the operation with the earliest latest-start time is updated. If you add the operation using the MCP panel, the latest start time is blank. If latest start is equal, the operation with the highest priority is updated. If priority is equal, the operation which specifies the earliest input arrival time is updated. If input arrival is also equal, the update is performed on a first-in-first-out basis.

The parameter SORTIA can be specified among OPSTAT input parameters to automatically choose the oldest eligible operation in the ready list, in terms of occurrence input arrival time. SORTIA is processed and effectively used by the event manager when all the following conditions occur:

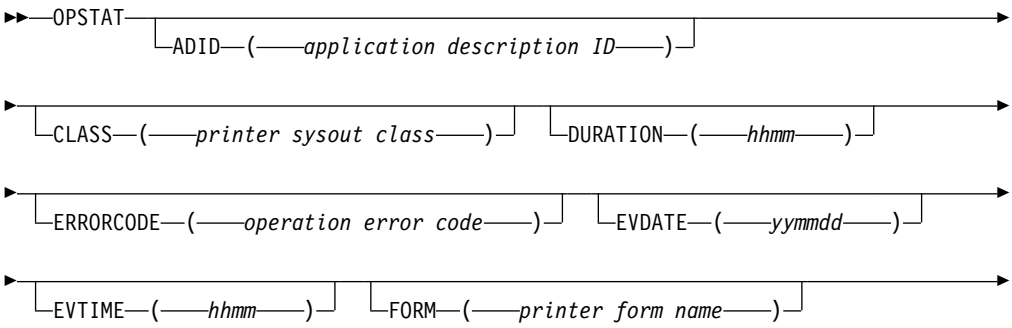
- Workstation, application name and operation number are all specified as input parameters for OPSTAT.
- Neither input arrival time nor token are specified as input parameters to OPSTAT.

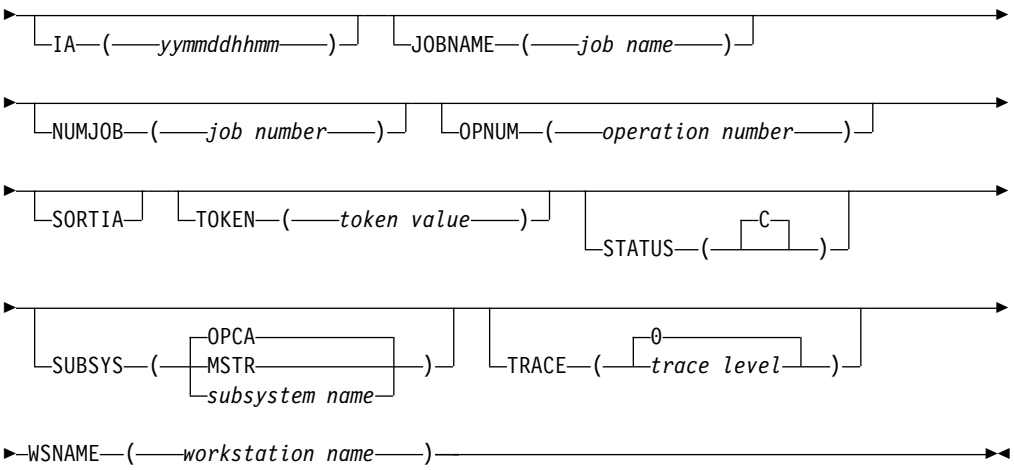
In any different situation the keyword SORTIA will be ignored.

Use of the OPSTAT command can be restricted with fixed resource code RL and the subresource RL.WSNAME. The authority of the requester is verified by the subsystem name identified in the command if an AUTHDEF statement is defined for that subsystem. When SUBSYS(MSTR) is specified, all tracker subsystems defined on the z/OS system where the OPSTAT command is issued will attempt to verify the authority of the requester before an event is generated. You might be rejected by one subsystem and accepted by another.

The subsystem to which you direct the command does not have to be active when the command is issued. An event will be generated and queued in CSA along with other job-tracking events. If the subsystem is not active when the command is issued, the authority of the requester is verified using the class name specified in the AUTHDEF statement when the subsystem was last started. If the subsystem has not been started since a z/OS IPL, no authority verification can be performed.

Format





Parameters

ADID (*application description identifier***)**
The application identifier of the operation whose status you want to change.

CLASS (*printer sysout class***)**
For a printer workstation, specifies the printer SYSOUT class of the operation whose status you want to change.

DURATION (*hhmm***)**
If you are specifying STATUS(C) to set the operation status to *complete*, you can optionally specify a duration for the completed operation. You specify the duration in hours and minutes, in the format *hhmm*.

ERRORCODE (*operation error code***)**
If you are specifying STATUS(E) to set the operation status to *ended-in-error*, you can optionally specify an error code for the operation. The error code can be any 4 characters.

EVDATE (*yymmdd***)**
The date of this operation status event. You must specify the date in the format *yymmdd*.

See the comments under the following parameter, EVTIME.

EVTIME (*hhmm***)**
The time of this operation status event. You must specify the time in the format *hhmm*.

You can use the EVDATE and EVTIME parameters if you want to indicate that the operation changed status at a time other than the current time. If you do not supply these parameters, the operation is considered to have changed status at the time IBM Workload Scheduler for z/OS processes the OPSTAT command.

FORM (*printer form name***)**
For a printer workstation, specifies the printer FORM name of the operation whose status you want to change.

IA (*yymmddhhmm***)**
The input arrival date and time of the occurrence containing the operation whose status you want to change. You must specify this in the format *yymmddhhmm*.

Note: IBM Workload Scheduler for z/OS interprets the yy part as follows:

YY	Year
72 - 99	1972 - 1999
00 - 71	2000 - 2071

JOBNAME (*job name***)**
The job name associated with the operation whose status you want to change.

NUMJOB (*job number***)**
Use this optional parameter to specify a job number for an operation on a user-defined computer automatic workstation. Specify a number from 0 to 999999. IBM Workload Scheduler for z/OS builds a job number in the format USRnnnnn or Unnnnnnn, depending on the value and padding the number with zeros on the left.

OPNUM (*operation number***)**
The operation number of the operation whose status you want to change.

SORTIA
Makes the code to automatically choose the oldest eligible operation in the ready list, in terms of occurrence input arrival time. It applies when both the following conditions occur:

- Workstation, application name and operation number are all specified as input parameters for OPSTAT.
- Neither input arrival time nor token are specified as input parameters to OPSTAT.

In any different situation the keyword SORTIA will be ignored.

TOKEN (*token value***)**
The token assigned for the operation whose status you want to change. A token is automatically assigned for operations started on workstations that specify a user-defined destination ID. The token can be used to uniquely identify the operation.

When TOKEN is used in conjunction with the ADID, IA, JOBNAME, or OPNUM parameters, all values must match the target operation. For example, if the token identifies the operation but OPNUM is also specified and does not match, the event will be rejected and message EQQE091E written to the controller message log.

Specify the token as a hexadecimal value in the format TOKEN(X'00ABCDEF').

STATUS (C)
Use the default value to set the new operation status as successfully completed at the workstation.

Changes to operation status using OPSTAT follow the same rules as status changes in the Ready List. In particular:

- You cannot change an operation status from W to C. This is because predecessor jobs might not be completed.
- You cannot change an operation status from X (suppressed by condition) or to X.
- To change the status of an operation to the previous logical status, specify STATUS(X). As from the previous point, do not use it to change the operation status to suppressed by condition.

For more information, refer to “Using the ready list” on page 565.

SUBSYS (MSTR | *subsystem name* | OPCA)
Name of the tracker subsystem that the OPSTAT command is directed to. The name can be up to 4 characters long. The first character must be alphabetic; the remaining characters must be alphanumeric. All lowercase characters are converted to uppercase.

If you specify **MSTR**, the OPSTAT command is directed to all tracker subsystems on the z/OS system where the OPSTAT command is issued.

Note: If the trackers and controller run on different subsystems in your configuration, specify the name of the tracker subsystem in this parameter.

TRACE (*level* | 0)
Event tracing indicator. When a positive number is specified, a trace entry is created for each event generated by the OPSTAT command. The trace record is written to the message log file identified by ddname EQQMLOG. The record identifies the name of each receiving subsystem. The default value 0 will not generate trace records.

WSNAME (*workstation name*)
You must supply the name of the workstation that you are reporting the status of an operation for.

Examples

These examples demonstrate how you can use the OPSTAT command in TSO, or in a batch job (using the batch program EQQEVPGM).

OPSTAT

Example 1 - TSO command

```
ALLOC F(EQQMLIB) DA('OPC.MESSAGE.LIBRARY') SHR REUSE

OPSTAT W(BDEC) ST(C) J(DNCD3000) A(ACLMSDLY)
```

Example 2 - Batch job

```
//OPSTATUS JOB (ACCOUNT),'Set completed',CLASS=A
//STEP1    EXEC PGM=EQQEVPGM
//STEPLIB  DD DSN=OPC.LOAD.MODULE.LIBRARY,DISP=SHR
//EQQMLIB  DD DSN=OPC.MESSAGE.LIBRARY,DISP=SHR
//EQQMLOG  DD SYSOUT=A
//SYSIN    DD *
OPSTAT W(BDEC) ST(C) J(DNCD3000) A(ACLMSDLY)
/*
```

In both of these examples, an operation for application ACLMSDLY at workstation BDEC is reported as completed.

SRSTAT

Purpose

The SRSTAT command lets you change the overriding (global) availability, quantity, and deviation of a special resource. You can do this to prevent operations from allocating a particular resource, or to request the ETT function to add an application occurrence to the current plan.

Usage

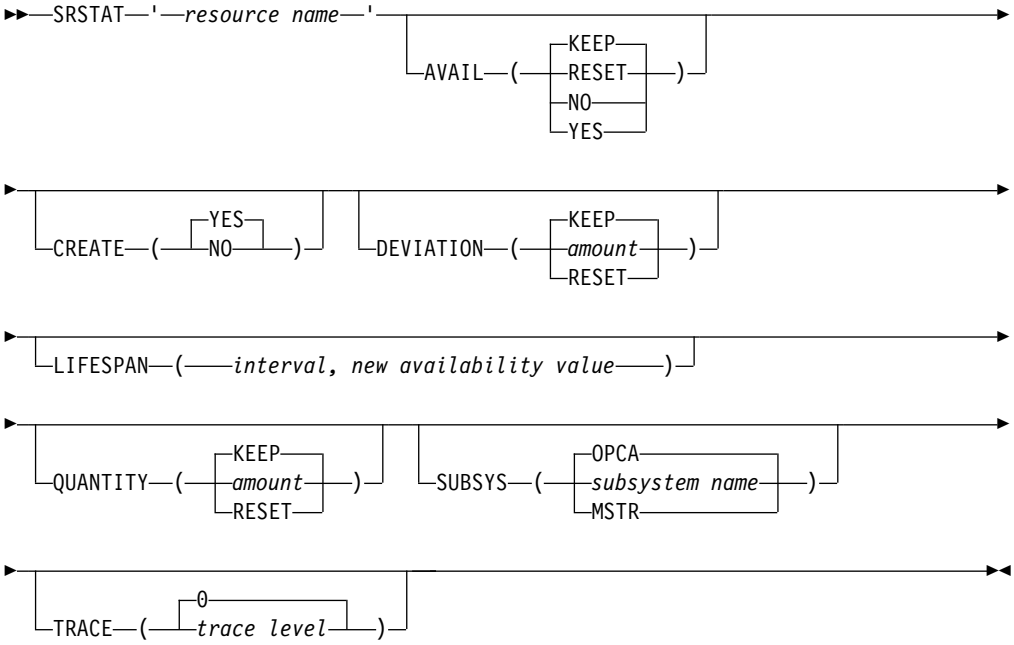
You can invoke SRSTAT as a TSO command or by using a batch job which executes program EQQEVPGM. If you invoke SRSTAT as a TSO command, you must allocate the EQQMLIB data set to the address space of the TSO user, either by adding DD statements to the logon procedure, or by using the ALLOC command after TSO logon. In the TSO environment, error messages and trace records are sent directly to the terminal user. Messages are not delivered to indicate successful command execution.

Use of the SRSTAT command can be restricted with fixed resource code SR and subresource SR.SRNAME. The authority of the requester is verified by the subsystem name identified in the command if an AUTHDEF statement is defined for that subsystem. When SUBSYS(MSTR) is specified, all tracker subsystems defined on the z/OS system where the SRSTAT command is issued will attempt to verify the authority of the requester before an event is generated. It is possible to be rejected by one subsystem and accepted by another.

The subsystem to which you direct the command does not have to be active when the command is issued. An event will be generated and queued in CSA along with other job-tracking events. If the subsystem is not active when the command is issued, the authority of the requester is verified using the class name specified in the AUTHDEF statement when the subsystem was last started. If the subsystem has not been started since a z/OS IPL, no authority verification can be performed.

See Chapter 5, “Creating special resources,” on page 75 for information about special resources, how to connect them to workstations, and how to specify intervals.

Format



Parameters

'resource name'

The name of the resource whose availability or quantity you want to change. This parameter must be contained within single quotation marks and can be up to 44 characters in length. All lowercase characters are converted to uppercase.

You must supply this parameter.

AVAIL (RESET | NO | YES | KEEP)

YES indicates that the availability status of the resource should be set to YES. Operations requiring the resource can start, as long as there are no other conditions preventing them from starting. For example, if two operations both require a resource for exclusive (X) use, IBM Workload Scheduler for z/OS lets only one of them start.

NO indicates that the availability status of the resource should be set to NO. Any operation that requires the resource will be prevented from starting, regardless of whether it was specified for shared (S) or exclusive (X) use.

RESET sets the overriding availability to blank so that the interval or default value is used.

KEEP, the default, does not change the availability status.

When you set the availability with SRSTAT (or other interfaces such as the EQQUSIN subroutine or the MCP panel), the specified availability lasts over interval boundaries, even though the next interval can specify a different availability, and persists after a daily planning job. Specify RESET to restore the planned availability.

CREATE (NO| YES)

NO indicates that the resource is not to be added to the current plan of the receiving IBM Workload Scheduler for z/OS subsystem, if it does not exist in the database. If the resource exists in the database, CREATE(NO) does not have any effect. You can specify CREATE(NO) if the resource is being used only as a means to generate an event for ETT—the event is generated even if the resource does not exist.

If YES is specified or defaulted, and the DYNAMICADD keyword of the RESOPTS initialization statement is set to YES or EVENT, IBM Workload Scheduler for z/OS adds the resource to the current plan of the receiving IBM Workload Scheduler for z/OS subsystem, if the resource is not in the database. It uses the following default values:

Text Blank.

Specres group ID
Blank.

Hiperbatch
No.

Used for
Control.

On error
Blank. If an error occurs, IBM Workload Scheduler for z/OS uses the value specified in the operation details or, if that is also blank, the value of the ONERROR keyword of RESOPTS.

On Complete
Blank.

When the operation completes, the On Complete value is considered according to the following order:

1. The On Complete value set at operation definition level, if not blank.
2. The On Complete value set at special resource definition level, if not blank.
3. The ONCOMPLETE or DYNONCOMPLETE keyword value, respectively set for the not dynamically added resources or the dynamically added resources, in all the other cases.

Max Usage Limit
0.

Max Usage Type
Reset.

Usage Counter
0.

Overriding availability, quantity, and deviation
The value specified by SRSTAT, or blank.

Default quantity
1. The default quantity is automatically increased if contention occurs.

Default availability
Yes.

Intervals
No intervals are created.

Workstations
* (all workstations can allocate the resource).

DEVIATION (RESET | *amount* | KEEP)
To make a temporary change to the quantity, you can specify a *deviation*, which is an amount to be added to (positive number) or subtracted from (negative number) the current quantity. A specified amount can be from -999 999 to +999 999. The default, KEEP, does not alter the deviation.

Note: The effect of deviation is cumulative. If you issue two SRSTAT commands with DEVIATION(-1), for example, this subtracts *two* from the deviation.

When the deviation is not zero, the value lasts over interval boundaries and persists after a daily planning job. Specify RESET or zero (0) to set the deviation to zero.

LIFESPAN (*interval***,** *new availability value***)**
The interval of time, in minutes, after which the global availability of the special resource is changed according to the value specified as *new availability value*. When you specify this parameter, a pending LIFESPAN action (the one specified as *new availability value*) comes into effect for the resource. The controller runs that action as soon as the LIFESPAN interval of time expires.

Only one pending LIFESPAN action can exist for one resource. This means that issuing an SRSTAT command with LIFESPAN replaces any existing pending LIFESPAN action.

To cancel a pending LIFESPAN action, issue an SRSTAT command with an interval of 0. When the interval of time is 0, no LIFESPAN action is run.

Interval can be an integer from 0 to 99999. *New availability value* can be one of the following (you must always specify one, because no default is provided):

YES The global availability is changed to Yes

NO The global availability is changed to No

RESET
The global availability is changed to blank

QUANTITY (RESET | *amount* | KEEP)
To change the overriding (global) quantity, specify the amount, from 1 to 999 999.

RESET sets the overriding quantity to blank so that the interval or default value is used. KEEP does not alter the quantity.

When you set the quantity with SRSTAT (or other interfaces such as the EQQUSIN subroutine or the MCP panel), the specified quantity lasts over interval boundaries, even though the next interval can specify a different quantity, and persists after a daily planning job. Specify RESET to restore the planned quantity.

SUBSYS (*subsystem name* | MSTR | OPCA)
The name of the tracker subsystem that the SRSTAT command is directed to. This parameter can be up to 4 characters long. The first character must be alphabetic; the remaining characters must be alphanumeric. All lowercase characters are converted to uppercase.

If you specify **MSTR**, the SRSTAT command is directed to all tracker subsystems on the z/OS system where the SRSTAT command is issued.

Note: If the trackers and controller in your configuration run on different subsystems, specify the name of the tracker subsystem in this parameter.

TRACE (*level* | 0)
Event tracing indicator. When a positive number is specified, a trace entry is created for each event generated by the SRSTAT command. The trace record is written to the message log file identified by ddname EQQMLOG. The record identifies the name of each receiving subsystem. The default value 0 will not generate trace records.

Examples

These examples demonstrate how you can use SRSTAT in TSO, or in a batch job (using the batch program EQQEVPGM).

SRSTAT

Example 1 - TSO command

```
ALLOC F(EQQMLIB) DA('OPC.MESSAGE.LIBRARY') SHR REUSE

SRSTAT 'IMS.DATA.BASE' SUBSYS(OPCB) AVAIL(YES)
```

Example 2 - Batch job

```
//CHSTATUS JOB (ACCOUNT),'Change DB status',CLASS=A
//STEP1    EXEC PGM=EQQEVPGM
//STEPLIB  DD DSN=OPC.LOAD.MODULE.LIBRARY,DISP=SHR
//EQQMLIB  DD DSN=OPC.MESSAGE.LIBRARY,DISP=SHR
//EQQMLOG  DD SYSOUT=A
//SYSIN    DD *
SRSTAT 'IMS.DATA.BASE' SUBSYS(OPCB) AVAIL(YES)
/*
```

Example 3 - Reduce tape pool

```
ALLOC F(EQQMLIB) DA('OPC.MESSAGE.LIBRARY') SHR REUSE

SRSTAT 'TAPES' SUBSYS(OPCB) DEV(RESET) Q(6)
SRSTAT 'TAPES' SUBSYS(OPCB) DEV(-1)
SRSTAT 'TAPES' SUBSYS(OPCB) DEV(-1)
SRSTAT 'TAPES' SUBSYS(OPCB) DEV(0)
```

In examples 1 and 2, the availability status of the resource IMS.DATA.BASE is changed to YES. In example 3, the number of tapes is set to 6, 5, 4, and then back to 6 (a deviation of 0 is a special value and means the same as reset).

WSSTAT

Purpose

The WSSTAT command lets you change the status of a workstation in the current plan. The status information is communicated to the controller to indicate a workstation as active, offline, or failed. When you use the WSSTAT command you can optionally define restart and routing options for the workload defined on the workstation when you are reporting a status of offline or failed.

Usage

You can invoke WSSTAT as a TSO command or by using a batch job which executes program EQQEVPGM. If you invoke WSSTAT as a TSO command, you must allocate the EQQMLIB data set to the address space of the TSO user, either by adding DD statements to the logon procedure, or by using the ALLOC command after TSO logon. In the TSO environment, error messages and trace records are sent directly to the terminal user. Messages are not delivered to indicate successful command execution.

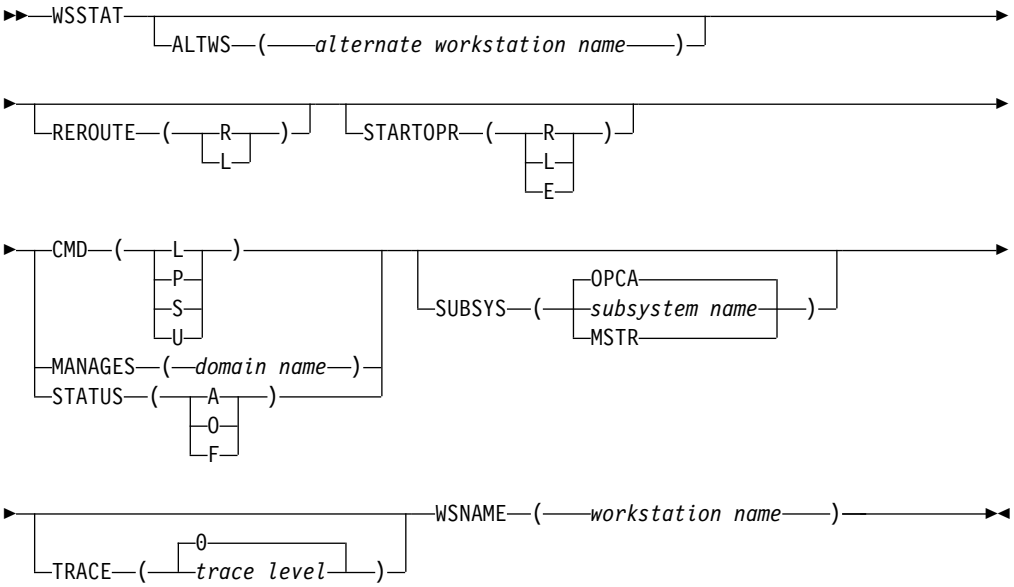
Use of the WSSTAT command can be restricted with fixed resource code RL and subresource RL.WSSTAT. The authority of the requester is verified by the subsystem name identified in the command if an AUTHDEF statement is defined for that subsystem. When SUBSYS(MSTR) is specified, all tracker subsystems defined on the z/OS system where the WSSTAT command is issued will attempt to verify the authority of the requester before an event is generated. It is possible to be rejected by one subsystem and accepted by another.

The subsystem to which you direct the command does not have to be active when the command is issued. An event will be generated and queued in CSA along with other job-tracking events. If the subsystem is not active when the command is issued, the authority of the requester is verified using the class name specified in the AUTHDEF statement when the subsystem was last started. If the subsystem has not been started since a z/OS IPL, no authority verification can be performed.

Note: If the status of a workstation has been set to offline manually, using the panels, then you are not allowed to reset it to active using the WSSTAT command.

The status of a workstation is active and a WSSTAT is performed to change the status to offline. If the IBM Workload Scheduler for z/OS subsystem is stopped using a cancel command before a CP backup occurs, when the IBM Workload Scheduler for z/OS subsystem restarts the workstation status is active and not offline. The same behaviour happens when the status is varied from offline to active.

Format



Parameters

ALTWS (*alternate workstation name***)**
When the workstation status is set to offline or failed, you can specify the alternate workstation where reroutable operations should be started.

If this parameter is omitted the value defined for the current workstation open interval will be used. If the REROUTE parameter specifies L, or if the default specifies no rerouting, the value of ALTWS is ignored.

The parameter is optional.

CMD (L | P | S | U)
Use this parameter to change the status of the fault-tolerant agent to one of the following statuses:

L To link the workstation

P To stop workstation

S To start workstation

U To unlink the workstation

You must specify either this or one of the alternative parameters.

MANAGES (*domain name***)**
Used in conjuntion with the WSNAME parameter, it instructs the

workstation specified by WSNAME to become the new domain manager of the domain specified by MANAGES. It cannot be specified in conjunction with STATUS or CMD. Example:

```
WSSTAT SUBSYS(TWST) WSNAME(U001) MANAGES(UK-DM)
```

This command instructs the U001 workstation to become the new domain manager of the UK-DM domain. The command is sent through the TWST tracker subsystem.

The name of the domain, consisting of up to 16 characters, must start with a letter. It can contain alphanumeric characters, dashes and underscores. No other characters must be used because they can generate unpredictable situations.

REROUTE (R | L)

This parameter is optional. When the workstation status is set to offline or failed, you can specify R for operations to be rerouted to the alternate workstation, or L for no rerouting (to leave the operations at the inactive workstation).

If this parameter is omitted, the value defined in either the WSOFFLINE or the WSFAILURE keyword on the JTOPTS initialization statement will be used as default.

STARTOPR (R | E | L)

This parameter is optional. When the workstation status is set to offline or failed, you can specify what IBM Workload Scheduler for z/OS should do with operations that are currently in started status at the workstation, where:

R Restart operations automatically on the alternate workstation.
E Set all started operations to ended-in-error.
L Leave the operations in started status.

If this parameter is omitted, the value defined in either the WSOFFLINE or the WSFAILURE keyword on the JTOPTS initialization statement is used as default.

Note:

1. If you select STARTOPR(E), a started job continues to run. IBM Workload Scheduler for z/OS never cancels jobs that have started.
2. For remote engine workstations, this parameter supports only the value L. If you specify any other value, it is forced to L.
3. If you set STARTOPR(R), a started job might be submitted again even if it is currently running, resulting in the same job being run twice.

STATUS (A | O | F)

The status you want to report for the workstation

A Active
O Offline
F Failed

You must specify either this or one of the alternative parameters.

SUBSYS (*subsystem name* **| MSTR | OPCA)**

The name of the tracker subsystem that the WSSTAT command is directed to. This parameter can be up to 4 characters long. The first character must be alphabetic; the remaining characters must be alphanumeric. All lowercase characters are converted to uppercase.

If you specify **MSTR**, the WSSTAT command is directed to all tracker subsystems on the z/OS system where the WSSTAT command is issued.

Note: If the tracker and controller in your configuration run on different subsystems, specify the name of the tracker subsystem in this parameter.

TRACE (*level* **|** **0)**
Event tracing indicator. When a nonzero positive number is specified, a trace entry is created for each event generated by the WSSTAT command. The trace record is written to the message log file identified by ddname EQQMLOG. The record identifies the name of each receiving subsystem. The default value 0 will not generate trace records.

WSNAME (*workstation name***)**
The name of the workstation to be updated. This parameter is required.

The WSSTAT parameters are checked for validity and consistency. The validity checks are carried out in the tracker where the command is executed. The validity check processes parameter names, length and type of parameter values.

Note: If you try to set the status of a fault-tolerant workstation to Failed (an invalid status for this type of workstation), you do not receive an immediate message. Instead, you receive message EQQE112E in the controller message log, and the workstation status is not changed.

If the input is valid, a *workstation status event* is generated and communicated to the controller. The processing of the event includes a consistency check of the values specified in the parameters. The following consistency checks are made:

- The workstation name is checked for existence.
- The alternate workstation is checked for existence.
- If the value given in the STATUS parameter equals current status of the workstation, the command will be ignored.

Examples

The following two examples demonstrate how you can use WSSTAT in TSO, or in a batch job (using the batch program EQQEVPGM).

WSSTAT

Example 1 - TSO command

```
ALLOC F(EQQMLIB) DA('OPC.MESSAGE.LIBRARY') SHR REUSE

WSSTAT SUBSYS(OPCB) WSNAME(AS4H) STATUS(O) START(R)
```

Example 2 - Batch job

```
//CHSTATUS JOB (ACCOUNT),'Change WS status',CLASS=A
//STEP1    EXEC PGM=EQQEVPGM
//STEPLIB  DD DSN=OPC.LOAD.MODULE.LIBRARY,DISP=SHR
//EQQMLIB  DD DSN=OPC.MESSAGE.LIBRARY,DISP=SHR
//EQQMLOG  DD SYSOUT=A
//SYSIN    DD *
WSSTAT SUBSYS(OPCB) WSNAME(AS4H) STATUS(A)
/*
```

In the first example the status of workstation AS4H is set to offline. Started operations will be restarted on the alternate workstation.

In the second example the status of workstation AS4H will be set to active status.

Appendix B. Batch programs

This appendix describes the JCL and parameters that the batch programs need, although you do not need this if you use the panels to generate and submit them.

For a description of how to create JCL skeletons for the batch jobs, refer to the section about EQQJOBS in the *Planning and Installation Guide*.

Most batch programs are invoked by a program named EQQBATCH, and are specified by a parameter in the JCL EXEC statement. This program must be authorized and, like all other batch load modules in IBM Workload Scheduler for z/OS, must be located in an authorized library. These batch programs are not invoked with EQQBATCH: EQQYLTOP, EQQPURGE, and EQQEVPGM.

After running batch programs, the generated reports can optionally be sent to other users by email.

DD statements referenced by batch jobs

The batch jobs use three categories of DD statements:
- DD statements that are required by EQQBATCH
- DD statements that refer to IBM Workload Scheduler for z/OS databases
- DD statements that refer to work data sets

For DCB and SPACE requirements of data sets that are referred to by these ddnames, see the JCL in each batch program example.

The corresponding JCL examples define which batch jobs use which DD statements.

DD statements used by EQQBATCH

The basic batch program, EQQBATCH, handles common functions necessary to initialize the batch jobs. These DD statements are required for all batch jobs:

EQQDMSG
Output; contains diagnostic messages.

EQQDUMP
Output; contains diagnostic trace information.

EQQMLIB
Input; messages, translatable terms, and headers.

EQQMLOG
Output; messages.

EQQPARM
Input; initialization parameters.

This DD statement in the JCL references the member in the parameter library that contains the BATCHOPT statement for the IBM Workload Scheduler for z/OS subsystem. The BATCHOPT statement defines runtime options for the batch jobs. These options can include:
- Date format for reports
- Report headers

- Page size for reports
- Subsystem name

For a more detailed description of the BATCHOPT statement, see *Customization and Tuning*.

STEPLIB
Input; step library. (This statement is not required if the IBM Workload Scheduler for z/OS modules are part of the z/OS link library.)

SYSIN
Input; inline input parameters to the batch programs.

SYSMDUMP
Output; the dump data set

DD statements describing the data

IBM Workload Scheduler for z/OS data is kept in VSAM as well as non-VSAM data sets:

EQQADDS
VSAM; application descriptions and JCL variable tables

EQQAD2DS
VSAM; application descriptions (used by the batch loader)

EQQCKPT
Sequential; checkpoint data set

EQQCP1DS
VSAM; primary-current-plan data set

EQQCP2DS
VSAM; alternate-current-plan data set

EQQCXDS
VSAM; current plan extension, containing special resource information

EQQJT*xx*
Sequential; job-tracking-log data set (maximum 99)

EQQJTARC
Sequential; job-tracking-archive data set

EQQLTBKP
VSAM; long-term plan backup

EQQLTDS
VSAM; long-term plan data set

EQQNCPDS
VSAM; new-current-plan data set

EQQNCXDS
VSAM; new current plan extension, containing special resource information

EQQOIDS
VSAM; operator instruction database

EQQRDDS
VSAM; resource definition database

EQQSCLIB
Partitioned; script library

EQQSCPDS
VSAM; current plan copy to produce the Symphony file

EQQWSDS
VSAM; workstation description and calendar database.

These data sets are common to most batch programs and to the IBM Workload Scheduler for z/OS subsystem. Ensure that your batch jobs use the same data sets as the IBM Workload Scheduler for z/OS subsystem (except when you creating a separate database using the batch loader program, as described in "How to code batch-loader control statements" on page 211).

The batch jobs also allocate work data sets.

Security and batch programs

Most batch programs do not use subresource security checking to update a database. If you have authority to update the application description database, for example, batch programs allow you to update any application. An exception to this rule is when the batch program uses the program interface to make the updates (as the EQQOIBLK does when you comment out the EQQOIDS ddname).

Batch programs and JCL examples

The batch programs are described, in alphabetical order, in the following pages. Each program is described with the format of the required SYSIN and a JCL example for the batch job.

Each job must contain:

```
//SYSIN DD *
data
/*
```

where *data* meets the conditions under the heading "SYSIN requirements" in the following descriptions. If the job does not require SYSIN, the DD statement for SYSIN is still required; it should be immediately followed by the `/*` statement.

IBM Workload Scheduler for z/OS interprets the year part (YY) in the SYSIN data streams as follows:

YY	Year
72 - 99	1972 - 1999
00 - 71	2000 - 2071

In the following example, a batch program for creating a new long-term plan with the SYSIN DD statement used in the example will produce a long-term plan for the period 1998/12/01 to 2000/04/30:

```
//SYSIN DD *
981201000430
/*
```

All batch programs that use the long-term plan must have a start day later than 1978/01/01 and an end date before 2066/12/31, because of the way IBM Workload Scheduler for z/OS handles calendars internally.

Table 53 on page 758 summarizes the batch program functions.

Note: For detailed information about restrictions or about the sorting program used in some of the listed batch programs (for example DFSORT) and its temporary work data sets (for example, LTOCWK*nn* used in the LTP samples), see the manual related to the specific sorting utility.

Table 53. Batch programs

Name	Function
EQQADCOP	Print applications: calculate and print application run days.
EQQADDEP	Print applications: cross-reference external dependencies.
EQQADMUP	Perform mass update of application descriptions.
EQQADPRT	Print applications: detailed.
EQQADXRF	Print applications: cross-reference job names.
EQQAUDIT	Print formatted audit reports
EQQAXR00	Print applications: cross-reference different items.
EQQCLPRC	Print calendars.
EQQCLPRP	Print periods.
EQQDNTOP	Create or extend the current plan.
EQQDOTOP	Print statistics for current planning period.
EQQDRTOP	Replan current planning period.
EQQDSTOP	Renew the Symphony file.
EQQDTTOP	Produce a trial plan.
EQQEVPGM	Change status of resources or operations.
EQQJVPRT	Print JCL variables.
EQQLTCRE	Create a new long-term plan.
EQQLTMOA	Modify the long-term plan for all applications or extend the long-term plan.
EQQLTMOO	Modify the long-term plan for one application.
EQQLTPRT	Print the long-term plan.
EQQLTTRY	Make a trial long-term plan.
EQQOIBAT	Print operator instructions.
EQQOIBLK	Operator instructions: perform mass update.
EQQPURGE	Purge DLF (data lookaside facility) object.
EQQSLTOP	File parse program, Process parse statement.
EQQWSPRT	Print all workstation descriptions.
EQQYLTOP	Batch loader.

EQQADCOP - Print applications: calculate and print application run days

The EQQADCOP batch program calculates and prints application run days.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The application ID is specified, starting in column 1.

JCL example

```
//*********************************************************************
//* CALCULATE AND PRINT APPLICATION RUNDATES
//*********************************************************************
//ADCOP    EXEC PGM=EQQBATCH,PARM='EQQADCOP',REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//LTREPORT DD SYSOUT=*,
//            DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//LTOCIN   DD DCB=(RECFM=FB,LRECL=751,BLKSIZE=6759),
//            SPACE=(CYL,(3,1)),UNIT=3390
//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//EQQWSDS  DD DSN=EID.EIDAR3.WS,DISP=SHR
//EQQLTDS  DD DSN=EID.EIDAR3.LT,DISP=SHR
//SYSIN    DD *
PAYDAILY
//* = APPLICATIONID
//* APPLICATION ID = SELECTED APPLICATION
```

EQQADDEP - Print applications: cross-reference external dependencies

The EQQADDEP batch program provides a printout of a cross-reference of external dependencies on the application description database. Note that EQQADDEP does not support applications with "valid from" dates later than the date on which the batch job runs.

SYSIN requirements

None.

JCL example

```
//*********************************************************************
//* APPLICATION CROSS REFERENCE OF EXTERNAL DEPENDENCIES
//*********************************************************************
//ADDEP    EXEC PGM=EQQBATCH,PARM='EQQADDEP',REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//ADREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//ADDPIN   DD DCB=(LRECL=065,BLKSIZE=3250,RECFM=FB),
//         SPACE=(CYL,(3,1)),DISP=(,DELETE),UNIT=3390
//ADDPOUT  DD DCB=(LRECL=065,BLKSIZE=3250,RECFM=FB),
//         SPACE=(CYL,(3,1)),DISP=(,DELETE),UNIT=3390
//ADDPWK01 DD SPACE=(CYL,(1,3)),UNIT=3390
//ADDPWK02 DD SPACE=(CYL,(1,3)),UNIT=3390
//ADDPWK03 DD SPACE=(CYL,(1,3)),UNIT=3390
//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//EQQAD2DS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//SYSIN    DD *
```

EQQADMUP - Perform mass update of application Descriptions

The EQQADMUP batch program performs a mass update of application descriptions in the AD database.

SYSIN requirements

Attention: The SYSIN parameter string is in a binary format. Do not try to create it manually, because any errors could corrupt your application description database. Always use the mass update dialog to generate the parameter.

JCL example

```
//*********************************************************************
//* APPLICATION DESCRIPTION MASS UPDATE
//*********************************************************************
//*
//ADMUP    EXEC PGM=EQQBATCH,PARM='EQQADMUP',REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//MUREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//EQQWSDS  DD DSN=EID.EIDAR3.WS,DISP=SHR
//*********************************************************************
//*         C A U T I O N
//* RENUMBERING THIS MEMBER AS WELL AS UPDATING THE SYSIN CARDS
//* MAY DAMAGE THE INPUT PARAMETERS TO THE AD MASS UPDATE BATCHJOB.
//*********************************************************************
//SYSIN    DD *
                                    XRAYNER U      OG     (  SAMPLE
CPU1      Y                                                  Y
                                   OG     -  SAMPLE            CPU1
                                              D

/*
```

EQQADPRT - Print applications: detailed

The EQQADPRT batch program provides a printout of application information from the application database.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The definition of the input parameters is:

```
COLUMNS  1         2         3
12345678901234567890123456789O
ABCDEFGHIJ                    LINE 1   (REQUIRED)
XXXXXXXXXXXXXXX               LINE 2-n (OPTIONAL)
where:
  A = 1 APPLICATIONS, 2 DEPENDENCIES, 3 OPERATIONS, 4 APPL vs OWNER
  B = 1 ALL APPLICATIONS, 2 SELECTED ITEM, 3 FROM FILE
  CDEFGH = (YYMMDD)
  IJ = Number of lines following
  XXXXXXXXXXXXXXX = Application ID (number specified by IJ)
```

Notes

If you specify a data set name on the select panel, the ADUSERDS DD is set to the data set containing application IDs. These report options are available:

- Detailed printout of applications
- Internal dependencies for applications
- Operation using particular workstations
- Applications with particular owners

The input type restricts the printout to one of the following:

- Applications that are valid only on the date specified
- The application IDs that are provided
- The application IDs in the specified data set

JCL example

```
//*****************************************************************
//* APPLICATION PRINT PROGRAM
//*****************************************************************
//ADPRT    EXEC PGM=EQQBATCH,PARM='EQQADPRT',REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//ADREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//ADREPRT2 DD DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050),
//         SPACE=(CYL,(3,1)),DISP=(NEW,DELETE),UNIT=3390
//EQQMLOG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//ADPRIN   DD DCB=(LRECL=200,BLKSIZE=3200,RECFM=FB),
//         SPACE=(CYL,(3,1)),DISP=(NEW,DELETE),UNIT=3390
//ADPROUT  DD DCB=(LRECL=200,BLKSIZE=3200,RECFM=FB),
//         SPACE=(CYL,(3,1)),DISP=(NEW,DELETE),UNIT=3390
//ADPRWK01 DD SPACE=(CYL,(3,1)),UNIT=3390
//ADPRWK02 DD SPACE=(CYL,(3,1)),UNIT=3390
//ADPRWK03 DD SPACE=(CYL,(3,1)),UNIT=3390
//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//EQQAD2DS DD DSN=EID.EIDAR3.AD,DISP=SHR
//ADUSERDS DD DSN=NULLFILE,DISP=SHR
//SYSIN    DD *
4200000001
SAMPLE
//* =PARAMETERS(ABCDEFGHIJ)
//*    A = 1 APPLICATIONS, A = 2 DEPENDENCIES, A = 3 OPERATIONS
//*    A = 4 APPLIC VS OWNER
//*    B = 1 ALL APLICATIONS, B = 2 SELECTED ITEM, B = 3 FROM FILE
//*    CDEFGH = (YYMMDD)
//*    IJ = NUMBER OF ITEMS
```

EQQADXRF - Print applications: cross-reference job names

The EQQADXRF batch program provides a printout of cross-references of job names on the application description database.

SYSIN requirements

None.

JCL example

```
//*****************************************************************
//* APPLICATION CROSS REFERENCE PROGRAM
//*****************************************************************
```

```
//ADXRF    EXEC PGM=EQQBATCH,PARM='EQQADXRF',REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//ADREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//ADWKIN   DD DCB=(LRECL=078,BLKSIZE=3900,RECFM=FB),
//         SPACE=(CYL,(3,1)),DISP=(,DELETE),UNIT=3390
//ADWKOUT  DD DCB=(LRECL=078,BLKSIZE=3900,RECFM=FB),
//         SPACE=(CYL,(3,1)),DISP=(,DELETE),UNIT=3390
//ADWKWK01 DD SPACE=(CYL,(3,1)),UNIT=3390
//ADWKWK02 DD SPACE=(CYL,(3,1)),UNIT=3390
//ADWKWK03 DD SPACE=(CYL,(3,1)),UNIT=3390
//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//SYSIN    DD *
```

EQQAUDIT - Print formatted audit reports

The EQQAUDIT batch program provides a printout of formatted audit reports.

Note:

1. When you run the EQQAUDIT batch program interactively only, all the parameters are converted to upper-case. Because the extended name field input is case-sensitive, query results will not be found if you include a lower- or mixed-case extended name in your search criteria. To avoid this problem, run the sample in batch.
2. Run the sample in batch if you include the following characters in your search criteria:

   ```
   / + & * -
   ```

JCL example

```
//*********************************************************************
//*Print formatted audit reports
//*********************************************************************
//*  This program will take input from either the JTARC/JTx-files (for
//*  reporting in real time) or from the //EQQTROUT-file of the daily
//*  plan extend/replan programs (for after-the-fact reporting).
//*
//*  If You don't allocate //LIVEMLOG dummy, it will also read that
//*  file and, looking at the time-stamps, merge those messages with
//*  the formatted report-lines from the tracklog-files.
//*
//*  If not excluded by the user-defined filters, each tracklog-event
//*  will generate one formatted report-line. The program will also:
//*
//*    - Print all JCL-lines if AMOUNT(DATA) specified for FILE(JS)
//*        (If PASSWORD= is encountered, the password will be blanked
//*         out and not appear in the listing)
//*
//*    - Print all variable values of a job if AMOUNT(DATA) was
//*        specified for FILE(VAR)
//*
//*    - Print all origin dates of a period if AMOUNT(DATA) was
//*        specified for FILE(PER)
//*
//*    - Print all specific dates of a calendar if AMOUNT(DATA) was
//*        specified for FILE(CAL)
//*
```

```
//*  You have to specify AMOUNT(DATA) for FILE(CAL) to have
//*    calendar identifier listed
//*
//*  You have to specify AMOUNT(DATA) for FILE(LTP) to have for
//*    example deleted occurrences identified in a meaningful way
//*
//*  An MCP-request will be broken down into sub-transactions and
//*    each sub-transaction listed in connection to the originating
//*    request
//*
//*    - All WS intervals will be printed if availability of a WS is
//*        changed
//*    - All contained group occurrences will be listed for a 'group'
//*        MCP request
//*
//*  If you specify a search-string to the program it will select
//*  events with the specified string in it somewhere. That MAY mean
//*  that you will not the see the string in the report-line itself
//*  as the line may have been too 'busy' to also have room for your
//*  string value, whatever it may be.
//*
//*  MLOG messages have only MM/DD time-stamps. Therefore You should
//*  avoid running the program with input files spanning the year
//*  boundary.
//*
//*--------------------------------------------------------------------
//*********************************************************************
//* EXTRACT AND FORMAT   OPC      JOB TRACKING EVENTS
//*********************************************************************
//AUDIT    EXEC PGM=EQQBATCH,PARM='EQQAUDIT',REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=TWS81.SERVICE.APFLIB1
//EQQMLIB  DD DISP=SHR,DSN=TWS81.SERVICE.SEQQMSG1
//EQQPARM  DD DISP=SHR,DSN=OPCSSD.DC0V.PARM(DC0VB)
//*
//EQQMLOG  DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//EQQDUMP  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSPRINT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//*--------------------------------------------------------------------
//* FILE BELOW IS CREATED IN DAILY PLANNING BATCH AND USED IF INPUT
//* OPTION IS 'TRL'
//*--------------------------------------------------------------------
//EQQTROUT DD DISP=SHR,DSN=TWS.TWSQ.TRACKLOG
//*
//*--------------------------------------------------------------------
//* FILES BELOW ARE THOSE SPECIFIED IN STC-JCL FOR THE OPC
//* CONTROLLER SUBSYSTEM AND USED IF INPUT OPTION IS 'JTX'.
//* NO NEED TO INSERT MORE EQQJTxx DATASETS, DEPENDING ON
//* THE NUMBER SPECIFIED IN JTLOGS(x) KEYWORD IN JTOPTS.
//*--------------------------------------------------------------------
//EQQCKPT  DD DISP=SHR,DSN=TWS.TWSQ.CKPT
//EQQJTARC DD DISP=SHR,DSN=TWS.TWSQ.JTARC
//EQQJT01  DD DISP=SHR,DSN=TWS.TWSQ.JT1
//EQQJT02  DD DISP=SHR,DSN=TWS.TWSQ.JT2
//EQQJT03  DD DISP=SHR,DSN=TWS.TWSQ.JT3
//EQQJT04  DD DISP=SHR,DSN=TWS.TWSQ.JT4
//EQQJT05  DD DISP=SHR,DSN=TWS.TWSQ.JT5
//*
//*--------------------------------------------------------------------
//* FILE BELOW IS THE MLOG WRITTEN TO BY THE CONTROLLER SUBSYSTEM
//* NOTE: IF YOU DON'T WANT YOUR MLOG MERGED, JUST USE 'DD DUMMY'
//*--------------------------------------------------------------------
//*LIVEMLOG DD DISP=SHR,DSN=TWS.TWSQ.MLOGC
//LIVEMLOG DD DISP=SHR,DSN=TWS.TWSQ.MLOGC
//*
```

```
//*-------------------------------------------------------------------
//* FILE BELOW IS WHERE THE REPORT IS WRITTEN. FBA 133
//*-------------------------------------------------------------------
//*AUDITPRT DD DISP=SHR,DSN=OPCSSD.DC0V.EQQAUDIT.REPORT
//AUDITPRT DD DISP=SHR,DSN=OPCSSD.DC0V.EQQAUDIT.REPORT
//*
//*-------------------------------------------------------------------
//* THESE ARE THE PARMS YOU CAN PASS ON TO THE EQQAUDIT PROGRAM
//*
//* POS 01-03: 'JTX' or 'TRL' TO DEFINE WHAT INPUT FILES TO USE
//* POS 04-57: STRING TO SEARCH FOR IN INPUT RECORD OR BLANK
//* POS 58-67: FROM_DATE/TIME AS YYMMDDHHMM OR BLANK
//* POS 68-77: TO_DATE/TIME AS YYMMDDHHMM OR BLANK
//*-------------------------------------------------------------------
//SYSIN    DD *
JTX
/*
```

EQQAXR00 - Print applications: cross-reference different items

The EQQAXR00 batch program provides cross-references between different items on the application database.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The definition of the input parameters is:

```
COLUMNS  1         2         3
12345678901234567890123456789O
AABBCCDDEE                    LINE 1   (REQUIRED)
where AA,BB,CC,DD,EE are the codes for the sort order (maximum of 5):
 01 = APPLICATION ID              09 = PRIORITY
 02 = APPLICATION TEXT            10 = SYSOUT CLASS
 03 = OP ID                       11 = FORM NUMBER
 04 = OP TEXT                     12 = SPECIAL RESOURCES
 05 = PERIOD NAME                 13 = WS RESOURCE R1
 06 = RUN CYCLE DESCRIPTION       14 = WS RESOURCE R2
 07 = JOB NAME                    15 = CALENDAR ID
 08 = JOB CLASS
```

JCL example

```
//*********************************************************************
//* APPLICATION CROSS REFERENCE OF SELECTED FIELDS
//*********************************************************************
//ADXREF   EXEC PGM=EQQBATCH,PARM='EQQAXR00',REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//ADREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//ADWKIN   DD DCB=(LRECL=220,BLKSIZE=4400,RECFM=FB),
//         SPACE=(CYL,(3,1)),DISP=(NEW,DELETE),UNIT=3390
//ADWKOUT  DD DCB=(LRECL=220,BLKSIZE=4400,RECFM=FB),
//         SPACE=(CYL,(3,1)),DISP=(NEW,DELETE),UNIT=3390
//ADWKWK01 DD SPACE=(CYL,(3,1)),UNIT=3390
//ADWKWK02 DD SPACE=(CYL,(3,1)),UNIT=3390
//ADWKWK03 DD SPACE=(CYL,(3,1)),UNIT=3390
```

```
//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//SYSIN    DD *
0701031215
/*
```

EQQCLPRC - Print calendars

The EQQCLPRC batch program provides a printout of calendar information from the calendar database. All calendar information from the date of submission to the end date that is specified will be printed.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The definition of the input parameters is:

```
COLUMNS  1         2         3
12345678901234567890123456789O
YYMMDD                        LINE 1   (REQUIRED)
where:
  YYMMDD = End date for the report (YY = YEAR, MM= MONTH, DD= DAY)
```

JCL example

```
/*******************************************************************
//* PRINT ALL CALENDARS
//*******************************************************************
//PRTCAL   EXEC PGM=EQQBATCH,PARM='EQQCLPRC',REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//CLREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//EQQWSDS  DD DSN=EID.EIDAR3.WS,DISP=SHR
//SYSIN    DD *
951231
//* = ENDDATE OF CALENDARS PRINT (YYMMDD)
```

EQQCLPRP - Print periods

The EQQCLPRP batch program provides a printout of period information from the calendar database.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The definition of the input parameters is:

```
COLUMNS  1         2         3
12345678901234567890123456789O
YYMMDDCCCCCCCCCCCCCCCC        LINE 1   (REQUIRED)
where:
  YYMMDD = End date for the report (YY = YEAR, MM= MONTH, DD= DAY)
  CCCCCCCCCCCCCCCC = Calendar for the calculation of the origin date
```

JCL example

```
//*******************************************************************
//* PRINT ALL PERIODS
//*******************************************************************
//PRTPER   EXEC PGM=EQQBATCH,PARM='EQQCLPRP',REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
```

```
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//CLREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//EQQWSDS  DD DSN=EID.EIDAR3.WS,DISP=SHR
//SYSIN    DD *
951231DEFAULT
//* = ENDDATE OF PERIODS PRINT (YYMMDD)
//*   CALENDAR NAME
```

EQQDNTOP - Create or extend the current plan

The EQQDNTOP batch program creates or extends the current planning period.

Note: Job tracking uses two data sets to log each event that has been processed. If you need to restart IBM Workload Scheduler for z/OS from a checkpoint, IBM Workload Scheduler for z/OS uses the older of the two current plan data sets. Events logged on the current log data set are then reprocessed. When this reprocessing finishes, a current plan backup copy is created so that the two current plan data sets are again equal. Job tracking continues to process new events as they occur. You do not need to re-create the current plan.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The layout of the SYSIN DD statement for the first step is:

```
COLUMNS  1         2         3
12345678901234567890123456789O
YYMMDDHHMMhhhmmW    abcdefgh          (format 1)
YYMMDDHHMMyymmddhhmmabcdefgh          (format 2)
where:
YYMMDDHHMM      = Plan start date and time          (both formats)
hhhmm           = Hours and minutes to be extended  (format 1)
                  (for example, 02400 is 24 hours)
W               = Work day flag. Set to W or blank. (format 1)
                  (for example, 04800W means extend for 48 days,
                   excluding any free days)
yymmddhhmm      = Plan end date and time            (format 2)
abcdefgh        = Report flags. Set to 1 or 0.      (both formats)
                         a = WORKSTATION SUMMARY
                         b = DAILY OPERATING PLANS
                         c = WORK STATION PLANS
                         d = WORK STATION INPUT ARRIVAL LISTS
                         e = NONREPORTING WORK STATIONS
                         f = PREVIOUS PERIOD RESULTS
                         g = PLANNED RESOURCE UTILIZATION
                         h = ACTUAL RESOURCE UTILIZATION
Examples:
          02400     11111111  To extend by 24 hours and have all reports.
          951201120010000000  To extend to 1 December 1995 at 12.00 and
                              have the workstation summary report only.
```

JCL example

```
//*********************************************************************
//* DAILY PLANNING - PLAN NEXT PERIOD
//*********************************************************************
//DNTOP    EXEC PGM=EQQBATCH,PARM='EQQDNTOP',REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
```

```
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//EQQDIN   DD DSN=&&A,DISP=(NEW,PASS),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//DX12IN   DD DCB=(RECFM=FB,LRECL=90,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//DX12OUT  DD DCB=(RECFM=FB,LRECL=90,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//EQQTROUT DD DUMMY,DCB=BLKSIZE=100
//*          -----              ---
//*  CHANGE WHEN  TRACKLOG IS TO BE SAVED
//*  DISP=MOD MUST BE SPECIFIED
//*  DCB PARAMETERS MUST BE DEFINED IN DD STATEMENT:
//*  LRECL=32000 RECFM=VBS
//*********************************************************************
//EQQMLOG  DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQWSDS  DD DISP=SHR,DSN=EID.EIDAR3.WS
//EQQADDS  DD DISP=SHR,DSN=EID.EIDAR3.AD
//EQQRDDS  DD DISP=SHR,DSN=EID.EIDAR3.RD
//EQQLTDS  DD DISP=SHR,DSN=EID.EIDAR3.LT
//EQQLTBKP DD DISP=SHR,DSN=EID.EIDAR3.LB
//EQQCP1DS DD DISP=SHR,DSN=EID.EIDAR3.CP1
//EQQCP2DS DD DISP=SHR,DSN=EID.EIDAR3.CP2
//EQQSCPDS DD DISP=SHR,DSN=EID.EIDAR3.SCP
//EQQSCLIB DD DISP=SHR,DSN=EID.EIDA.SCRPTLIB
//EQQNCPDS DD DISP=SHR,DSN=EID.EIDAR3.NCP
//EQQNCXDS DD DISP=SHR,DSN=EID.EIDAR3.NCX
//EQQCXDS  DD DISP=SHR,DSN=EID.EIDAR3.CX
//EQQJTARC DD DISP=SHR,DSN=EID.EIDA.JTARC
//EQQCKPT  DD DISP=SHR,DSN=EID.EIDA.CKPT//SYSIN    DD *
         02400     11111111
//* = PLSTRTTIMEPLENDTIME REPORTS
//* PLSTRTTIME(YYMMDDHHMM) = PLAN START DATE,TIME IF REFRESH
//* PLENDTIME (YYMMDDHHMM) = PLAN END TIME
//*           (HHHMM     ) = PLAN EXTENSION IN HOURS AND MINUTES
//*                          COUNTING ALL DAYS
//*           (HHHMMW    ) = PLAN EXTENSION IN HOURS AND MINUTES
//*                          COUNTING ONLY WORK DAYS
//* REPORTS(ABCDEFGH)      = REQUESTED REPORTS (1/0)
//*                          A = WORKSTATION SUMMARY
//*                          B = DAILY OPERATING PLANS
//*                          C = WORKSTATION PLANS
//*                          D = WORKSTATION INPUT ARRIVAL LISTS
//*                          E = NONREPORTING WORKSTATIONS
//*                          F = PREVIOUS PERIOD RESULTS
//*                          G = PLANNED RESOURCE UTILIZATION
//*                          H = ACTUAL RESOURCE UTILIZATION
/*
//*********************************************************************
//* STEP2 DAILY PLAN - SORT OF REPORT RECORDS
//*********************************************************************
//*
//SORT     EXEC PGM=SORT,REGION=4096K,TIME=1440,COND=(8,LT)
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SORTIN   DD DSN=&&A,DISP=(OLD,DELETE)
//SORTOUT  DD DISP=(NEW,PASS),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SORTWK01 DD DISP=(NEW,DELETE),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
```

```
//SORTWK02 DD DISP=(NEW,DELETE),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SORTWK03 DD DISP=(NEW,DELETE),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SYSIN    DD *
      SORT FIELDS=(1,130,CH,A)
/*
//*********************************************************************
//* STEP3 DAILY PLAN - PLAN NEXT PRINT THE REPORTS
//*********************************************************************
/*
//DPREPORT EXEC PGM=EQQBATCH,PARM='EQQDPRPT',COND=(8,LT),
//         REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//SYSPRINT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//EQQPOUT  DD DSN=*.SORT.SORTOUT,DISP=(OLD,DELETE)
//SYSIN    DD *
//*
```

EQQDOTOP - Print statistics for current planning period

The EQQDOTOP batch program prints current plan statistics.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The layout of the SYSIN DD statement for the first step is:

```
COLUMNS  1         2         3
12345678901234567890123456789O
YYMMDDHHMMyymmddhhmm
where:
YYMMDDHHMM      = Plan start date and time
yymmddhhmm      = Plan end date and time
```

JCL example

```
//*********************************************************************
//* DAILY PLANNING - PRINT CURRENT PERIOD RESULTS
//*********************************************************************
//DOTOP    EXEC PGM=EQQBATCH,PARM='EQQDOTOP',REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCTEST.ESA131.SEQQMSG0
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//SYSPRINT DD SYSOUT=*
//EQQMLOG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//EQQDUMP  DD SYSOUT=*
//SYSMDUMP DD DSN=EID.EIDA.SYSDUMPB,DISP=MOD
//EQQDIN   DD DSN=&&A,DISP=(NEW,PASS),
//            DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//            SPACE=(CYL,(3,1)),UNIT=3390
//DX12IN   DD DCB=(RECFM=FB,LRECL=90,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//DX12OUT  DD DCB=(RECFM=FB,LRECL=90,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
```

```
//EQQCP1DS DD DSN=EID.EIDAR3.CP1,DISP=SHR
//EQQCP2DS DD DSN=EID.EIDAR3.CP2,DISP=SHR
//EQQXD1DS DD DSN=EID.EIDAR3.XD1,DISP=SHR
//EQQXD2DS DD DSN=EID.EIDAR3.XD2,DISP=SHR
//EQQCKPT  DD DSN=EID.EIDA.CKPT,DISP=SHR
//SYSIN    DD *
95061012009506111600
//* = PLSTRTTIMEPLENDTIME
//* PLSTRTTIME(YYMMDDHHMM) = PLAN START DATE,TIME IF REFRESH
//* PLENDTIME (YYMMDDHHMM) = PLAN END DATE,TIME/*
//*********************************************************************
//* STEP2 DAILY PLAN - SORT OF REPORT RECORDS
//*********************************************************************
//*
//SORT     EXEC PGM=SORT,REGION=4096K,TIME=1440,COND=(8,LT)
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SORTIN   DD DSN=&&A,DISP=(OLD,DELETE)
//SORTOUT  DD DISP=(NEW,PASS),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SORTWK01 DD DISP=(NEW,DELETE),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SORTWK02 DD DISP=(NEW,DELETE),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SORTWK03 DD DISP=(NEW,DELETE),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SYSIN    DD *
      SORT FIELDS=(1,130,CH,A)
/*
//*********************************************************************
//* STEP3 DAILY PLAN - PLAN NEXT PRINT THE REPORTS
//*********************************************************************
/*
//DPREPORT EXEC PGM=EQQBATCH,PARM='EQQDPRPT',COND=(8,LT),
//         REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCTEST.ESA131.SEQQMSG0
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//SYSPRINT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//EQQPOUT  DD DSN=*.SORT.SORTOUT,DISP=(OLD,DELETE)
//SYSIN    DD *
//*
```

EQQDRTOP - Replan current planning period

The EQQDRTOP batch program provides a new plan for the current planning period.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The layout of the SYSIN DD statement for the first step is:

```
COLUMNS  1         2         3
12345678901234567890123456789O
abcdefgh
```

```
where:
abcdefgh        = Report flags. Set to 1 or 0.
                  a = WORKSTATION SUMMARY
                  b = DAILY OPERATING PLANS
                  c = WORK STATION PLANS
                  d = WORK STATION INPUT ARRIVAL LISTS
                  e = NONREPORTING WORK STATIONS
                  f = PREVIOUS PERIOD RESULTS
                  g = PLANNED RESOURCE UTILIZATION
                  h = ACTUAL RESOURCE UTILIZATION
```

JCL example

```
//*********************************************************************
//* DAILY PLANNING - REPLAN CURRENT PERIOD
//*********************************************************************
//DRTOP    EXEC PGM=EQQBATCH,PARM='EQQDRTOP',REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCTEST.ESA131.SEQQMSG0
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//EQQDIN   DD DSN=&&A,DISP=(NEW,PASS),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//            SPACE=(CYL,(3,1)),UNIT=3390
//DX12IN   DD DCB=(RECFM=FB,LRECL=90,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//DX12OUT  DD DCB=(RECFM=FB,LRECL=90,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//EQQTROUT DD DUMMY,DCB=BLKSIZE=100
//*           -----             ---
//*  CHANGE WHEN TRACKLOG IS TO BE SAVED
//*  DISP=MOD MUST BE SPECIFIED
//*  DCB PARAMETERS MUST BE DEFINED IN DD STATEMENT:
//*  LRECL=32000 RECFM=VBS
//*********************************************************************
//EQQMLOG  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//EQQDUMP  DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQWSDS  DD DISP=SHR,DSN=EID.EIDAR3.WS
//EQQADDS  DD DISP=SHR,DSN=EID.EIDAR3.AD
//EQQRDDS  DD DISP=SHR,DSN=EID.EIDAR3.RD
//EQQSCPDS DD DISP=SHR,DSN=EID.EIDAR3.SCP
//EQQSCLIB DD DISP=SHR,DSN=EID.EIDA.SCRPTLIB
//EQQLTDS  DD DISP=SHR,DSN=EID.EIDAR3.LT
//EQQLTBKP DD DISP=SHR,DSN=EID.EIDAR3.LB
//EQQCP1DS DD DISP=SHR,DSN=EID.EIDAR3.CP1
//EQQCP2DS DD DISP=SHR,DSN=EID.EIDAR3.CP2
//EQQNCPDS DD DISP=SHR,DSN=EID.EIDAR3.NCP
//EQQNCXDS DD DISP=SHR,DSN=EID.EIDAR3.NCX
//EQQCXDS  DD DISP=SHR,DSN=EID.EIDAR3.CX
//EQQJTARC DD DISP=SHR,DSN=EID.EIDA.JTARC
//EQQCKPT  DD DISP=SHR,DSN=EID.EIDA.CKPT
//SYSIN    DD *
//*********************************************************************
//* STEP2 DAILY PLAN - SORT OF REPORT RECORDS
//*********************************************************************
//*
//SORT     EXEC PGM=SORT,REGION=4096K,TIME=1440,COND=(8,LT)
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SORTIN   DD DSN=&&A,DISP=(OLD,DELETE)
//SORTOUT  DD DISP=(NEW,PASS),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SORTWK01 DD DISP=(NEW,DELETE),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
```

```
//SORTWK02 DD DISP=(NEW,DELETE),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SORTWK03 DD DISP=(NEW,DELETE),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SYSIN    DD *
      SORT FIELDS=(1,130,CH,A)
/*
//*********************************************************************
//* STEP3 DAILY PLAN - PLAN NEXT PRINT THE REPORTS
//*********************************************************************
//DPREPORT EXEC PGM=EQQBATCH,PARM='EQQDPRPT',COND=(8,LT),
//         REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCTEST.ESA131.SEQQMSG0
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//SYSPRINT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//EQQPOUT  DD DSN=*.SORT.SORTOUT,DISP=(OLD,DELETE)
//SYSIN    DD *
//*
```

EQQDSTOP - Renew the symphony file

The EQQDSTOP batch program renews the symphony file. The file is created from the active current plan.

SYSIN requirements

None.

JCL example

```
//*************************************************************
//* DAILY PLANNING - REFNEW SYMPHONY FROM CP
//*************************************************************
//DSTOP    EXEC PGM=EQQBATCH,PARM='EQQDSTOP',REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//*************************************************************
//EQQMLOG  DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQCKPT  DD DISP=SHR,DSN=EID.EIDA.CKPT
//EQQADDS  DD DISP=SHR,DSN=EID.EIDA.AD
//EQQSCPDS DD DISP=SHR,DSN=EID.EIDAR3.SCP
//EQQSCLIB DD DISP=SHR,DSN=EID.EIDA.SCRPTLIB
//SYSIN    DD *
/*
```

EQQDTTOP - Produce a trial plan

The EQQDTTOP batch program provides a trial plan for the current planning period. A long-term plan must already exist before you can make a trial plan.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The layout of the SYSIN DD statement for the first step is:

```
COLUMNS  1         2         3
12345678901234567890123456789O
YYMMDDHHMMhhhmmW    Tabcdefgh          (format 1)
YYMMDDHHMMyymmddhhmmTabcdefgh          (format 2)
where:
YYMMDDHHMM      = Plan start date and time          (both formats)
hhhmm           = Hours and minutes to be extended  (format 1)
                  (for example, 02400 is 24 hours)
W               = Work day flag. Set to W or blank. (format 1)
                  (for example, 04800W means extend for 48 days,
                   excluding any free days)
yymmddhhmm      = Plan end date and time            (format 2)
T               = Type of trial plan (C=REPLAN,N=NEXT,F=FUTURE)
abcdefgh        = Report flags. Set to 1 or 0.      (both formats)
                       a = WORKSTATION SUMMARY
                       b = DAILY OPERATING PLANS
                       c = WORKSTATION PLANS
                       d = NOT USED. ALWAYS 0.
                       e = NONREPORTING WORKSTATIONS
                       f = NOT USED. ALWAYS 0.
                       g = PLANNED RESOURCE UTILIZATION
                       h = NOT USED. ALWAYS 0.
```

JCL example

```
//*********************************************************************
//* DAILY PLANNING - PLAN A TRIAL PERIOD
//*********************************************************************
//EQQDTTOP EXEC PGM=EQQBATCH,PARM='EQQDTTOP',REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//EQQDIN   DD DSN=&&A,DISP=(NEW,PASS),
//            DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//            SPACE=(CYL,(3,1)),UNIT=3390
//DX12IN   DD DCB=(RECFM=FB,LRECL=90,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//DX12OUT  DD DCB=(RECFM=FB,LRECL=90,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//EQQTROUT DD DUMMY,DCB=BLKSIZE=100
//*           -----              ---
//*  CHANGE WHEN  TRACKLOG IS TO BE SAVED
//*  DISP=MOD MUST BE SPECIFIED
//*  DCB PARAMETERS MUST BE DEFINED IN DD STATEMENT:
//*  LRECL=32000 RECFM=VBS
//*********************************************************************
//EQQMLOG  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//EQQDUMP  DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQWSDS  DD DISP=SHR,DSN=EID.EIDAR3.WS
//EQQADDS  DD DISP=SHR,DSN=EID.EIDAR3.AD
//EQQADDS  DD DISP=SHR,DSN=EID.EIDA.AD
//EQQLTDS  DD DISP=SHR,DSN=EID.EIDAR3.LT
//EQQCP1DS DD DISP=SHR,DSN=EID.EIDAR3.CP1
//EQQCP2DS DD DISP=SHR,DSN=EID.EIDAR3.CP2
//EQQNCPDS DD DISP=SHR,DSN=EID.EIDAR3.NCP
//EQQJTARC DD DISP=SHR,DSN=EID.EIDA.JTARC
//EQQCKPT  DD DISP=SHR,DSN=EID.EIDA.CKPT
/*
//SYSIN    DD *
950505083902400     F11101010
```

```
//* = PLSTRTTIMEPLENDTIME TREPORTS
//* PLSTRTTIME(YYMMDDHHMM) = PLAN START DATE,TIME IF REFRESH
//* PLENDTIME (YYMMDDHHMM) = PLAN END TIME
//*           (HHHMM     ) = PLAN EXTENSION IN HOURS AND MINUTES
//*                          COUNTING ALL DAYS
//*           (HHHMMW    ) = PLAN EXTENSION IN HOURS AND MINUTES
//*                          COUNTING ONLY WORK DAYS
//* TYPE OF TRIAL PLAN (T) = REQUESTED TYPE (C=REPLAN,N=NEXT,F=FUTURE)
//* REPORTS(ABCDEFGH)      = REQUESTED REPORTS (1/0)
//*                          A = WORKSTATION SUMMARY
//*                          B = DAILY OPERATING PLANS
//*                          C = WORKSTATION PLANS
//*                          D = NOT USED ALWAYS 0
//*                          E = NONREPORTING WORKSTATIONS
//*                          F = NOT USED ALWAYS 0
//*                          G = PLANNED RESOURCE UTILIZATION
//*                          H = NOT USED ALWAYS 0
//*********************************************************************
//* STEP2 DAILY PLAN - SORT OF REPORT RECORDS
//*********************************************************************
//*
//SORT     EXEC PGM=SORT,REGION=4096K,TIME=1440,COND=(8,LT)
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SORTIN   DD DSN=&&A,DISP=(OLD,DELETE)
//SORTOUT  DD DISP=(NEW,PASS),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SORTWK01 DD DISP=(NEW,DELETE),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SORTWK02 DD DISP=(NEW,DELETE),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SORTWK03 DD DISP=(NEW,DELETE),
//         DCB=(RECFM=FB,LRECL=558,BLKSIZE=5580),
//         SPACE=(CYL,(3,1)),UNIT=3390
//SYSIN    DD *
      SORT FIELDS=(1,130,CH,A)
/*
//*********************************************************************
//* STEP3 DAILY PLAN - PLAN NEXT PRINT THE REPORTS
//*********************************************************************
/*
//DPREPORT EXEC PGM=EQQBATCH,PARM='EQQDPRPT',COND=(8,LT),
//         REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//SYSPRINT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//EQQPOUT  DD DSN=*.SORT.SORTOUT,DISP=(OLD,DELETE)
//SYSIN    DD *
//*
```

EQQEVPGM - Issue commands in batch

Use EQQEVPGM to issue the TSO commands for IBM Workload Scheduler for z/OS in batch.

SYSIN requirements

The SYSIN data can consist of one or more BACKUP, OPINFO, OPSTAT, SRSTAT, or WSSTAT commands. These commands have the same syntax as the corresponding TSO commands, which are described, with examples, in the Appendix A, "TSO commands," on page 729.

JCL example

```
//STEP1    EXEC PGM=EQQEVPGM
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQMLOG  DD SYSOUT=*
//SYSIN    DD *
 SRSTAT 'TAPES' SUBSYS(EIDA)
        AVAIL(YES)
        DEVIATION(-1)
```

EQQJVPRT - Print JCL variables

The EQQJVPRT batch program prints a single JCL variable table or all JCL variable tables (when no SYSIN data is specified).

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The parameter is the name of the variable table, starting in column 1.

JCL example

```
//*********************************************************************
//* PRINT JCL VARIABLE TABLES
//*********************************************************************
//JVTPRT  EXEC PGM=EQQBATCH,PARM='EQQJVPRT',REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//JVREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//JVPRIN   DD DCB=(RECFM=VBS,LRECL=32756,BLKSIZE=6220),
//            SPACE=(440,(4000,4000)),UNIT=3390
//JVPROUT  DD DCB=(RECFM=VBS,LRECL=32756,BLKSIZE=6220),
//            SPACE=(440,(4000,4000)),UNIT=3390
//JVPRWK01 DD SPACE=(CYL,(1,5)),UNIT=3390
//JVPRWK02 DD SPACE=(CYL,(1,5)),UNIT=3390
//JVPRWK03 DD SPACE=(CYL,(1,5)),UNIT=3390
//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//SYSIN    DD *
PAY
//* = JCL VARIABLE TABLE NAME
```

EQQLTCRE - Create a new long-term plan

The EQQLTCRE batch program creates a completely new long-term plan. The input parameters to the batch program give the start date and end date to the long-term plan that is created.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The layout of the SYSIN DD statement is:

```
COLUMNS  1         2         3
12345678901234567890123456789O
YYMMDDyymmdd                  LINE 1   (REQUIRED)
where:
 YYMMDD = STARTDATE  (YY = YEAR, MM = MONTH, DD = DAY)
 yymmdd = ENDDATE    (yy = YEAR, mm = MONTH, dd = DAY)
```

JCL example

```
//*********************************************************************
//* LONG TERM PLANNING - CREATE THE LONG TERM PLAN
//*********************************************************************
//LTCREATE EXEC PGM=EQQBATCH,PARM='EQQLTCRE',REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCTEST.ESA131.SEQQMSG0
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//LTREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//LTPRED3  DD DCB=(RECFM=FB,LRECL=100,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//LTPRIN   DD DCB=(RECFM=FB,LRECL=100,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=SYSDA
//LTPROUT  DD DCB=(RECFM=FB,LRECL=100,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=SYSDA
//LTOCIN   DD DCB=(RECFM=FB,LRECL=751,BLKSIZE=4506),
//         SPACE=(4410,(2400,2400)),UNIT=3390
//LTOCOUT  DD DCB=(RECFM=FB,LRECL=751,BLKSIZE=4506),
//         SPACE=(4410,(2400,2400)),UNIT=3390
//LTPRWK01 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTPRWK02 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTPRWK03 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOCWK01 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOCWK02 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOCWK03 DD SPACE=(CYL,(1,5)),UNIT=3390
//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//EQQWSDS  DD DSN=EID.EIDAR3.WS,DISP=SHR
//EQQLTDS  DD DSN=EID.EIDAR3.LT,DISP=SHR
//EQQLTBKP DD DSN=EID.EIDAR3.LB,DISP=SHR
//EQQLDDS  DD DSN=EID.EIDAR3.LD,DISP=SHR,
//            AMP=('BUFNI=10,BUFND=10')
//SYSIN    DD *
950511950626
/*
//* = STARTDATE (YYMMDD)
//*   ENDDATE (YYMMDD)
//*
```

EQQLTMOA - Modify the long-term plan for all applications or extend the long-term plan

The EQQLTMOA batch program can modify the long-term plan for all applications or extend the long-term plan. (If the start date of the long-term plan does not move forward each time you extend it, you might have an uncompleted occurrence at the start of the long-term plan.)

SYSIN requirements

SYSIN data is required only for extending the long-term plan. The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. Specify either an end date or the number of days to be extended.

```
COLUMNS  1         2         3
12345678901234567890123456789O
YYMMDD                       New LTP end date
            DDDD             Extension in days, counting all days
```

JCL example

```
//*********************************************************************
//* LONG TERM PLANNING - EXTEND THE LONG TERM PLAN
//*********************************************************************
//LTEXTEND EXEC PGM=EQQBATCH,PARM='EQQLTMOA',REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCTEST.ESA131.SEQQMSG0
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//LTREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//LTOLIN   DD DCB=(RECFM=VB,LRECL=1000,BLKSIZE=6220),
//         SPACE=(CYL,(1,5)),UNIT=3390
//LTOLOUT  DD DCB=(RECFM=VB,LRECL=1000,BLKSIZE=6220),
//         SPACE=(CYL,(1,5)),UNIT=3390
//LTPRED3  DD DCB=(RECFM=FB,LRECL=100,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//LTPRIN   DD DCB=(RECFM=FB,LRECL=100,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//LTPROUT  DD DCB=(RECFM=FB,LRECL=100,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//LTOCIN   DD DCB=(RECFM=FB,LRECL=751,BLKSIZE=4506),
//         SPACE=(4410,(300,300)),UNIT=3390
//LTOCOUT  DD DCB=(RECFM=FB,LRECL=751,BLKSIZE=4506),
//         SPACE=(4410,(300,300)),UNIT=3390
//LTOLWK01 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOLWK02 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOLWK03 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTPRWK01 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTPRWK02 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTPRWK03 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOCWK01 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOCWK02 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOCWK03 DD SPACE=(CYL,(1,5)),UNIT=3390
//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//EQQWSDS  DD DSN=EID.EIDAR3.WS,DISP=SHR
//EQQLTDS  DD DSN=EID.EIDAR3.LT,DISP=SHR,
//            AMP=('BUFNI=10,BUFND=10')
//EQQLTBKP DD DSN=EID.EIDAR3.LB,DISP=SHR
//EQQLDDS  DD DSN=EID.EIDAR3.LD,DISP=SHR,
//            AMP=('BUFNI=10,BUFND=10')
//SYSIN    DD *
             0002
//* YYMMDD      DDDD        WHERE
//* YYMMDD                = EXTEND DATE OR BLANK
//*             DDDD      = PLAN EXTENSION IN DAYS
//*                           COUNTING ALL DAYS
//*                           OR BLANK
/*
```

EQQLTMOO - Modify the long-term plan for one application

The EQQLTMOO batch program modifies the long-term plan for one application.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The parameter is the application ID, beginning in column 1.

JCL example

```
//*********************************************************************
//* LONG TERM PLANNING - MODIFY ONE OCCURRENCE
//*********************************************************************
//LTMODONE EXEC PGM=EQQBATCH,PARM='EQQLTMOO',REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//LTREPORT DD SYSOUT=*,
//            DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//LTOCIN   DD DCB=(RECFM=FB,LRECL=751,BLKSIZE=4506),
//         SPACE=(4410,(2400,2400)),UNIT=3390
//EQQWSDS  DD DSN=EID.EIDAR3.WS,DISP=SHR
//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//EQQLTDS  DD DSN=EID.EIDAR3.LT,DISP=SHR
//SYSIN    DD *
APP4
//* = APPLICATIONID
//* APPLICATION ID = SELECTED APPLICATION
```

EQQLTPRT - Print the long-term plan

The EQQLTPRT batch program prints information on the long-term plan. The input parameters to the batch program support these print functions:

- Print the long-term plan for all applications.
- Print the long-term plan for one application.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The layout of the SYSIN DD statement is:

```
COLUMNS  1         2         3
12345678901234567890123456789012345678
YYMMDDHHMMyymmddhhmmRSxxxxxxxxxxxxxxxx
where:
YYMMDD = STARTDATE     HHMM = STARTTIME
yymmdd = ENDDATE       hhmm = ENDTIME
R = REPORTTYPE (F=FULL,D=DEPENDENCIES)
S = SORT ORDER (R = INPUT ARRIVAL DATE, O = OWNER ID AND INPUT
            ARRIVAL DATE, A = OWNER ID APPLICATION ID )
xxxxxxxxxxxxxxxx = APPLICATION ID, or 'ALL'
```

JCL example

```
//*********************************************************************
//* LONG TERM PLANNING - PRINT THE LONG TERM PLAN
//*********************************************************************
//LTPPRINT EXEC PGM=EQQBATCH,PARM='EQQLTPRT',REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCTEST.ESA131.SEQQMSG0
```

```
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//LTREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*

//LTOLIN   DD DCB=(RECFM=VBS,LRECL=32756,BLKSIZE=6220),
//         SPACE=(CYL,(1,5)),UNIT=3390
//LTOLOUT  DD DCB=(RECFM=VBS,LRECL=32756,BLKSIZE=6220),
//         SPACE=(CYL,(1,5)),UNIT=3390
//LTPRED3  DD DCB=(RECFM=FB,LRECL=100,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//LTPRIN   DD DCB=(RECFM=FB,LRECL=100,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//LTPROUT  DD DCB=(RECFM=FB,LRECL=100,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//LTOCIN   DD DCB=(RECFM=FB,LRECL=751,BLKSIZE=4506),
//         SPACE=(4410,(2400,2400)),UNIT=3390
//LTOCOUT  DD DCB=(RECFM=FB,LRECL=751,BLKSIZE=4506),
//         SPACE=(4410,(2400,2400)),UNIT=3390
//LTOLWK01 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOLWK02 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOLWK03 DD SPACE=(CYL,(1,5)),UNIT=3390

//LTPRWK01 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTPRWK02 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTPRWK03 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOCWK01 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOCWK02 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOCWK03 DD SPACE=(CYL,(1,5)),UNIT=3390

//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//EQQWSDS  DD DSN=EID.EIDAR3.WS,DISP=SHR
//EQQLTDS  DD DSN=EID.EIDAR3.LT,DISP=SHR
//EQQLDDS  DD DSN=EID.EIDAR3.LD,DISP=SHR,
//            AMP=('BUFNI=10,BUFND=10')
//SYSIN    DD *
9508030751951122240 0DRALL
//* = STARTDATE (YYMMDD)
//*   STARTTIME (HHMM)
//*   ENDDATE (YYMMDD)
//*   ENDTIME (HHMM)
//*   REPORTTYPE (F=FULL,D=DEPENDENCIES)
//*   SORT (R,O,A)
//*   ALL
/*
```

EQQLTTRY - Make a trial long-term plan

The EQQLTTRY batch program simulates an long-term plan create, extend, or modify all.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The layout of the SYSIN DD statement is as follows:

```
COLUMNS  1         2         3
12345678901234567890123456789 0
YYMMDDyymmdd                  (format 1)
YYMMDD      dddd              (format 2)
where:
```

```
  YYMMDD = plan start date, or blank
  yymmdd = plan end date             (format 1)
  dddd   = extension length, in days (format 2)
```

You can specify the following for a trial long-term plan:

Create Specify a start date and an end date to produce a trial create.

Extend
To produce a trial extend, either specify an extension length, or an end date that is later than the end of the current long-term plan but no start date.

Modify all
Do not specify a start date, end date, or extension length to produce a trial modify all.

JCL example

```
//*******************************************************************
//* LONG TERM PLANNING - PLAN A TRIAL PERIOD
//*******************************************************************
//LTPRYS   EXEC PGM=EQQBATCH,PARM='EQQLTTRY',REGION=4096K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCTEST.ESA131.SEQQMSG0
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//LTREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//LTOLIN   DD DCB=(RECFM=VB,LRECL=1000,BLKSIZE=6220),
//         SPACE=(CYL,(1,5)),UNIT=3390
//LTOLOUT  DD DCB=(RECFM=VB,LRECL=1000,BLKSIZE=6220),
//         SPACE=(CYL,(1,5)),UNIT=3390
//LTPRED3  DD DCB=(RECFM=FB,LRECL=100,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=3390
//LTPRIN   DD DCB=(RECFM=FB,LRECL=100,BLKSIZE=6300),
//         SPACE=(4620,(300,300)),UNIT=SYSDA
//LTPROUT  DD DCB=(RECFM=FB,LRECL=100,BLKSIZE=6300),
//         SPACE=(4550,(300,300)),UNIT=SYSDA
//LTOCIN   DD DCB=(RECFM=FB, LRECL=751, BLKSIZE=4506),
//         SPACE=(4410,(2400,2400)),UNIT=SYSDA
//LTOCOUT  DD DCB=(RECFM=FB, LRECL=751, BLKSIZE=4506),
//         SPACE=(4410,(2400,2400)),UNIT=SYSDA
//LTOLWK01 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOLWK02 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOLWK03 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTPRWK01 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTPRWK02 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTPRWK03 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOCWK01 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOCWK02 DD SPACE=(CYL,(1,5)),UNIT=3390
//LTOCWK03 DD SPACE=(CYL,(1,5)),UNIT=3390
//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//EQQWSDS  DD DSN=EID.EIDAR3.WS,DISP=SHR
//EQQLTDS  DD DSN=EID.EIDAR3.LT,DISP=SHR
//EQQLTBKP DD DSN=EID.EIDAR3.LB,DISP=SHR
//EQQLDDS  DD DSN=EID.EIDAR3.LD,DISP=SHR,
//            AMP=('BUFNI=10,BUFND=10')
//SYSIN DD *
           0003
//* YYMMDDYYMMDDDDDD        WHERE
```

```
//* YYMMDD               = NEW START DATE OR BLANK
//*       YYMMDD         = NEW END DATE OR BLANK
//*             DDDD     = PLAN EXTENSION IN DAYS
//*                        COUNTING ALL DAYS
//*                        OR BLANK
/*
```

EQQOIBAT - Print operator instructions

The EQQOIBAT batch program prints or removes the operator instructions from the operator instruction database. These print options can be selected:

- Print operator instructions in AD ID order.
- Purge old temporary operator instructions, up to the date specified.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The definition of the input parameters is:

```
COLUMNS  1         2         3
12345678901234567890123456789O
5                          format 1 - print in application order
7yymmdd                    format 4 - purge instructions
where:
  for format 4, instructions are purged if the valid-to date is
                less than yymmdd.
```

JCL example

```
//*********************************************************************
//* OPERATOR INSTRUCTIONS - BATCH PROGRAM
//*********************************************************************
//OIBAT    EXEC PGM=EQQBATCH,PARM='EQQOIBAT',REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//OIREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//OIWKIN   DD DCB=(LRECL=32756,BLKSIZE=32760,RECFM=VB),
//         SPACE=(CYL,(2,4)),UNIT=3390
//OIWKOUT  DD DCB=(LRECL=32756,BLKSIZE=32760,RECFM=VB),
//         SPACE=(CYL,(2,4)),UNIT=3390
//OIWKWK01 DD SPACE=(CYL,(1,4)),UNIT=3390
//OIWKWK02 DD SPACE=(CYL,(1,4)),UNIT=3390
//OIWKWK03 DD SPACE=(CYL,(1,4)),UNIT=3390
//EQQOIDS  DD DSN=EID.EIDAR3.OI,DISP=SHR
//SYSIN    DD *
5
/*
```

EQQOIBLK - Operator instructions: perform mass update

The EQQOIBLK batch program updates operator instructions in the operator instruction database. These mass update options are supported:

- Update using sequential input without replacing old operator instructions
- Update using sequential input and replace old operator instructions

If the subsystem is active, comment out the EQQOIDS ddname, and the program uses the program interface to update the instructions. If the subsystem is stopped,

include the EQQOIDS ddname, and the program uses VSAM I/O to update the database. The subsystem name is specified by the SUBSYS keyword of the BATCHOPT statement.

SYSIN requirements

The SYSIN data is normally supplied from the select panel; it is the input parameter to the batch program. The definition of the input parameters is:

```
8Y    (INSERT NEW, REPLACE OLD, OPERATOR INSTRUCTIONS)
8N    (INSERT NEW ONLY)
```

The EQQOPIN DD will reference the name of the selected sequential file. For a description of the contents of this file, see "Layout of the operator instruction data set."

JCL example

```
//*********************************************************************
//* OPERATOR INSTRUCTIONS - BATCH INPUT FROM A SEQ. data set
//* Note:
//* If output is to a stopped opc subsystem, change *QQOIDS to EQQOIDS
//*********************************************************************
//OIBLK    EXEC PGM=EQQBATCH,PARM='EQQOIBLK',REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.STAGE.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCSHIP.ESA131.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//OIREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//OIWKIN   DD DCB=(LRECL=32756,BLKSIZE=32760,RECFM=VB),
//         SPACE=(CYL,(2,4)),UNIT=3390
//OIWKOUT  DD DCB=(LRECL=32756,BLKSIZE=32760,RECFM=VB),
//         SPACE=(CYL,(2,4)),UNIT=3390
//OIWKWK01 DD SPACE=(CYL,(1,4)),UNIT=3390
//OIWKWK02 DD SPACE=(CYL,(1,4)),UNIT=3390
//OIWKWK03 DD SPACE=(CYL,(1,4)),UNIT=3390
//EQQADDS  DD DSN=EID.EIDAR3.AD,DISP=SHR
//*****************************************************
//* IF THE CONTROLLER IS STOPPED WHEN RUNNING THIS JOB,
//* CHANGE //*QQOIDS TO //EQQOIDS,
//*QQOIDS  DD DSN=EID.EIDAR3.OI,DISP=SHR
//*****************************************************
//EQQOPIN  DD DSN=XRAYNER.OPERATOR.MESSAGES,DISP=SHR
//SYSIN    DD *
8Y
/*
```

Layout of the operator instruction data set

Specify your operator instructions in the sequential data set defined by the EQQOPIN DD statement. The data set should consist of 80-byte records and be fixed blocked.

Each instruction has two parts:

- Header (a single record)
- Instruction (one or more records)

A header record must precede each operator instruction. Here is the format for the header:

```
OPC KEY=aaaaaaaaaaaaaaaannnttttttttttt,VALFROM=eeeeeeeeee
```

The characters OPC must be in columns 1 to 3. The variables have the following meaning:

aaaaaaaaaaaaaaaa
: Application ID. This is required and must be 16 characters (padded with blanks to the right, if necessary).

nnn
: A valid operation number. This is a required field.

ttttttttt
: Specifies when the operator instruction is valid to. This field is required if you specify a valid-from (VALFROM) date and time. Use the YYMMDDHHMM format. If both valid-to and valid-from dates and times are specified, the instruction is temporary. If both are blank, the instruction is considered permanent.

eeeeeeeee
: Specifies when the operator instruction is valid from. This field is required if you specify a valid-to date and time. Use the YYMMDDHHMM format. If both valid-from and valid-to dates and times are specified, the instruction is temporary. If both are blank, the instruction is considered permanent.

The keywords KEY and VALFROM can be in any order, but they must be separated by either blanks or a comma.

The operator instruction itself consists of 80-byte records following the instruction header. The first 72 positions contain the instruction text; the last 8 positions are ignored. A maximum of 443 records is allowed for any one instruction.

For example:

```
OPC KEY=APPLICATIONABC  0059308311200,VALFROM=9308011200
If the job ends abnormally, it can be restarted from
the CPU_005 operation without any JCL changes.

OPC KEY=APPLICATIONXXX  015
If the job ends abnormally, it can be restarted
from the CPU_020 operation without changing the JCL.
```

You should include the name of the operator-instruction sequential-input data set on the SPECIFYING SEQUENTIAL FILE NAME panel. You can display this panel by selecting option 1.5.5.2 from the main menu.

EQQPURGE - Purge data lookaside facility object

The EQQPURGE batch program receives a data set name as input and purges the corresponding data lookaside facility (DLF) object by invoking the macro COFSDONO. Sample JCL is in the EQQPROC member of the samples library. See *Customization and Tuning* for more details.

SYSIN requirements

None.

JCL example

```
//EQQPROC EXEC PGM=EQQPURGE,PARM=
//*********************************************************************
//*  THIS PROCEDURE IS STARTED FROM OPC TO INITIATE PURGE
//*  PROCESSING OF DLF OBJECTS USED BY OPC JOBS.
```

```
//*  EQQPROC INVOKES PROGRAM EQQPURGE.
//*  PROGRAM EQQPURGE READS JCL FROM data set WITH DDNAME
//*  JCLIN AND UPDATES IT WITH THE NAME OF THE DLF OBJECT TO BE
//*  PURGED. WHEN THE JCL IS UPDATED EQQPURGE WRITES THE JCL TO
//*  JES INTERNAL READER.
//*  SAMPLE EQQJCLIN CONTAINS SAMPLE JCL FOR FILE JCLIN
//*
//*  JCLIN ORGANIZATION : PS (OR A PDS MEMBER)
//*        RECORD LENGTH: 80
//*
//*  TO GET THIS PROCEDURE TO WORK, YOU SHOULD DO THE FOLLOWING:
//*  1. CHANGE STEPLIB DSN TO THE IBM Workload Scheduler for z/OS
//*     LOAD LIBRARY NAME
//*  2. CHANGE JCLIN DSN TO data set NAME CONTAINING JCL
//*  3. EQQPROC MUST BE DEFINED AS A STARTED TASK ACCORDING TO
//*   DOCUMENTATION FOR THE SECURITY PRODUCT USED.
//*
//*  WHEN THE INPUT TO PROGRAM EQQPURGE IS INVALID, ONE OF THE FOLLOWING
//*  WTO'S IS WRITTEN TO THE OPERATOR CONSOLE:
//*    EQQPURGE : PARAMETER CARD SPECIFIES AN INVALID NAME
//*    EQQPURGE : ERROR OPENING FILE WITH DDNAME JCLIN
//*    EQQPURGE : INVALID JCLIN RECORD LENGTH, MUST BE 80
//*    EQQPURGE : ERROR OPENING INTERNAL READER
//*
//*********************************************************************
//STEPLIB   DD DISP=SHR,DSN=IBM Workload Scheduler for z/OS
//*  LOAD LIBRARY NAME
//JCLIN     DD DISP=SHR,DSN=INPUT JCL data set NAME
//JCLOUT    DD SYSOUT=(A,INTRDR)
//SYSPRINT  DD SYSOUT=*
```

EQQPURGE returns one of the following codes upon completion:

CC = 00:

Retained object found and deleted.

Explanation:

The DLF object has been purged from Hiperspace.

Action:

EQQPURGE terminates.

User response:

None.

CC = 02:

The object did not exist in DLF.

Explanation:

This is a return code from COFSDONO.

Action:

EQQPURGE terminates; no object is purged.

User response:

None.

CC = 04:

The data set name could not be located in catalog

Explanation:

The catalog locate for this data set name was unsuccessful.

Action:

EQQPURGE terminates; no object is purged.

User response:

data sets that are to be handled by IBM Workload Scheduler for z/OS Hiperbatch support must be cataloged, because the JCL invoking EQQPURGE is distributed to all systems where DLF is running, according

to routing information in the JCL. Expect this return code when EQQPURGE executes on a system where the DLF object does not exist.

CC = 08:
The data set name passed has an invalid length.
Explanation:
The data set name passed to EQQPURGE is either of length 0 or longer than 44 characters.
Action:
EQQPURGE terminates without further processing.
User response:
Verify that EQQPURGE was invoked with a valid IBM Workload Scheduler for z/OS resource name.

CC = 40:
DLF is not active.
Explanation:
EQQPURGE received return code 40 from the COFSDONO macro indicating that DLF is not active.
Action:
EQQPURGE terminates without further processing.
User response:
Start DLF if it should be active on this system, or update the file in EQQPROC with ddname JCLIN to avoid routing jobs to this system.

CC = 44:
Unexpected error in DLF.
Explanation:
EQQPURGE received return code 44 from the COFSDONO macro indicating that an unexpected error occurred in DLF when processing the purge request.
Action:
EQQPURGE terminates without further processing.
User response:
Contact your system programmer.

If EQQPURGE receives invalid input, one of the following WTOs is written to the operator console:
EQQPURGE:
Parameter card specifies an invalid name.
Explanation:
The object name passed to EQQPURGE is either of length 0 or longer than 44 characters.
Action:
The JCL from the JCLIN data set is neither substituted nor written to the internal reader.
User response:
Verify that EQQPROC has been started by IBM Workload Scheduler for z/OS.

EQQPURGE:
Error opening file with ddname JCLIN.
Explanation:
EQQPURGE could not open input file JCLIN.
Action:
EQQPURGE terminates.

User response:
Verify that the JCLIN statement is present in EQQPROC.

EQQPURGE:
Invalid JCLIN record length; must be 80.
Explanation:
The record length of the data set with ddname JCLIN is not 80.
Action:
EQQPURGE terminates; no JCL is processed.
User response:
Reallocate JCLIN with the correct record length.

EQQPURGE:
Error opening internal reader.
Explanation:
EQQPURGE could not open JES internal reader data set.
Action:
EQQPURGE terminates; no JCL is processed.
User response:
Verify that the JCLOUT statement is present and correctly specified in EQQPROC.

EQQSLTOP - File parse program, process parse statement

The EQQSLTOP batch program provides a syntactic check of the script library members. In the EQQSCLIB ddname, there can be allocated more than one script library. For every member with a problem, the parsing process issues a message explaining the problem found and the message EQQ4033I, indicating the script library where the failing member is defined. In this way, even if different members with the same name are defined in different script libraries allocated in the EQQSCLIB ddname, the members in error are located immediately. If all script libraries defined in the EQQSCLIB ddname are empty, the message EQQ4031W is displayed.

SYSIN requirements

You can customize the program as shown hereafter.

The following example shows that all members of script libraries allocated in the EQQSCLIB ddname are processed:

```
SYSIN DD*
PARSE
```

The following example shows that a specific member of the script libraries allocated in the EQQSCLIB ddname are processed:

```
SYSIN DD*
PARSE MEMBER (membername)
```

where *membername* is the name of the script library member to be processed. It can be long up to 8 characters, and one row can contain only one parse statement. Empty rows are allowed, all the rows are processed until the end of the SYSIN ddname.

JCL example

```
//*********************************************************************
//* FILE PARSE PROGRAM
//*********************************************************************
//PARSE    EXEC PGM=EQQBATCH,PARM='EQQSLTOP',REGION=4M
```

```
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQMLOG  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//SYSIN    DD *
//PARSE MEMBER (membername)
//PARSE MEMBER (....)
```

EQQWSPRT - Print all workstation descriptions

The EQQWSPRT batch program provides a printout of all workstation descriptions from the workstation description database.

SYSIN requirements

None.

JCL example

```
//*********************************************************************
//* PRINT WORK STATION DESCRIPTION
//*********************************************************************
//PRTWORK  EXEC PGM=EQQBATCH,PARM='EQQWSPRT',REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=OPCDEV.TEST.APFLIB
//EQQMLIB  DD DISP=SHR,DSN=OPCDEV.TEST.MSGS
//EQQPARM  DD DISP=SHR,DSN=EID.EIDA.PARM(EIDA)
//WSREPORT DD SYSOUT=*,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=6050)
//EQQMLOG  DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSMDUMP DD DISP=MOD,DSN=EID.EIDA.SYSDUMPB
//EQQDUMP  DD SYSOUT=*
//EQQDMSG  DD SYSOUT=*
//EQQWSDS  DD DSN=EID.EIDAR3.WS,DISP=SHR
//SYSIN    DD *
```

EQQYLTOP - Batch loader

The EQQYLTOP batch program lets you create or update information in the application-description or operator-instruction databases. For a complete description, including SYSIN requirements and JCL examples, see "What is the batch loader?" on page 207.

Sending generated reports by email

About this task

Reports generated by running batch programs can optionally be sent to other users by email. If you want to use this facility, perform the following steps:

1. On your computer, create a copy of the file `SENDREPORT.MAC`, available in the `C:\Send Report Macro` directory of the *TEP Int Filewatch Feat Agent* CD. Change the name, but keep the extension `.MAC`. You can create more than one copy of this file to suit your needs; each copy must have a different name.
2. Copy this file into the installation path of the Personal Communications tool; for example: `C:\Documents and Settings\Administrator\Application Data\IBM\Personal Communications`
3. Customize this file with all the following required parameters, as shown in the following example:

```
[PCOMM SCRIPT HEADER]
LANGUAGE=VBSCRIPT
DESCRIPTION=MAIL
[PCOMM SCRIPT SOURCE]
autECLSession.SetConnectionByName(ThisSessionName)


REM This line calls the macro subroutine
subSub1_

sub subSub1_()
   autECLSession.autECLOIA.WaitForAppAvailable

   autECLSession.autECLPS.SendKeys "[home]"

   ' uncomment the following line if you selected the option "Tab to action bar
   ' choices" in the ISPF Settings panel
   ' autECLSession.autECLPS.SendKeys "[newline]"

   autECLSession.autECLPS.SendKeys "start"
   autECLSession.autECLPS.SendKeys "[enter]"

   autECLSession.autECLPS.SendKeys "6"
   autECLSession.autECLPS.SendKeys "[enter]"

   autECLSession.autECLXfer.ReceiveFile "outputfile", "'zOSreport'", "ASCII
      CRLF NOCLEAR"

   autECLSession.autECLPS.SendKeys "swap"
   autECLSession.autECLPS.SendKeys "[enter]"

   Dim wsh
   Set wsh=CreateObject("WScript.Shell")
   wsh.Run "mailto:receiveremail" + "?Subject=emailsubject" + "&Body=emailtext"
        + "&attach=outputfile"  end sub
```

where:

outputfile
: Is the report file on your PC, for example, `C:\audit.txt`.

zOSreport
: Is the z/OS report you want to send, for example, `TWS.AUDIT.LIST`.

receiveremail
: Is the email address you want to send the report to, for example, `user@company.com`.

emailsubject
: Is the subject of your email, for example, `Automatically%20sent%20by%20zOS`.

emailtext
: Is your email body text, for example, `Received%20file%20from%20zOS%20and%20prepare%20the%20email%20with%20attachment`.

4. Send the report by using either the macro icon **Start a macro** in the Personal Communications toolbar or, from the **Actions** menu, by clicking **Start Playing Macro/Script...**

Attention:

- When customizing the parameters, you cannot insert spaces, but must use the `%20` sequence for every single space character, for example, `Automatically%20sent%20by%20zOS`.

- The `Command line at bottom` option of Personal Communications is not supported.

Appendix C. Report examples

This appendix provides examples of the following reports:
- Calendars
- Periods
- Workstation descriptions
- Application descriptions
- JCL variable tables
- Mass update
- Operator instructions
- Long-term plan
- Daily planning

A description of the batch programs and examples of the JCL are provided in the Appendix B, “Batch programs,” on page 755.

Note: On many reports, the year and month are not shown for the planned start, planned end, and latest out dates. Only the day number is shown. It is assumed that the year and month of these dates are the same as the current year and current month. However, in some cases a date in a preceding month or a following month has been calculated. This is indicated after the day number by a < for a preceding month or a > for a following month.

Calendar reports

```
ABCD COMPANY                                                    PAGE 0001
 REPORTS FROM SUBSYS EIDC                                       14 FEB 03
                                                                    09:41

                      P R I N T O U T   O F   T H E   C A L E N D A R
                      = = = = = = = = = = = = = = = = = = = = = = = = =
                                 GENERAL INFORMATION
                                 ==================
CALENDAR ID           :   DEFAULT
CALENDAR DESCRIPTION  :   Default calendar
WORK DAY END TIME     :   01.00
START DATE OF PRINTOUT:   03/02/14
END   DATE OF PRINTOUT:   03/12/31
LATEST USER UPDATE    :   03/02/13
UPDATED BY            :   KATARIN
DEFAULT STATUS        :   MONDAY   TUESDAY WEDNESDAY THURSDAY FRIDAY  SATURDAY  SUNDAY

                           WORK     WORK     WORK     WORK     WORK     FREE     FREE
```

Figure 330. Calendars - General information

```
ABCD COMPANY               PAGE 0002
 REPORTS FROM SUBSYS EIDC                                    14 FEB 03
                                                                 09:41

                           DESCRIPTION OF SPECIFIC DATES ENTERED TO THE CALENDAR
                           ====================================================

DATE       STATUS    COMMENTS
--------   ------    ------------------------------
03/04/14    FREE     Good Friday
03/12/24    FREE     Christmas Eve
03/12/25    FREE     Christmas Day
03/12/26    FREE     Boxing Day
04/01/01    FREE     New Year's Day
```

Figure 331. Calendars - Description of specific dates

```
ABCD COMPANY                                  PAGE 0003
 REPORTS FROM SUBSYS EIDC                                14 FEB 03

                    STATUS OF DAYS WITHIN THE PRINTOUT PERIOD
                    =========================================

MONTH    MONDAY       TUESDAY      WEDNESDAY    THURSDAY     FRIDAY       SATURDAY     SUNDAY
-----    ----------   ----------   ----------   ----------   ----------   ----------   ----------
02                    03/02/14 W   03/02/15 W   03/02/16 W   03/02/17 W   03/02/18 F   03/02/19 F
02       03/02/20 W   03/02/21 W   03/02/22 W   03/02/23 W   03/02/24 W   03/02/25 F   03/02/26 F
02/03    03/02/27 W   03/02/28 W   03/03/01 W   03/03/02 W   03/03/03 W   03/03/04 F   03/03/05 F
03       03/03/06 W   03/03/07 W   03/03/08 W   03/03/09 W   03/03/10 W   03/03/11 F   03/03/12 F
03       03/03/13 W   03/03/14 W   03/03/15 W   03/03/16 W   03/03/17 W   03/03/18 F   03/03/19 F
03       03/03/20 W   03/03/21 W   03/03/22 W   03/03/23 W   03/03/24 W   03/03/25 F   03/03/26 F
03/04    03/03/27 W   03/03/28 W   03/03/29 W   03/03/30 W   03/03/31 W   03/04/01 F   03/04/02 F
04       03/04/03 W   03/04/04 W   03/04/05 W   03/04/06 W   03/04/07 W   03/04/08 F   03/04/09 F
04       03/04/10 W   03/04/11 W   03/04/12 W   03/04/13 W   03/04/14 F   03/04/15 F   03/04/16 F
04       03/04/17 W   03/04/18 W   03/04/19 W   03/04/20 W   03/04/21 W   03/04/22 F   03/04/23 F
                        >>>>>>>  END OF CALENDAR PRINTOUT  <<<<<<<
```

Figure 332. Calendars - Status of days

Period reports

```
ABCD COMPANY                                          PAGE 0001
 REPORTS FROM SUBSYS EIDC                             14 FEB 03
                                                          08:43

                      P R I N T O U T   O F   T H E   P E R I O D S
                      = = = = = = = = = = = = = = = = = = = = = = =


                                 GENERAL INFORMATION
                                 ===================

START DATE OF PRINTOUT:   03/02/14
END   DATE OF PRINTOUT:   04/12/31
CALENDAR ID           :   DEFAULT
CALENDAR DESCRIPTION  :   Default calendar
```

Figure 333. Description of period characteristics - General information

```
ABCD COMPANY                                          PAGE 0002
 REPORTS FROM SUBSYS EIDC                             14 FEB 03
                                                          08:43

                              DESCRIPTION OF  PERIOD CHARACTERISTICS
                              ======================================

PERIOD   DESCRIPTION                    INTERVAL ORIGIN  INTERVAL END     INTERVAL ORIGIN  INTERV END
         JCL VARIABLE TABLE   TYPE      DATE     DDD DAY DATE     DDD DAY DATE     DDD DAY DATE   DDD DAY
-------- -------------------- ---------- ---------------- ---------------- ---------------- ------------

FIRSTTHU First Thu each month NONCYCLIC  03/01/05 005 THU                  03/02/02 033 THU
                                         03/03/02 061 THU                  03/04/06 096 THU
                                         03/05/04 124 THU                  03/06/01 152 THU
                                         03/07/06 187 THU                  03/08/03 215 THU
                                         03/09/07 250 THU                  03/10/05 278 THU
                                         03/11/02 306 THU                  03/12/07 341 THU
                                         04/01/04 004 THU                  04/02/01 032 THU
                                         04/03/07 067 THU                  04/04/07 098 SUN
                                         04/05/02 123 THU                  04/06/06 158 THU
                                         04/07/04 186 THU                  04/08/01 214 THU
                                         04/09/05 249 THU                  04/10/03 277 THU
                                         04/11/07 312 THU                  04/12/05 340 THU


FSTTHU7  First Thurs in July  NONCYCLIC  03/07/06 187 THU                  04/07/04 186 THU
                                         05/07/03 184 THU

                           >>>>>>>  END OF PERIOD PRINTOUT  <<<<<<<
```

Figure 334. Description of period characteristics

Workstation description reports

```
ABCD COMPANY                                              PAGE 0001
 REPORTS FOR SUBSYS EIDA                                  15 FEB 03
                                                              11:23

        P R I N T O U T   O F   W O R K   S T A T I O N   D E S C R I P T I O N S
        = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =

WORK STATION NAME   : CPU1                                  DEFAULTS
DESCRIPTION         : Main JES processor                     TRANSPORT TIME    : 00.00
                                                             DURATION          : 00.05
WORK STATION TYPE   : COMPUTER
REPORTING ATTRIBUTE : AUTO.
PRINTOUT ROUTING    : SYSPRINT                              RESOURCE 1
CONTROL ON SERVERS  : YES                                    NAME              : R1
                                                             PLANNING          : YES
OPTIONS             :                                        CONTROL           : NO
 SPLITTABLE         : NO
 JOB SETUP          : NO                                    RESOURCE 2
 DESTINATION        :                                        NAME              : R2
 STARTED TASK       : NO                                     PLANNING          : YES
 WTO                : NO                                     CONTROL           : NO
 WAIT               : NO
 LAST UPDATED BY    : XRAYNER    ON 94/04/29   AT 17.35
                      DAY/DATE      OPEN TIME      PARALLEL   RESOURCES  ALTERNATE DAY
                                    INTERVAL       SERVERS    R1   R2    WS
                      STA           00.00 - 24.00  99         99   99
                 >>>>>>>>>         END OF WORK STATION REPORT     <<<<<<<<
```

Figure 335. Workstation description report

```
ABCD COMPANY                                  PAGE 0008
 REPORTS FOR SUBSYS EIDA                        15:22

                             DESCRIPTION OF ALL WORK STATIONS CLOSED DATES
                             ============================================

DATE       COMMENTS                         WORK STATION CLOSED   LAST UPDATED
----       --------                         -------------------   ------------

03/09/16   Night shift operation only          08.00  -  24.00     ANDERSM   99/04/21  15.21
03/09/17   Night shift operation only          08.00  -  24.00     ANDERSM   99/04/21  15.21
03/10/15   Hardware upgrade shutdown           00.00  -  24.00     ANDERSM   99/04/21  15.21
```

Figure 336. All workstations closed report

Application description reports

```
ABCD COMPANY                                        PAGE 0001
 REPORTS FOR SUBSYS EIDA                            03 MAY 03
                                                        13:25

          P R I N T O U T   O F   A P P L I C A T I O N   D E S C R I P T I O N S
          = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =

REPORT TYPE: CROSS-REFERENCE OF JOBNAMES AND ACTIVE APPLICATIONS
================================================================

JOBNAME  APPL ID          VALID TO  OPERATION ID
-------- ---------------- --------  ---------------------------------------------
CICSA    CICSA            71/12/31  STC1_010
PAYBACKP PAYBACKP         71/12/31  CPU1_015 WTO1_030
PAYDAILY PAYDAILY         71/12/31  CPU1_020 SETP_010 WTO1_005
PAYMONTH PAYM1            71/12/31  CPU1_040
PAYMSLIP PAYM1            71/12/31  CPU1_050 PRT1_099
PAYQUERY PAYQUERY         71/12/31  CPU1_050
PAYRECOV PAYRECOV         71/12/31  CPU1_015
PAYTAXYR PAYTAXYR         71/12/31  CPU1_015
PAYTRANS PAYM2            71/12/31  CPU1_040
PAYWEEK  PAYW             71/12/31  CPU1_020
PAYWSLIP PAYW             71/12/31  CPU1_030 PAY1_095 PRT1_090

APPL ID          VALID TO JOBNAME   OPERATION ID
---------------- -------- --------- -------------------------------------------
CICSA            71/12/31 CICSA     STC1_010
PAYBACKP         71/12/31 PAYBACKP  CPU1_015 WTO1_030
PAYDAILY         71/12/31 PAYDAILY  CPU1_020 SETP_010 WTO1_005
PAYM1            71/12/31 PAYMONTH  CPU1_040
                          PAYMSLIP  CPU1_050 PRT1_099
PAYM2            71/12/31 PAYTRANS  CPU1_040
PAYQUERY         71/12/31 PAYQUERY  CPU1_050
PAYRECOV         71/12/31 PAYRECOV  CPU1_015
PAYTAXYR         71/12/31 PAYTAXYR  CPU1_015
PAYW             71/12/31 PAYWEEK   CPU1_020
                          PAYWSLIP  CPU1_030 PAY1_095 PRT1_090
                               >>>>>>> END OF APPLICATION DESCRIPTION PRINTOUT <<<<<<<
```

Figure 337. Cross-references of job names and active applications

```
ABCD COMPANY                                  PAGE 0001
 REPORTS FOR SUBSYS EIDA                                  03 MAY 03
                                                             13:32

         P R I N T O U T   O F   A P P L I C A T I O N   D E S C R I P T I O N S
        = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =

REPORT TYPE: CROSS-REFERENCE OF APPLICATIONS AND EXTERNAL DEPENDENCIES
======================================================================

APPL ID     S    OP ID    JOBNAME      PREDECESSORS                       S  SUCCESSORS
--------   ---   -------- --------     ---------------------------------- --- ----------
PAYBACKP    A    CPU1_015 PAYBACKP     PAYDAILY         CPU1_020 PAYDAILY
                                       PAYM1            CPU1_050 PAYMSLIP
                                       PAYM2            CPU1_040 PAYTRANS
                                       PAYTAXYR         CPU1_015 PAYTAXYR
PAYDAILY    A    CPU1_020 PAYDAILY                                        A  PAYBACKP  CPU1_015 PAYBACKP
                                                                         A  PAYM1     CPU1_040 PAYMONTH
                                                                         A  PAYW      CPU1_020 PAYWEEK
PAYM1       A    CPU1_040 PAYMONTH     PAYDAILY         CPU1_020 PAYDAILY
                                                                         A  PAYM2     CPU1_040 PAYTRANS
                 CPU1_050 PAYMSLIP                                       A  PAYBACKP  CPU1_015 PAYBACKP
PAYM2       A    CPU1_040 PAYTRANS     PAYM1            CPU1_040 PAYMONTH
                                       PAYW             CPU1_020 PAYWEEK
                                                                         A  PAYBACKP  CPU1_015 PAYBACKP
                                                                         A  PAYTAXYR  CPU1_015 PAYTAXYR
PAYTAXYR    A    CPU1_015 PAYTAXYR     PAYM2            CPU1_040 PAYTRANS
                                                                         A  PAYBACKP  CPU1_015 PAYBACKP
PAYW        A    CPU1_020 PAYWEEK      PAYDAILY         CPU1_020 PAYDAILY
                                                                         A  PAYM2     CPU1_040 PAYTRANS

                              >>>>>>> END OF APPLICATION DESCRIPTION PRINTOUT <<<<<<<
```

Figure 338. Cross-references of applications and external dependencies

```
ABCD COMPANY                                  PAGE 0001
 REPORTS FOR SUBSYS EIDA                                    11 JUN 03
                                                               16:50
      P R I N T O U T   O F   A P P L I C A T I O N   D E S C R I P T I O N S
      = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =

REPORT TYPE: DETAILED          SELECTION DATE: 03/05/11
====================           ========================
ABCD COMPANY                                   PAGE 0002
 REPORTS FOR SUBSYS EIDA                       11 JUN 03
                                                   16:50

APPL ID: PAYDAILY
=========================

                                                 COMMON DATA
                                                 ===========

APPL TEXT/                            CALENDAR ID/       TYPE        NUM. NUM.          GROUP DEFN
OWNER ID         OWNER DESCRIPTION    VALID FROM - TO    STATUS  PRI RUNC OPER GROUP ID LATEST UPD USR
---------------- -------------------  ------------------ ------- --- ---- ---- -------- ----
daily payroll jobs                                       APPL
SAMPLE           payroll application  03/01/29  71/12/31 ACTIVE    5    1    3          94/06/08 XRAYNER

                                       OFFSET-BASED RUN CYCLE INFORMATION
                                       ==================================

VALID    APPL     PERIOD   RC               INPUT           RC VALID         FREE DAY RUN CYCLE DESC
FROM     STATUS   NAME     TYPE   RUN DAYS  ARRIVE DEADLINE FROM     TO      RULE     JCL VAR TABLE
-------- -------- -------- ------ --------- ------ -------- -------- -------- -------- -------------
03/01/29 ACTIVE   DAILY    NORMAL  001      12.00    16.00 03/01/29 71/12/30 CANCEL
                                                                                          PAY
                           <REPEAT EVERY 00.10 FROM 19.11 UNTIL 21.00>
```

Figure 339. Application descriptions - Common data

Priority (PRI): 1=low, 8=high, 9=urgent

Run cycle type (RC TYPE): normal (times and days when run) or negative (times and days when not to run).

```
ABCD COMPANY                                          PAGE 0003
 REPORTS FOR SUBSYS EIDA                              11 JUN 03
                                                         16:50

APPL ID: PAYDAILY            VALID FROM: 03/01/29    STATUS: ACTIVE
=========================    ====================    ================

                                              OPERATION DATA
                                              ==============

OPERATION                              NUMBER   SPC     SMOOTH          CLASS & MVS OPTIONS      EXPECT
NAME NO  TEXT                   DUR    PS R1 R2 RES HRC FAC LIM JOBNAME FORM   A H T S E D R R C ARR DEAD
-------- ---------------------- -----  -------- --- --- ------- ------- ------ ---------------- -----
WTO1_005 PAYX CLOSE DATASET     00.01  1  0  0   1             PAYDAILY        Y Y Y N Y N     N
                                                 PAYROLL.DATABASE 1 X
SETP_010 Job setup for paydaily 00.03  1  0  0   1             PAYDAILY        Y Y N N Y N     N
                                                 PAYROLL.DATABASE 1 X
CPU1_020 Runs pay04 and pay06   00.05  1  0  0   0             PAYDAILY        Y Y N N Y N
```

Figure 340. Application descriptions - Operation data

NUMBER PS
Number of parallel servers required by the operation.

NUMBER R1
Number of R1 workstation resources required by the operation.
NUMBER R2
Number of R2 workstation resources required by the operation.
DUR Estimated duration of the operation at the workstation.
SPC RES
Number of special resources allocated by the operation. If present, the names will appear on following lines with the usage indicator S for shared or X for exclusive.
HRC Highest return code that is to be treated as NOT ended-in-error.

MVS OPTIONS
A Automatic submit, Y or N
H Hold/release, Y or N
T Time dependent operation, Y or N
S Suppress time job if late, Y or N
E Error tracking, Y or N
D Deadline WTO, Y or N
R Restartable operation, Y, N or blank=default
R Reroutable operation, Y, N or blank=default
C Clean up type, A=automatic, I=immediate, or N=none

```
  INTERNAL OPERATION LOGIC
 ========================

                                        TRSP  INT &  EXT                INTERNAL
LTP PRINT   REASON FOR DEPENDENCY       TIME  PREDECESSOR               OPERATION SUCCESSOR
---------   --------------------------- ----- ------------------------- --------- ---------
                                                                        WTO1_005  SETP_010
                                                                WTO1_005  SETP_010  CPU1_020
                                                                SETP_010  CPU1_020

                                                                          PAYDAILY  PAYDAILY
                                                                PAYDAILY  PAYDAILY  PAYDAILY
                                                                          PAYDAILY  PAYDAILY
```

Figure 341. Application descriptions - Internal operation Logic

```
ABCD COMPANY                                                    PAGE 0001
 REPORTS FOR SUBSYS EIDA                                        11 JUN 03
                                                                   17:02
      P R I N T O U T   O F   A P P L I C A T I O N   D E S C R I P T I O N S
      = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =

REPORT TYPE: OPERATIONS USING PARTICULAR WORKSTATIONS
=====================================================
WORKSTATION: CPU1
=================
                           NUMBER    SPEC.RESOURCE                      VALID      VALID
OPER ID  OPERATION TEXT    PS R1 R2    NO / NAME     DUR    APPL ID     FROM       TO         STATUS
-------- ----------------  --------  -------------   -----  ---------   --------   --------   -------
CPU1_050 job1 in app1       1  0  0      2           00.05  APP1        03/03/03   71/12/31   ACTIVE
                                          MAWS * S
                                          MAWS2 * S
CPU1_050 job 2              1  0  0      0           00.05  APP2        03/03/03   71/12/31   ACTIVE
CPU1_050                    1  0  0      0           00.05  APP3        03/03/03   71/12/31   ACTIVE
CPU1_015 job1 in app1       1  0  0      2           00.05  APP5        03/05/05   71/12/31   ACTIVE
                                          MAWS * S
                                          MAWS2 * S
CPU1_015                    1  0  0      0           00.03  APP6        03/05/06   71/12/31   ACTIVE
CPU1_050                    1  0  0      0           03.00  CP          03/03/08   71/12/31   ACTIVE
CPU1_015                    1  0  0      0           00.05  JOB8        03/01/29   71/12/31   ACTIVE
CPU1_050                    1  0  0      0           03.00  LTP         03/03/09   71/12/31   ACTIVE
CPU1_010                    1  0  0      0           00.01  MAWS        03/04/28   71/12/31   ACTIVE
CPU1_010                    1  0  0      0           00.01  MEME        03/05/05   71/12/31   ACTIVE
CPU1_010                    1  0  0      3           00.01  MEMEWEEK    03/05/08   71/12/31   ACTIVE
                                          MAWS 6 X Y
                                          MAWS2 6 X Y
                                          A REALLY REALLY LONG RESOURCE NAME IS HERE * S
CPU1_015                    1  0  0      2           00.05  MEME66      03/01/28   71/12/31   ACTIVE
                                          PAYROLL.DATABASE 5 S
                                          PAYROLL.DATABASE.TWO * S N
CPU1_015 Daily payroll backup 1  0  0      2           00.05  PAYBACKP    03/01/28   71/12/31   ACTIVE
                                          PAYROLL.DATABASE 1S
                                          TAPES
CPU1_020 Runs pay04 and pay06 1  0  0      0           00.05  PAYDAILY    03/01/28   71/12/31   ACTIVE
CPU1_040 Monthly payroll job  1  0  0      1           00.05  PAYM1       03/01/29   71/12/31   ACTIVE
                                                 PAYROLL.DATABASE 1X
CPU1_050 Print mnthly payslip 1  0  0      0           00.05  PAYM1       03/01/29   71/12/31   ACTIVE
CPU1_040 Create bank girotape 1  0  0      1           00.10  PAYM2       03/01/29   71/12/31   ACTIVE
                                          TAPES 1X
CPU1_050 Run as required    1  0  0      1           00.05  PAYQUERY    03/02/02   71/12/31   ACTIVE
                                                PAYROLL.DATABASE 1S
CPU1_015 Recover payroll db 1  0  0      2           00.05  PAYRECOV    03/01/28   71/12/31   ACTIVE
                                          PAYROLL.DATABASE 1X
                                          TAPES 1X
CPU1_015 Third Thurs in July  1  0  0      1           00.05  PAYTAXYR    03/01/28   71/12/31   ACTIVE
                                          PAYROLL.DATABASE 1X
CPU1_020 pay07, pay10, pay16  1  0  0      1           00.05  PAYW        03/01/28   71/12/31   ACTIVE
                                          PAYROLL.DATABASE 1X
CPU1_030 pay14, pay15       1  0  0      0           00.05  PAYW        03/01/28   71/12/31   ACTIVE
CPU1_030                    1  0  0      1           00.20  TEST3       03/05/01   71/12/31   ACTIVE
                                          PAYROLL.DATABASE 1X
                        >>>>>>> END OF APPLICATION DESCRIPTION PRINTOUT <<<<<<<
```

Figure 342. Application descriptions - Operations using particular work stations

NUMBER: PS = parallel servers; R1, R2 = workstation resources 1 and 2

DUR: Duration

The special resource name is followed by the quantity and whether it is exclusive (X) or shared (S). A quantity of * means ALL.

```
ABCD COMPANY                                              PAGE 0001
 REPORTS FOR SUBSYS EIDA                            05 MAY 03
                                                        08:18

       P R I N T O U T   O F   A P P L I C A T I O N   D E S C R I P T I O N S
       = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =

REPORT TYPE: CROSS-REFERENCE LIST
=================================

JOB NAME APPL ID          VAL.TO   SPEC. RES.                                 OPR.ID   CALENDAR ID
-------- ---------------- -------- ------------------------------------------ -------- -----------

         GPAYM            71/12/31
         GPAYW            71/12/31
CICSA    CICSA            71/12/31                                            STC1_010
JOB1     APP1             71/12/31                                            CPU1_050 DEFAULT
JOB2     APP2             71/12/31                                            SETP_020 DEFAULT
                                                                              CPU1_050 DEFAULT
JOB3     APP3             71/12/31                                            CPU1_050 DEFAULT
MAWS     MAWS             71/12/31                                            CPU1_010
PAYBACKP PAYBACKP         71/12/31                                            WTO1_030
                                    PAYROLL.DATABASE                          CPU1_015
                                    TAPES                                     CPU1_015
PAYDAILY PAYDAILY         71/12/31 PAYROLL.DATABASE                          WTO1_005
                                                                              SETP_010
                                                                              CPU1_020
PAYMONTH PAYM1            71/12/31 PAYROLL.DATABASE                          CPU1_040
PAYMSLIP PAYM1            71/12/31                                            CPU1_050
                                                                              PRT1_099
PAYQUERY PAYQUERY         71/12/31 PAYROLL.DATABASE                          CPU1_050 DEFAULT
PAYRECOV PAYRECOV         71/12/31 PAYROLL.DATABASE                          CPU1_015
                                    TAPES                                     CPU1_015
PAYTAXYR PAYTAXYR         71/12/31 PAYROLL.DATABASE                          CPU1_015
PAYTRANS PAYM2            71/12/31 TAPES                                     CPU1_040
PAYWEEK  PAYW             71/12/31 PAYROLL.DATABASE                          CPU1_020
PAYWSLIP PAYW             71/12/31                                            CPU1_030
                                                                              PRT1_090
                                                                              PAY1_095
                              >>>>>>> END OF APPLICATION DESCRIPTION PRINTOUT <<<<<<<
```

Figure 343. Application descriptions - Cross-reference

Run the EQQAXR00 program to produce the cross-reference list, selecting up to five fields for the sort sequence. Using the AD DATABASE panel, select 6 (XRF OF ITEMS) from the PRINTING APPLICATIONS panel.

JCL variable table report

```
ABCD COMPANY                                                          PAGE 0001
 REPORTS FOR SUBSYS EIDA                                              03 MAY 03
                                                                          17:48
          PRINTOUT OF JCL VARIABLES
          =========================
JCL VARIABLE TABLE ID : PAY               OWNERID : SAMPLE
VARIABLE NAME
DEPT       DESCRIPTION    :
           DEFAULT VALUE  : EXTRA
           UPPER CASE     : N
           SETUP          : N
           SUBSTITUTION
           EXIT           :
           VALUE REQUIRED : N
           DEFAULT POS    : 00
           DIALOG TEXT    :



           VALIDATION CRITERIA
           -------------------
           VERIFICATION TYPE   :
           VARIABLE LENGTH     : 00
           NUMERIC             :
           COMPARISON OPER     :
           VALIDATION PATTERN  :
           VALID RANGES/VALUES :

           VARIABLE DEPENDENCIES
           ---------------------
INDEPEND.                                          SETS CURRENT VARIABLE
VARIABLE   VALUE                                   TO
           NONE
```

Figure 344. JCL variable table report

Mass update reports

```
ABCD COMPANY                                                    PAGE 0001
 REPORTS FOR SUBSYS EIDA                                        02 AUG 01
                                                                    13:22

   P R I N T O U T   O F   A P P L I C A T I O N   D E S C R I P T I O N   M A S S   U P D A T E
   = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
EXPLANATION OF CONTENTS OF 'UPDATED FIELD' USED IN THE REPORT
     A. COMMON FIELDS                                  B. RUNCYCLE DEFINITION FIELDS
     A -  1: APPLICATION TEXT                          B -  1: RUNCYCLE TEXT
     A -  2: OWNER ID                                  B -  2: PERIOD NAME/RULE NAME
     A -  3: OWNER TEXT                                B -  3: INPUT ARRIVAL TIME
     A -  4: PRIORITY                                  B -  4: DEADLINE DAY
     A -  5: AUTHORITY GROUP ID                        B -  5: DEADLINE TIME
     A -  6: CALENDAR ID                               B -  6: FREE DAY RULE
     A -  7: APPLICATION GROUP ID                      B -  7: IN EFFECT FROM
                                                       B -  8: OUT OF EFFECT FROM
                                                       B -  9: VARIABLE TABLE
                                                       B - 10: RULE NAME
                                                       B - 11: REPEAT EVERY
                                                       B - 12: REPEAT END TIME
     C. OPERATION DATA FIELDS
     C -  1: OPERATION TEXT                            C - 13: AUTOMATIC RELEASE
     C -  2: WORKSTATION NAME                          C - 14: TIME DEPENDENT
     C -  3: DURATION                                  C - 15: SUPPRESS IF LATE
     C -  4: NUMBER OF SERVERS                         C - 16: FORM NUMBER
     C -  5: WORK STATION RESOURCE 1                   C - 17: SYSOUT CLASS
     C -  6: WORK STATION RESOURCE 2                   C - 18: SMOOTHING FACTOR
     C -  7: SPECIAL RESOURCE NAME                     C - 19: FEEDBACK LIMIT
     C -  8: JOB NAME                                  C - 20: INPUT ARRIVAL DAY
     C -  9: JOB CLASS                                 C - 21: INPUT ARRIVAL TIME
     C - 10: AUTOMATIC ERROR TRACKING                  C - 22: DEADLINE DAY
     C - 11: HIGHEST RETURN CODE                       C - 23: DEADLINE TIME
     C - 12: SUBMIT                                    C - 24: DEADLINE WTO
                                                       C - 25: RESTARTABLE
                                                       C - 26: REROUTEABLE
                                                       C - 27: CLEAN UP TYPE
                                                       C - 28: USER SYSOUT
                                                       C - 29: EXPANDED JCL
                                                       C - 30: EXTERNAL MONITOR
                                                       C - 31: CENTRALIZED SCRIPT
                                                       C - 32: USE EXTENDED JOB NAME
                                                       C - 33: EXTENDED JOB NAME
    D. INTERNAL PREDECESSOR FIELDS                    E. EXTERNAL PREDECESSOR FIELDS
    D -  1: PREDECESSOR OP NUMBER                     E -  1: PREDECESSOR APPLICATION ID
    D -  2: PREDECESSOR WS NAME                       E -  2: PREDECESSOR OP NUMBER
    D -  3: TRANSPORT TIME                            E -  3: PREDECESSOR WS NAME
                                                      E -  4: TRANSPORT TIME
                                                      E -  5: EXTERNAL DEPENDENCY TEXT
```

Figure 345. Mass update report - Application descriptions

```
ABCD COMPANY                                                    PAGE 0003
 REPORTS FOR SUBSYS EIDA                                 02 AUG 01
                                                             13:22
UPDATED FIELD: C -27                                                 USER: XRAYNER
==============================                                       =============
UPDATE PERFORMED FOR OWNER ID: SAMPLE      , WORKSTATION NAME: CPU1
=========================================================================
APPL ID          STATUS   VALID TO OP ID    COMMENT          O L D / N E W   V A L U E S
---------------- -------- -------- -------- ---------------- --------------------------
PAYDAILY         ACTIVE   71/12/31 CPU1_020                  OLD:N                        NEW:M
PAYM1            ACTIVE   71/12/31 CPU1_040                  OLD:N                        NEW:M
                                   CPU1_050                  OLD:N                        NEW:M
PAYM2            ACTIVE   71/12/31 CPU1_040                  OLD:N                        NEW:M
PAYTAXYR         ACTIVE   71/12/31 CPU1_015                  OLD:N                        NEW:M
TEST3            ACTIVE   71/12/31 CPU1_030                  OLD:N                        NEW:M
                            >>>>>>> END OF APPLICATION DESCRIPTION MASS UPDATE <<<<<<<
```

Figure 346. Mass update report - Cleanup type updated

Operator instructions reports

```
ABCD COMPANY                                                          PAGE 0001
 REPORTS FOR SUBSYS EIDA                                              03 MAY 03
                                                                         16:56
      P R I N T O U T   O F   O P E R A T O R   I N S T R U C T I O N S
      = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
                                 GENERAL INFORMATION
                                 ===================
REPORT PRODUCED BY              : PRINT OPERATOR INSTRUCTIONS IN AD ORDER
DATE OF REPORT                  : 03/05/03

--------------------------------------------------------------------------------
APPL ID           OP     VALID FROM      VALID TO     WSID |       LAST UPDATE
                  NO                                       |  DATE    TIME    USER
---------------  ---  --------------  -------------- ---- | -------- -----  --------
PAYBACKP          015                 71/12/31 24.00 CPU1 | 03/02/01 09.13  XRAYNER
--------------------------------------------------------------------------------
                    I N S T R U C T I O N   T E X T
--------------------------------------------------------------------------------

THE DAILY BACKUP FOR THE PAYROLL DATABASE.                      00000100
RUN THIS JOB AFTER ALL THE PAYROLL JOBS (DAILY,                 00000200
WEEKLY, MONTHLY, OR YEARLY) THAT ARE SCHEDULED                  00000300
ON THE DAY.                                                     00000400
WHEN THE JOB FINISHES, OPC/ESA SENDS A MESSAGE                  00000500
TO OPEN THE CICSA PAYROLL DATASETS.                             00000600
--------------------------------------------------------------------------------
APPL ID           OP     VALID FROM      VALID TO     WSID |       LAST UPDATE
                  NO                                       |  DATE    TIME    USER
---------------  ---  --------------  -------------- ---- | -------- -----  --------
PAYDAILY          010                 71/12/31 24.00 SETP | 03/01/30 18.36  XRAYNER
--------------------------------------------------------------------------------
                    I N S T R U C T I O N   T E X T
--------------------------------------------------------------------------------
THIS JOB CAN RUN ONLY WHEN THE RESOURCE 'PAYROLL.DATABASE'      00000100
IS FREED BY CICSA.                                              00000200
TO DO THIS, RUN THE CICS TRANSACTION PAYC.                      00000300
--------------------------------------------------------------------------------
APPL ID           OP     VALID FROM      VALID TO     WSID |       LAST UPDATE
                  NO                                       |  DATE    TIME    USER
---------------  ---  --------------  -------------- ---- | -------- -----  --------
PAYDAILY          020                 71/12/31 24.00 CPU1 | 03/01/30 18.43  XRAYNER
--------------------------------------------------------------------------------
                    I N S T R U C T I O N   T E X T
--------------------------------------------------------------------------------
THIS JOB CAN RUN ONLY WHEN THE CICSA DATABASE                   00000100
IS CLOSED. CLOSE IT WITH THE PAYC TRANSACTION.                  00000200
THE JOB RUNS TWO PROGRAMS:                                      00000300
 PAY04 TRANSFERS PAYROLL TRANSACTIONS FROM THE                  00000400
     CICSA DATABASE TO A SEQUENTIAL DATASET.                    00000500
 PAY06 VALIDATES THE TRANSACTIONS AND UPDATES                   00000600
     THE PAYROLL DATABASE IF THERE ARE NO ERRORS.               00000700
RECOVERY PROCEDURE                                              00000800
==================                                              00000900
IF PAY04 FAILS, THE JOB CAN BE RERUN.                           00001000
IF PAY06 FAILS BEFORE THE DATABASE HAS BEEN UPDATED (RC=4),     00001100
YOU CAN RERUN THE JOB AFTER PAYROLL HAVE CORRECTED THE DATA.    00001200
IF PAY06 HAS UPDATED THE DATABASE, YOU MUST RUN THE             00001300
PAYRECOV JOB BEFORE RERUNNING THIS JOB.                         00001400
```

Figure 347. Operator instructions report

Long-term plan reports

```
ABCD COMPANY                                                        PAGE 0001
 REPORTS FOR SUBSYS EIDA                                            03 MAY 08
                                                                        18:51

           P R I N T O U T   O F   L O N G   T E R M   P L A N
           = = = = = = = = = = = = = = = = = = = = = = = = = = =

                                GENERAL INFORMATION
                                ===================

REPORT PRODUCED BY              : TRIAL EXTEND LONG TERM PLAN
REPORT TYPE                     : FULL / NORMAL
LATEST USER UPDATE              : 08/05/03
NEXT DAILY PLAN PERIOD END      : 08/05/04 20.00
THE CURRENT LTP COVERS PERIOD   : 08/03/04 TO 08/06/26
PRINTOUT IS FOR PERIOD          : 08/04/28 00.00 TO 08/07/01 24.00
PRINTOUT IS FOR APPLICATION(S)  : ALL
SORT ORDER OF PRINTOUT          : RUN DATE / INPUT ARRIVAL TIME / APPL ID
```

Figure 348. Long-term plan report - General information, heading page

The following data appears on the heading page:

Data Explanation

Report produced by
Long-term report function used to produce report

Report type
FULL or DEPENDENCIES/NORMAL or TEMPORARY

Latest user update
Date when long-term plan was last updated

The LTP covers period
Start day and end day selected in long-term plan panel

Printout is for period
Start of first occurrence to end of last occurrence in plan

Printout is for application(s)
ALL, or an application ID

Sort order of printout
Requested or default sort order

```
ABCD COMPANY                                                    PAGE 0002
 REPORTS FOR SUBSYS EIDA                                        03 MAY 08
                                                                    18:51

                              LONG TERM PLAN FOR DATE: 08/05/02
                              =================================

-------------------------------------------------------------------------------------------------
APPL ID     INPUT                P| APPL/OPERATION TEXT     |DEPEND. |DEPENDING OCCURRENCES:
OWN IDOP ID ARR   DEADLINE       I|+ LTP COMMENT+ VAR TABLE |OP ID   |TYPE APPL ID OP ID    INPUT ARR
----------- ----- -------------- -|-------------------------|--------|-------------------------

CP                                |                         |        |
SAMPLE3     12.00          16.00 7| current plan            |CPU1_050|P    LTP CPU1_050          12.00
                                  |                         |        |
LTP                               |                         |        |
SAMPLE3     12.00          15.00 7| long-term-plan          |        |S    CP                    12.00
                                  |                         |        |S    CP           08/05/03 12.00
                                  |                         |        |S    CP           08/05/04 12.00
                                  |                         |CPU1_050|S    CP  CPU1_050 08/05/05 12.00
                                  |                         |CPU1_050|S    CP  CPU1_050 08/05/08 12.00
                                  |                         |CPU1_050|S    CP  CPU1_050 08/05/09 12.00
:                                 |                         |        |
                                  |                         |        |
PAYBACKP                          |                         |        |
SAMPLE      12.00 08/05/03 06.00 5| backup payroll database |CPU1_015|PRED PAYDAILYCPU1_020      12.00
                                  |                         |        | wait for the daily job and
                                  |                         |        | other payroll jobs
                                  |+PAY                     |        |
                                  |                         |        |
PAYDAILY                          |                         |        |
SAMPLE      12.00          16.00 5| daily payroll jobs      |        |SUCC PAYBACKP              12.00
                                  |+PAY                     |        |
```

Figure 349. Long-term plan report for applications, sorted by run date

```
ABCD COMPANY                                                    PAGE 0002
 REPORTS FOR SUBSYS EIDA                                        03 MAY 08
                                                                    19:32

                              LONG TERM PLAN FOR OWNER: SAMPLE
                              ========================================
-------------------------------------------------------------------------------------------
APPL ID/OP ID                P| APPL/OPERATION TEXT     |DEPEND. |DEPENDING OCCURRENCES:
INPUT ARRIVAL  DEADLINE      I|+ LTP COMMENT             |OP ID   |TYPE APPL ID  OP ID    INPUT ARR
----------     -------------- -|-------------------------|--------|----------------------
                                |                         |        |
PAYBACKP                        |                         |        |
08/05/04 12.00 08/05/05 06.00 5| backup payroll database |CPU1_015|P  PAYDAILY CPU1_020 08/05/04 12.00
                                |                         |        |   wait for the daily job and
                                |                         |        |   other payroll jobs
                                |                         |        |
                                |                         |        |
PAYDAILY                        |                         |        |
/05/04 12.00 08/05/04 16.00 5| daily payroll jobs      |CPU1_020|S    PAYBACKP CPU1_015 08/05/04 12.00
                                |                         |        |
                                |                         |        |
PAYBACKP                        |                         |        |
08/05/05 12.00 08/05/06 06.00 5| backup payroll database |CPU1_015|P  PAYDAILY CPU1_020 08/05/05 12.00
                                |                         |        |   wait for the daily job and
                                |                         |        |   other payroll jobs
                                |                         |        |
                                |                         |        |
PAYDAILY                        |                         |        |
08/05/05 12.00 08/05/05 16.00 5| daily payroll jobs      |CPU1_020|S  PAYBACKP CPU1_015 08/05/05 12.00
                                |                         |CPU1_020|S  PAYW     CPU1_020 08/05/05 12.00
                                |                         |        |
                                |                         |        |
                           >>>>>>>  END OF LONG TERM PLAN PRINTOUT  <<<<<<<
```

Figure 350. Long-term plan report for applications, sorted by owner

This data appears on an long-term plan full report:

Data Explanation

Appl ID
Application ID of the occurrence

Owner ID/op ID
Application owner ID and the operation ID of any operations that have changed operation date on the long-term plan file

Input arr
Application input arrival time

Deadline
Application deadline date and time

PI Application priority

Appl/operation text
Application or operation text

+ LTP Comment
Comments generated from IBM Workload Scheduler for z/OS

+ Var table
Variable tables

Depend. op ID
ID of operation with external dependency

Depending occurrences
All external predecessors and successors listed (for reports on only one application, external dependencies not listed)

Type P (non-conditional predecessor), S (non-conditional successor), PC (conditional predecessor), or SC (conditional successor)

Appl ID
Application ID of dependent occurrence

Op ID, input arrival
ID of dependent operation occurrence input interval

```
TOTAL DURATION PER WORKSTATION
      ==============================

                                    NO OF
                          WS    DURATION  OPS
                          ----  --------  -----
                          CPU1      6.10      4
                          SETP      0.03      1
                          WTO1      0.02      2
```

Figure 351. Long-term plan report - Total duration per workstation

Data Explanation

Total duration per workstation
Lists all workstations used

WS, duration and no of ops
Workstation name, total time of all operations at the workstation, number of operations at the workstation

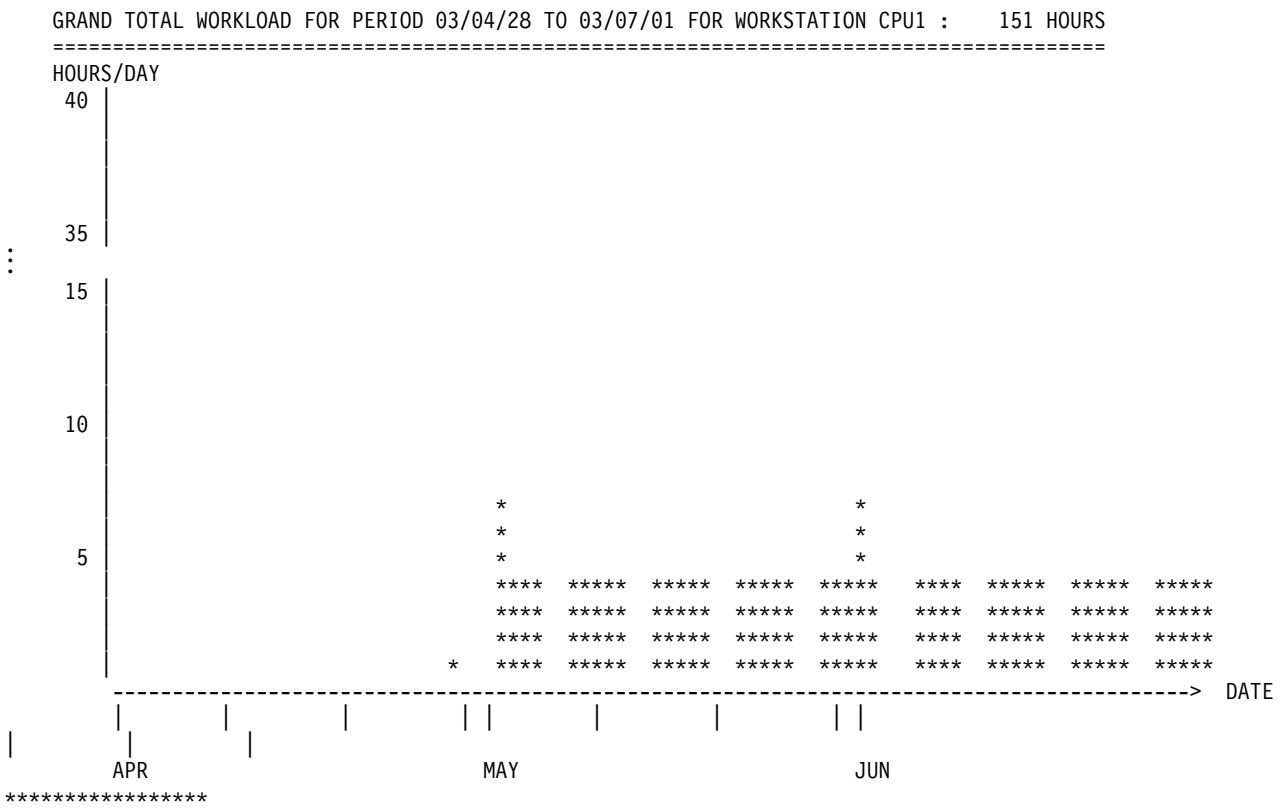


Figure 352. Long-term plan report - Grand total workload for period

Daily planning reports

```
ABCD COMPANY                                                PAGE 0001
 REPORTS FOR SUBSYS EIDA                                    06 MAY 08
                                                                12:33

              P R I N T O U T   O F   D A I L Y   P L A N
              = = = = = = = = = = = = = = = = = = = = = =

                                 GENERAL INFORMATION

REQUESTED PLANNING PERIOD               : 08/05/06 09.06 - 08/05/06 24.00
PLAN COVERS                             : 08/05/06 09.06 - 08/05/13 24.00
TYPE OF PLANNING                        : PLAN NEXT PERIOD

LONG TERM PLAN USED                     : 08/05/04
OLD CURRENT PLAN USED                   : NO
NEW CURRENT PLAN CREATED                : YES

WORKSTATION SUMMARY                     : YES
DAILY OPERATING PLAN                    : YES
WORKSTATION PLANS                       : YES
INPUT ARRIVAL LISTS                     : YES
NON-REPORTING WORKSTATION PLANS ONLY    : YES
CURRENT PERIOD RESULTS                  : NO
PREVIOUS PERIOD RESULTS                 : NO
MISSED FEEDBACK REPORT                  : YES
PLANNED RESOURCE UTILIZATION            : YES
ACTUAL RESOURCE UTILIZATION             : YES
CRITICAL PATH                           : NO

NUMBER OF PLANNED APPLICATIONS          :     3
NUMBER OF PLANNED OPERATIONS            :     6

NUMBER OF MESSAGES - ERROR              :     0
                   - WARNING            :     0
                   - INFORMATION        :     0
```

Figure 353. Daily planning reports - General information

The following data appears on the general information page:

Data Explanation

Requested planning period
Start and end times as specified in panel.

Plan covers
Start time is the time the latest backup of the current plan was taken; end time is the end of the tail-end period. If no current plan exists, start time is the earliest input arrival time.

Type of planning
Name of daily planning function used to produce this set of plans.

Long-term plan used
Time the long-term plan was last updated; appears only if the long-term plan was used as input to this daily planning run.

Old current plan used
Time the last current plan backup was taken; appears only if the current plan was used in this planning run.

New current plan created
YES if new current plan created; NO if no plan was created.

Workstation summary
Report produced, YES or NO.

Daily operating plan
Report produced, YES or NO.

Workstation plans
Report produced, YES or NO.

Input arrival lists
Report produced, YES or NO.

Nonreporting workstation plans only
Report produced, YES or NO.

Current period results
Start and end time for period covered; NO if no report produced.

Previous period results
Start and end time for period covered; NO if no report produced.

Missed feedback report
Report produced, YES or NO.

Planned resource utilization
Report produced, YES or NO.

Actual resource utilization
Report produced, YES or NO.

Critical path
Report produced, YES or NO.

Number of planned applications
Number of occurrences in daily plan.

Number of planned operations
Number of operations in daily plan.

Number of messages
Number of error, warning, and information messages.

```
                DAILY OPERATING PLAN  (080530   08.44 - 080531   08.44)
                ======================================================

-------------------------------------------------------------------------------------------
APPLICATION ID          |                        |                      |                  |    |    |
 APPLICATION OWNER      |INP ARRIVAL   DEFINED   |APPLICATION TEXT      |  PREDECESSORS    SPEC |EXT |    |
 OP ID    JOBNAME  P  S|   START  DUR DEADLINE  | OPERATION  TEXT      |APPL   ID OP ID INP ARR|RES |MON |COND
 -------- -------- - --|-- ---------- --------|----------------------|--------- ------ ------|----|----
                        |                        |                      |                  |    |    |
PAYBACKP           5  W|   12.00      09 06.00|Backup payroll DB     |                  |    |    |
 SAMPLE                 |                      |                      |                  |    |    |
 CPU1_015 PAYBACKP      |   12.09 00.05        |Daily payr backup     |PAYDAILY  CPU1_020|*   |    |N
 WTO1_030 PAYDAILY      |   12.14 00.0109 06.00|PAYX OPEN DATASET     |          CPU1_015|    |    |N
 FTW1_001 MASSI1       |29 15.00 00.0229 17.00|                      |                  |    |Y   |N
 ---------------------------------------------------------------------------------------------
 PAYBACKP           5  W|   12.00      09 06.00|Backup payroll db     |                  |    |    |
   SAMPLE               |                      |                      |                  |    |    |
   CPU1_015 PAYBACKP    |   12.09 00.05         | Daily payr bckup    |PAYDAILY CPU1_020 12.00|    |    |N
   WTO1_030 PAYBACKP    |   12.14 00.0109 06.00| PAYX OPEN DATAS      |         CPU1_015 |    |    |N
-------------------------------------------------------------------------------------------
                        |                        |                      |                  |    |    |
  PAYDAILY          5  W|   12.00         16.00| Daily payr jobs      |                  |    |    |
   SAMPLE               |                      |                      |                  |    |    |
   WTO1_005 PAYDAILY    |   12.00 00.01         | PAYX CLOSE DS        |                  |*   |    |N
   SETP_010 PAYDAILY    |   12.01 00.03         | Job setup pay        |           WTO1_005|*   |    |N
   CPU1_020 PAYDAILY    |   12.04 00.05   16.00| Runs pay04,pay06     |           SETP_010|*   |    |N
-------------------------------------------------------------------------------------------
                              >>>>>>>  END OF DAILY OPERATING PLAN REPORT  <<<<<<<
```

Figure 354. Daily planning reports - Daily operating plan

The daily operating plan shows all work to be done during the period covered by the plan. It is a printed copy of the current plan. All applications are listed in alphanumeric order. Where there are several occurrences of the same application, these are listed in order of their input arrival times.

The following data appears in the daily operating plan:

Data **Explanation**

Application ID
Application name

Application owner
Owner ID of the application

Operation ID
Operation number and workstation name

P Application priority

S Application status

Input arrival
Application input time

Start Operation planned start time; for status C, actual start time

Dur Estimated duration of the operation; blank if operation is complete

Defined deadline
Application or operation deadline

Application text
Application descriptive text

Operation text
Operation text

Predecessors
Internal and external predecessors

Application ID Op ID
Predecessor application ID: blank if internal predecessor; operation ID: blank if the predecessor occurrence starts after the period covered by this plan

Special resources
* indicates that this operation specifies special resources

External monitor
Specifies if this operation is to be monitored by an external product, Y or N

Conditional dependency
Specifies if there is any conditional dependency defined for this operation, Y or N

```
ABCD COMPANY                                                          PAGE 0003
 REPORTS FOR SUBSYS EIDA                                              06 MAY 03
                                                                         12:33

                        PLAN FOR WORKSTATION CPU1  (03/05/06 09.06 - 03/05/06 24.00)
                        ============================================================
-------------------------------------------------------------------------------------
APPLICATION ID        |    |RESOURCES| PLANNED  PLANNED  LATEST  |OPERATION TEXT   | PRED APPL ID
 OP¶ JOBNAME  FORM  C|P  S| PS R1 R2| START      END     OUT    |                 |OP ID JOBNAME  INP
 --- -------- ----- -|- --| -- -- --| -------- -------- --------|-----------------|----- -------- ---
-------------------------------------------------------------------------------------
             >>> WORKSTATION OPEN   03/05/06 00.00 - 24.00 WITH 99 PARALLEL SERVER(S) <<<
-------------------------------------------------------------------------------------
CP                    |    |         |                         |                 |
 050 XRAYNERC        |7  A|  1  0  0|    12.00    15.00    16.00|                 |
PAYDAILY              |    |         |                         |                 |
 020 PAYDAILY        |5  W|  1  0  0|    12.04    12.09    16.00|Runs pay04,pay06|SETP_010 PAYDAILY
PAYBACKP              |    |         |                         |                 |PAYDAILY
 015 PAYBACKP        |5  W|  1  0  0|    12.09    12.14 09 05.59|Daily payr bkp   |CPU1_020 PAYDAILY
-------------------------------------------------------------------------------------
             >>> WORKSTATION OPEN   03/05/07 00.00 - 24.00 WITH 99 PARALLEL SERVER(S) <<<
-------------------------------------------------------------------------------------
⋮

          INPUT ARRIVAL LIST FOR WORKSTATION CPU1  (03/05/06 09.06 - 03/05/06 24.00)
          ========================================================================
-----------------------------------------------------------------------------------
APPLICATION ID          | INPUT   PLANNED   REM  |OPERATION TEXT          |OWNER ID
 OP¶ JOBNAME  FORM  C P|ARRIVAL   START    DUR  |                        |
 --- -------- ----- - -|-------- -------- -----|------------------------|---------------
CP                     |                      |                        |
 050 XRAYNERC         7|   12.00    12.00 03.00|                        |SAMPLE3
```

Figure 355. Daily planning reports - Plan for workstation

The report in Figure 355 lists the work to be done at the workstation in order of planned operation start times. You can request this report either for all workstations or only for nonreporting workstations.

On the PLAN FOR WORKSTATION report, IBM Workload Scheduler for z/OS leaves the input arrival day for the predecessor application blank if it is the same day as the start of the planning interval (shown in the report title).

On the INPUT ARRIVAL LIST report, IBM Workload Scheduler for z/OS leaves the input arrival day blank if it is the same day as the start of the planning interval (shown in the report title).

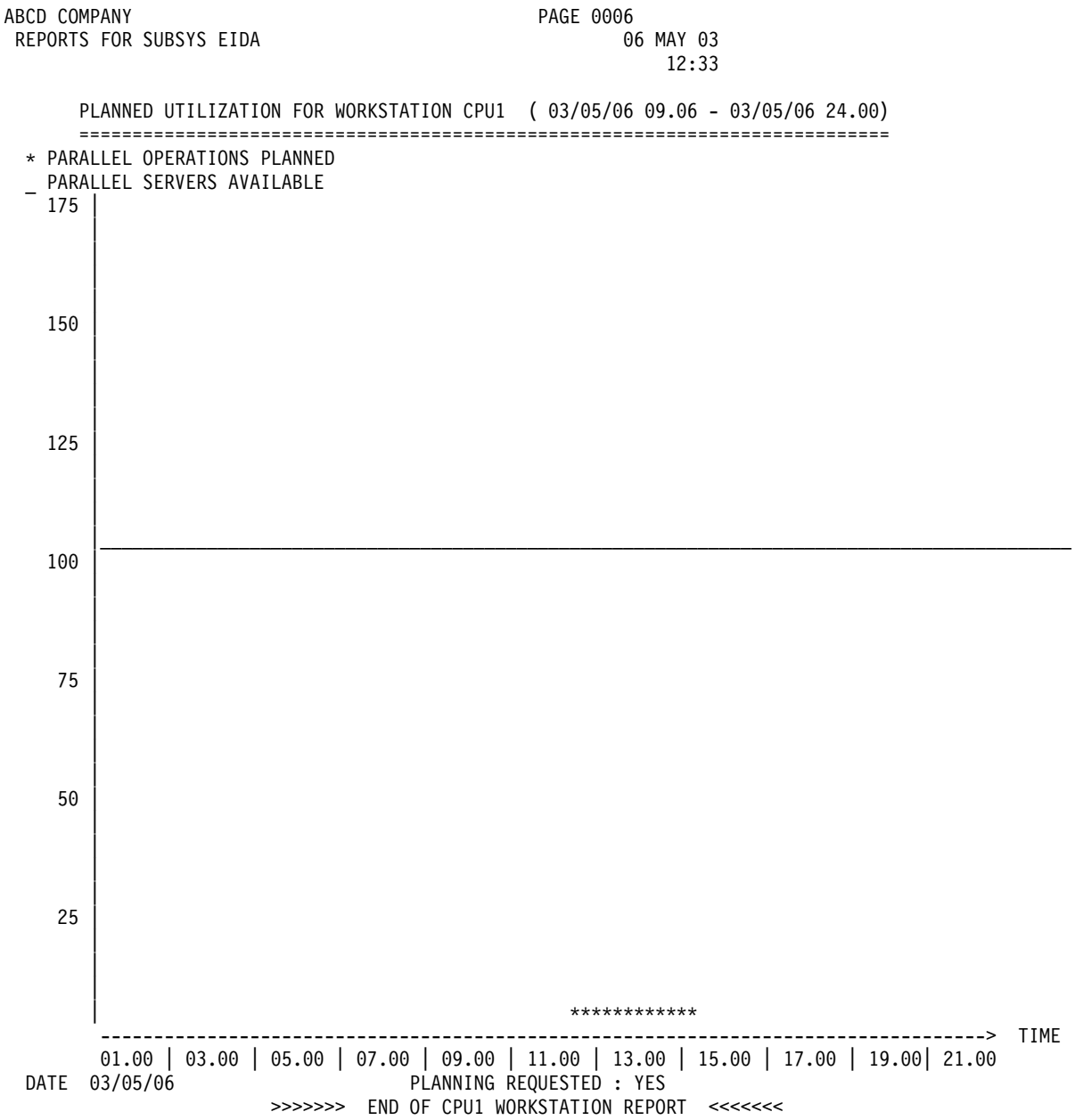


Figure 356. Daily planning reports - Workstation usage (parallel operations)

Daily planning produces workstation usage histograms, which show how many operations are processed by the workstation.

The level of resource available during the interval; that is, the number of parallel servers as shown by the horizontal line. The histogram shows the number of operations planned concurrently during each 15-minute interval. A histogram is produced for each 24-hour interval included in the daily planning period.

```
ABC COMPANY                        PAGE 0195
DATA PROCESSING DEPARTMENT                              17 APR 03
OPC/ESA                                                    10:12

                    PLANNED UTILIZATION FOR WORKSTATION CPU1  (               - 03/04/16 24.00)
                    ================================================================================
  * UTILIZATION OF RESOURCE 1  ( TA )
  _ LIMIT FOR RESOURCE
    35 |
       |
       |
       |
       |
    30 |
       |
       |
       |_____________________________________________________________________________
       |
    25 |
       |
       |
       |
       |
    20 |
       |
       |
       |
       |
    15 |
       |
       |
       |                 *
       |                 *                     *
    10 |                 *                     *
       |                 *                     *
       |                 *              *      *
       |                 **             **     *
       |                 **         *   **     ***
     5 |                 **         *   **     ***    *
       |                 ***       **   **    * ***    *
       |                 ****      **** ***   *****  * *
       |                *******  * **** ****  ******* *
       |                **********************************
        -------------------------------------------------------------------------TIME
        06.00 | 08.00 | 10.00 | 12.00 | 14.00 | 16.00 | 18.00 | 20.00 | 22.00 | 24.00| 02.00
  DATE  03/04/17                     PLANNING REQUESTED : YES
```

Figure 357. Daily planning reports - Workstation usage (resource 1)

If R1 and R2 resources are specified to be planned for on the workstation; histograms are produced showing usage of these resources. These have a similar layout to the workstation usage histograms described above. The number of operations using the special resource is shown for every 15-minute interval.

```
ABCD COMPANY                                          PAGE 0034
 REPORTS FOR SUBSYS EIDA                              06 AUG 03
                                                          06:03
                  PLANNED RESOURCE UTILIZATION  (03/08/07 08.00 - 03/08/08 08.00)
                  ================================================================
RESOURCE NAME    : PAYROLL.DATABASE              DESCRIPTION: Serializes access to Paymore database
DYNAMICALLY ADDED: NO
INTERVAL START | INTERVAL   END |           |             |     PLANNED |  ALLOCATION FAILURES BY
| NUMBER OF
DATE      TIME | DATE      TIME | AVAILABLE |    QUANTITY | UTILIZATION |     CONNECT |    QUANTITY
| CONTENTIONS
=============================================================================================================
03/08/07  8.00 | 03/08/07 10.00 |     YES   |           1 |           1 |           1 |           0
|           2
03/08/07 10.00 | 03/08/07 12.30 |     YES   |           1 |           1 |           0 |           0
|           0
03/08/07 12.30 | 03/08/07 20.00 |     YES   |           1 |           1 |           0 |           0
|           1
03/08/07 20.00 | 03/08/08 08.00 |     YES   |           1 |           1 |           0 |           0
|           0
```

Figure 358. Daily planning reports - Planned resource usage

You see this data on the planned resource usage report:

Data Explanation

Dynamically added
If this is YES, the resource was dynamically added during daily planning (it is not present in the database and was added because an operation needs it, and the DYNAMICADD keyword of the BATCHOPTS statement is set to YES).

Available
This is the planned availability, taken from the resource database interval values or the default availability. It does not show the overriding (global) availability, because daily planning does not use this for planning purposes.

Quantity
This is the planned quantity, taken from the resource database interval values or the default quantity. It does not show the overriding (global) quantity, because daily planning does not use this for planning purposes.

Planned utilization
This is the maximum number of the resource that is planned to be in use in the interval.

Allocation connect failures
This is the number of times that the planning program could not allocate this resource to an operation because the required workstation was not connected to the resource.

Allocation quantity failures
This is the number of times that the planning program could not allocate this resource to an operation because there was not enough quantity. It does not include cases where the allocation was delayed (because of contention) but was successful later in the interval.

Contentions
This is the number of times that the planning program could not allocate this resource to an operation, so that the operation missed its latest start time. This is counted only once for each operation, in the interval containing the latest start time of the operation.

Reports for a previous planning period

Daily planning also provides a set of management reports for a previous planning period. These reports are produced when you run *Plan Next Period* or *Replan Current Period*. These reports are created if the PREVRES keyword on the BATCHOPT statement specifies YES. Two of the reports, *completed applications* and *operations ended in error*, can also be requested when you submit a daily planning batch job.

A *previous planning period* is a 24-hour period starting on a fixed-hour boundary as defined by the PLANHOUR keyword of the BATCHOPT statement.

The data is kept in the current plan until the next daily planning run has produced the reports and is then deleted. For example, if you have specified the fixed-hour boundary as 0800 and you are running a Plan Next Period at 0759 on Wednesday morning, you will get reports from the interval 0800 Monday to 0800 Tuesday. If you then run a Replan Current Period at noon Wednesday, you will get the reports from 0800 Tuesday to 0800 Wednesday.

When an occurrence has been reported in any of the previous period reports, it will not be reported again in any subsequent daily plans for the same planning period. This means that the reporting period might not cover a full previous 24 hours when several daily plans have been executed within a planning period.

```
ABCD COMPANY                                PAGE 0024
 REPORTS FOR SUBSYS EIDA                                  11 JUN 03
                                                             16:30

                  SUMMARY OF COMPLETED APPLICATIONS  ( 03/06/10 01.00 - 03/06/11 01.00 )
                  ==========================================================================

              NO OF      NO OF   NO OF    APPL WITH  AVERAGE  APPL     AVERAGE   APPL     AVG
APPL          COMPLETED  RERUN   DELETED  LATE       INPUT    MISSING  DEADLINE  EARLY  DEADL
PRIORITY      APPL       APPL    APPL     INPUT      DELAY    DEADLINE DELAY     COMPL. EARLY
--------      ---------  ------  -------  ---------  -------  -------- --------  -----  -----
    9
    8
    7          2                1        1        19.54       1     15.55         1  03.59
    6
    5          1                                                 1     46.18
    4
    3
    2
    1
---------------------------------------------------------------------------------------------
               3                1        1        19.54       2     31.06         1  03.59
```

Figure 359. Daily planning reports - Summary of completed applications

The report shown in Figure 359 shows the number of applications processed in the period and gives the number of applications:

- With late input arrival, showing the average input delay
- That missed their deadlines, showing the average deadline delay
- That completed before their deadlines, showing the average deadline earliness
- That were rerun
- That were deleted

It provides a summary of events in the latest daily planning period.

```
ABCD COMPANY                                    PAGE 0025
 REPORTS FOR SUBSYS EIDA                      11 JUN 03
                                                 16:30

                            COMPLETED APPLICATIONS  ( 03/06/10 01.00 - 03/06/11 01.00 )
                            ============================================================
APPLICATION ID     APPLICATION TEXT            PLANNED   ACTUAL  INPUT           ACTUAL  OUTPUT ERROR ADD
 OPERATION ID       OPERATION TEXT         PRI  INP ARR  INP ARR DELAY  DEADLINE COMPLETE DELAY  CODEFUNC
                     USER DATA
---------------- ------------------------ --- -------- -------- ------ -------- -------- -----  ----
APP6               test variable dep         7 08 07.53    07.55  00.00    23.00 DELETED   00.00 DIALOG
CP                 Current plan              7 09 12.00    07.54  19.54 09 16.00    07.55  15.55
 CPU1_050 XRAYNERC                             09 12.00    07.54  19.54 09 16.00    07.55
CP                 Current plan              7    12.00    12.00  00.00    16.00    12.01  00.00
 CPU1_050 XRAYNERC                                12.00    12.00           16.00    12.01
PAYDAILY           Daily payroll jobs        5 08 08.00 08 07.34  00.00 08 16.00    14.18  46.18
 WTO1_005 PAYDAILY  PAYX CLOSE DATASET          08 08.00 08 07.34        08 16.00 08 13.11
        USER DATA:
 SETP_010 PAYDAILY  Job setup for paydaily               08 07.36        08 16.00 08 07.36
 CPU1_020 PAYDAILY  Runs pay04 and pay06                    12.14        08 16.00    14.18

                            COMPLETED APPLICATIONS  ( 03/06/11 01.00 - 03/06/11 16.30 )
                            ============================================================
APPLICATION ID     APPLICATION TEXT            PLANNED   ACTUAL  INPUT            ACTUAL OUTPUT ERROR ADD
 OPERATION ID       OPERATION TEXT         PRI  INP ARR  INP ARR DELAY  DEADLINE COMPLETE DELAY CODE FUNC
                     USER DATA
---------------- ------------------------ --- -------- -------- ------ -------- -------- ----  ----
PAYBACKP           Backup payroll database   5 08 12.00 10 12.18  48.18 09 06.00    09.36  51.36
 CPU1_015 PAYBACKP  Daily payroll backup               10 12.18        09 06.00 10 14.18
 WTO1_030 PAYBACKP  PAYX OPEN DATASET                  10 12.18        09 06.00    09.36
```

Figure 360. Daily planning reports - Completed applications

The report shown in Figure 360 shows all applications completed or deleted in the given period. Also, each operation with a specified input arrival or deadline is printed in the report.

An error code is present if specified when adding an occurrence into the long-term or current plan. This is defined as a rerun of a whole application, whereas a rerun of one or more operations in an application is reported in the error statistics report.

The report is produced automatically if specified at installation time or it might also be requested each time a Plan Next Period, a Replan Current Period, or a Print Current Period Results is run. If the report is requested at run time, a report covering the current period from the fixed-hour boundary of the current plan up to the present time will also be printed.

Note: The completion time used in the report is either the real completion time for the application or operation or DELETED for deleted applications. The real complete time for an application is defined as the time of the last completed operation with no specified input arrival or deadline. If the occurrence or operation has been manually completed, the real completion time is set to the time of the manual completion.

```
ABCD COMPANY                                                    PAGE 0031
 REPORTS FOR SUBSYS EIDA                                        11 JUN 03
                                                                    16:30

     ERROR STATISTICS ON COMPLETED APPLICATIONS  ( 03/06/10 01.00 - 03/06/11 01.00 )
     ================================================================================
APPLICATION ID     PRI INP  ARR APPLICATION TEXT           ERROR   RERUN   NUMBER OF
   OPR    JOBNAME               OPERATION TEXT             DUR     DUR     ERRORS
--------- -------- --- -------- ------------------------ ------- ------- -----------
PAYDAILY            5  08 08.00 Daily payroll jobs
 CPU1_020 PAYDAILY               Runs pay04 and pay06       0.01    0.00
--------------------------------------------------------------------------------------
TOTAL FOR ERROR CODE :                                     0.01    0.00     1
---------------------------------------------- ERROR CODE : S0C4 ----------------
 CPU1_020 PAYDAILY               Runs pay04 and pay06       0.01    0.00
--------------------------------------------------------------------------------------
TOTAL FOR ERROR CODE : S0C4                                0.01    0.00     1
--------------------------------------------------------------------------------------
TOTAL FOR ALL ERRORS                                       0.02    0.00     2
```

Figure 361. Daily planning reports - Error statistics on completed applications

The report shown in Figure 361 shows applications that have had one or more operations rerun because of an error condition and which are now completed successfully.

The error duration (time lost due to errors) is printed if not zero. The rerun duration (time lost when rerunning completed applications) is printed for any application that has been added into the long-term current plans with a rerun (error) code. The report is listed in error-code order. It gives the total error duration, rerun duration, number of errors for each error code, and the total number of errors.

Note:

1. Applications included in this report are not included in the completed applications report.
2. Only operations that are rerun after an error are included in this report. If the operation is manually completed, it is included in the completed applications report.

```
ABCD COMPANY                                                  PAGE 0027
 REPORTS FOR SUBSYS EIDA                                    11 JUN 03
                                                                16:30

                OPERATIONS IN ERROR   (                - 03/06/11 16.30 )
                ======================================================
APPLICATION ID APPLICATION TEXT                 INPUT   STARTED  ENDED IN DEFINED LATEST OP ERROR  CATM
 OPERATION ID   OPERATION TEXT     JOBNAME  PRI ARRIVAL    AT     ERROR AT DEADLINE OUT DUR  CODE  STAT
                USER DATA
-------------- ------------------ -------- --- -------- -------- -------- -------- ---------
PAYM1          MONTHLY PAYROLL JOBS          5  10 08.00 10 08.09          10 18.00
 CPU1_040      Monthly payroll job PAYMONTH     10 08.00 11 16.14 11 16.14 10 18.00   00.01 S0C4
PAYW           Weekly payroll jobs           5  09 14.00 10 10.37          09 16.00
 CPU1_020      pay07, pay10, pay16 PAYWEEK      09 14.00          10 10.37 09 16.00   00.00 OJCV
```

Figure 362. Daily planning reports - Operations in error

The report shown in Figure 362 lists all operations that have ended abnormally and are not yet taken care of.

The report is produced automatically if specified at installation time or it might be requested each time a Plan Next Period, a Replan Current Period, or a Print Current Period Results is run.

The report, if produced per shift using, for example, Print Current Period Results, could relieve operators of the task of having to record such information manually, and can also be used by the scheduler or shift supervisor to see where corrective action is necessary.

```
ABCD COMPANY                                                PAGE 0017
 REPORTS FOR SUBSYS EIDA                                    06 MAY 03
                                                                12:33

                     MISSED FEEDBACK REPORT          (               -               )
                     ========================================================================
APPL ID           APPLICATION    PLANNED   ACTUAL    PLANNED   ACTUAL   REASON FOR
 OPERATION ID     INPUT ARRIVAL  DURATION  DURATION  DEADLINE  DEADLINE MISSED FEEDBACK
----------------  -------------  --------  --------  --------  -------- ---------------
APPLMVS             29 09.10                        00 12.00  29 11.30 OUTSIDE LIMITS
 CPU1_050                          01.00   0000.02                      OUTSIDE LIMITS
 CPU1_052                          01.00   0000.02   00 11.30  29 11.15 OUTSIDE LIMITS
```

Figure 363. Daily planning reports - Missed feedback report

The report shown in Figure 363 is printed during a Plan Next Period or Replan Current Period run, if the scheduler has not been able to feedback application durations and deadlines.

The report lists all occurrences and operations where the feedback of the actual duration and deadline to the application description data set has not been possible.

Note:

1. The planned deadline is the deadline set in the application description, represented in the format DD HH.MM, where DD is a day offset and HH.MM an absolute time.
2. The actual deadline is an absolute day and time, in the format DD HH.MM. For example, if the operation or occurrence completed on 29 March 2006 at 11:15, DD is 29 and HH.MM is 11.15.

The reasons for missed feedback include:

OUTSIDE LIMITS
Feedback is outside the limit set for feedback.

APPL IN USE
Application description was being updated by another user when feedback was attempted.

I/O PROBLEMS
AD record not found (if no operation ID printed) or operation not found in AD.

DL BEFORE IA
The occurrence completed before the IA was reached.

NO RUN CYCLE FOUND
It was not possible to match the occurrence with a run cycle in the application.

```
ABCD COMPANY                                PAGE 0038
 REPORTS FOR SUBSYS EIDA                                03 JUN 03
                                                          06:03
                            ACTUAL RESOURCE UTILIZATION  (03/06/01 20.00 - 03/06/02 20.00)
                            ============================================================
RESOURCE NAME    : PAYROLL.DATABASE                DESCRIPTION: Serializes access to Paymore database
DYNAMICALLY ADDED: NO
INTERVAL START | INTERVAL   END |    AVAILABILITY   |        UTILIZATION        | ALLOCATION | CONTENTION
|    IDLE
DATE      TIME | DATE      TIME | PLANNED |  ACTUAL | PLANNED MAX | ACTUAL  MAX |   FAILURES
|       TIME |    TIME
=============================================================================================
03/06/01 20.00 | 03/06/02 08.00 |   YES   |    100% |           1 |           1 |          0
|          0% |      4%
03/06/02 08.00 | 03/06/02 10.00 |   YES   |    100% |           0 |           1 |          0
|          0% |     80%
03/06/02 10.00 | 03/06/02 12.30 |   YES   |    100% |           1 |           1 |          1
|         12% |     17%
03/06/02 12.30 | 03/06/02 20.00 |   YES   |    100% |           1 |           1 |          0
|          0% |     20%
```

Figure 364. Daily planning reports - Actual resource usage

You see this data on the actual resource usage report:

Data Explanation

Dynamically added
If this is YES, the resource was dynamically added during daily planning or the life of the plan.

Planned availability
This is the planned availability, taken from the resource database interval values or the default availability. It does not show the overriding (global) availability, because daily planning does not use this for planning purposes.

Actual availability
This is the percentage of time that the resource was available as planned.

Planned maximum utilization
This is the maximum number of the resource that was planned to be in use in the interval.

Actual maximum utilization
This is the maximum number of the resource that was in use in the interval.

Allocation failures
It is increased by one each time IBM Workload Scheduler for z/OS tries unsuccessfully to allocate the resource to an operation during this interva; it can be increased many times for each waiting operation.

Contention time
This is the percentage of time that operations were waiting for the resource.

Idle time
This is the percentage of time that the resource was not allocated.

Database views

This section describes the views you can use to extract information from the DB2 database containing the historical run data that the scheduler archived to support the Dynamic Workload Console reporting feature.

For a description of the reports provided by the Dynamic Workload Console reporting feature, refer to Chapter 36, "Reporting with IBM Workload Scheduler for z/OS," on page 701.

JOB_HISTORY_V

The JOB_HISTORY_V view displays historical data about jobs already run.

Column name	Description	Type	Length
JOB_STREAM_NAME_IN_RUN	The name of the occurrence to which the job belonged when it run.	STRING	16
JOB_NAME	The name of the job.	STRING	8
WORKSTATION_NAME	The name of the workstation where the job was scheduled to run.	STRING	4
WORKSTATION_NAME_IN_RUN	The name of the workstation where the job ran.	STRING	4
JOB_OPERATION_NUMBER	The operation number of the job.	INTEGER	10
JOB_STREAM_START_TIME	The occurrence input arrival.	TIMESTAMP	10
JOB_RUN_DATE_TIME	The actual start date and time.	TIMESTAMP	10
LATE_START_TIME	The actual start time, when it is later than the latest start time calculated by the scheduler.	INTEGER	12
LATE_END_TIME	The actual end time, when it is later than the defined deadline.	INTEGER	12
PLANNED_DURATION	The estimated duration of the job.	INTEGER	12
TOTAL_ELAPSED_TIME	The actual duration of the job.	INTEGER	12
LONG_DURATION	Indicates if the job duration exceeded the estimated duration, based on the long duration policy set in the DBOPT statement.	CHARACTER	1
JOB_STATUS	The status of the job. Possible values are: **S** Successful **E** Error	CHARACTER	1
RERUN_NUMBER	The iteration number of the job. The first job run is identified by 1; the first job rerun is identified by 2, the second by 3, and so on.	INTEGER	10
ERROR_CODE	The error code, if the status of the job is E=Error.	STRING	4
JOB_NUMBER	The number of the job.	INTEGER	10
SUMISSION_DEST	The destination where the job was submitted. A destination marked with ******** identifies a local destination.	STRING	8
EXECUTION_DEST	The destination where the job was executed. A destination marked with ******** identifies a local destination.	STRING	8
JOB_LATEST_TIME	The latest time within which the job can start without causing the critical job miss its deadline.	TIMESTAMP	10

Column name	Description	Type	Length
JOB_CRITICAL	If the job is a critical path target or eligible for WLM assistance, if late. Possible values are: **Y** Yes **N** No	CHARACTER	1
JOB_PROMOTED	If the job is promoted. Jobs running on a z/OS system are promoted to WLM, while jobs defined on z-centric and dynamic workstations are promoted to the operating system. Possible values are: **Y** Yes **N** No	CHARACTER	1

JOB_STATISTICS_V

The JOB_STATISTICS_V view displays runtime statistics for each job.

Column name	Description	Type	Length
JOB_NAME	The name of the job.	STRING	8
ABENDED_RUNS	The number of times the job ended in error.	INTEGER	10
LONG_DURATION_RUNS	The number of times the job duration exceeded the estimated duration, based on the long duration policy set in the DBOPT statement.	INTEGER	10
SUCCESSFUL_RUNS	The number of times the job ran successfully.	INTEGER	10
LATE_START_RUNS	The number of times the job started later than its latest start time.	INTEGER	10
LATE_END_RUNS	The number of times the job ended later than its deadline.	INTEGER	10
TOTAL_RERUNS	The total number of reruns.	INTEGER	10
LAST_RUN_DATE	The actual start date and time of the last run.	TIMESTAMP	10
LAST_ELAPSED_TIME	The actual duration of the last run.	INTEGER	12
MIN_RUN_DATE	The actual start date and time when the job took the shortest time to run.	TIMESTAMP	10
MIN_ELAPSED_TIME	The minimum duration run.	INTEGER	12
MAX_RUN_DATE	The actual start date and time of the maximum duration run.	TIMESTAMP	10
MAX_ELAPSED_TIME	The maximum duration run.	INTEGER	12
AVERAGE_ELAPSED_TIME	The average duration. The scheduler calculates it considering only the successfully completed jobs, based on the smoothing policy set in the DBOPT statement.	INTEGER	12
TOTAL_ELAPSED_TIME	The sum of the times the job used the CPU and the time the job waited for other processes to release the CPU for all its runs.	INTEGER	12

Appendix D. Supported z/OS commands

You can start, stop, cancel, or modify IBM Workload Scheduler for z/OS using the following z/OS operator commands:

S START
P STOP
C CANCEL
F MODIFY

In addition, you can use the MODIFY (F) command to start and stop individual subtasks.

You can enter these commands from a multiple console support (MCS) console or from a program such as the spool display and search facility (SDSF). In both cases, the terminal or console operator must have the required authority to enter operator commands.

If IBM Workload Scheduler for z/OS history function is active and any DB2 maintenance is applied, stop and restart the controller to pick up the updated DB2 modules. If not, IBM Workload Scheduler for z/OS might experience ABEND0C4, ABEND0C1, or ABENDU3999 in the general service subtask or GS executors. Also, the controller might be unable to shut down cleanly because it is unable to close its DB2 session.

A space abend, terminating the mother task for IBM Workload Scheduler for z/OS, can occur in the following situations:

- If the EQQMLOG becomes full while processing START or MODIFY commands that require parsing of initialization parameters or specifying the NEWNOERR or NOERRMEM(MEMBER) options
- If the EQQMLOG is already full when START or MODIFY commands are issued

Starting the scheduler

To start IBM Workload Scheduler for z/OS, enter this z/OS operator command:

```
/S procname
```

where *procname* is the IBM Workload Scheduler for z/OS JCL procedure name.

If a started task with this name is already active, the second attempt to invoke it ends with an error message. If this happens, the started task in error cannot write an error message to the message log (DD name EQQMLOG) because the message log is already being used by the active started task. If IBM Workload Scheduler for z/OS is to run as a batch job, do not start it with an operator command. Instead, submit a batch job with the same name as IBM Workload Scheduler for z/OS subsystem. JES starts this job in the same manner as any ordinary job.

Note: Because IBM Workload Scheduler for z/OS uses JES exits, among other things, to track the progress of z/OS jobs, it does not start before JES is active.

Stopping the scheduler

To stop IBM Workload Scheduler for z/OS, enter the following z/OS operator command:

```
/P procname
```

where *procname* is the IBM Workload Scheduler for z/OS JCL procedure name

If you are stopping a controller, the controller creates a backup copy of the current plan data set (if required) and ends all active functions.

When IBM Workload Scheduler for z/OS ends, it writes this message to the message log:

```
EQQZ086I NO ACTIVE OPC SUBTASKS.
OPC IS ENDING
```

Canceling the scheduler

If IBM Workload Scheduler for z/OS is still active 5 minutes after you enter the STOP operator command, you must cancel IBM Workload Scheduler for z/OS.

You might also need to cancel IBM Workload Scheduler for z/OS if the current plan is corrupt, because a normal shutdown causes a backup to the alternate file (refer to *Customization and Tuning* for details of current plan recovery). There are two ways to do this. The first is to enter:

```
/C procname,DUMP
```

where *procname* is the IBM Workload Scheduler for z/OS JCL procedure name.

This causes IBM Workload Scheduler for z/OS to end with a dump on the SYSMDUMP file (if the DD name is in the started-task JCL). The second way is to enter:

```
/C procname
```

where *procname* is the IBM Workload Scheduler for z/OS JCL procedure name.

This causes IBM Workload Scheduler for z/OS to end without a dump.

If the STOP command is ineffective and you have no earlier documentation of the problem, cancel IBM Workload Scheduler for z/OS with a dump so that the error can be located.

Modifying the scheduler

Use the MODIFY command to supply information to IBM Workload Scheduler for z/OS after it has started. The syntax of the MODIFY command is:

```
/F procname,modifyoption
```

where:

procname
The IBM Workload Scheduler for z/OS JCL procedure name.

modifyoption
Can be one of the following:

S=*taskname*
Starts the specified subtask.

P=*taskname*
Stops the specified subtask.

taskname can be one of the following:

APPC APPC subtask.

AR Automatic recovery subtask.

A4 APPC tracker router subtask.

CPH Critical path handler subtask.

DRT Data router subtask.

EMGR
Event manager subtask.

ERDR All active event-reader subtasks.

EWTR Event writer subtask.

EXA External router subtask.

FL Fetch job log task.

GEN General service subtask.

HTC HTTP Client subtask.

HTS HTTP Server subtask.

IP TCP/IP router subtask.

JCC Job-completion-checker subtask.

NMM Normal-mode-manager subtask. The normal mode manager must be restarted as soon as possible after it has stopped. Many functions of IBM Workload Scheduler for z/OS require an active NMM task to execute successfully.

PENF53
Deactivates the ENF mechanism implemented for the ENF 53 event. In this way, a dynamic time change for all the IBM Workload Scheduler for z/OS subsystems cannot be performed. By default, the ENF 53 mechanism is automatically deactivated when the controller is stopped.

PSU Pre-submit task.

RODM
RODM subtask.

SENF53
Activates the ENF mechanism implemented for the ENF 53 event, so that a dynamic time change for all the IBM Workload Scheduler for z/OS subsystems can be performed. By default, the ENF 53 mechanism is automatically activated at controller startup.

SUB Submit subtask.

TWS End-to-end with fault tolerance capabilities task.

VTAM
Network communication function (NCF) subtask.

WSA Workstation analyzer subtask.

Only the tasks in IBM Workload Scheduler for z/OS subtask table can be activated by a MODIFY command. The subtask table is built when IBM Workload Scheduler for z/OS is started. This means that you can only start a task that has stopped earlier in the current session. If you attempt to start a started subtask or stop a stopped subtask, error message EQQZ049W is issued, and no action is taken.

BKSTATUS
Issue this command on the primary controller or backup controller to collect detailed information about plans, JT events, and processes. By comparing the information that is returned in EQQMLOG, you can verify the alignment status between the controllers.

For example, on the primary controller, the following messages are shown in EQQMLOG:

```
EQQN133I PRIMARY CONTROLLER INFO:
EQQN133I CP INFO:
EQQN133I - CP RUN         : 00000004
EQQN133I - CP TOD         : CDDD39D2CA9AB661
EQQN133I LTP INFO:
EQQN133I - LT RUN         : 00000002
EQQN133I - LT TOD         : CDDD39D526710741
EQQN133I LATEST WRITTEN JT EVENT INFO:
EQQN133I - EVENT TYPE     : 29
EQQN133I - SEQUENCE NUMBER: 00000CD3
EQQN133I - TIME STAMP     : 141006/16522655
EQQN133I LATEST TRANSFER PLAN INFO:
EQQN133I - NCP JOB NAME   : ROZSENCP
EQQN133I - NCP JOB ID     : STC00814
EQQN133I - NCP JOB STATUS : C
EQQN133I - LTP JOB NAME   : ROZSENLT
EQQN133I - LTP JOB ID     : STC00813
EQQN133I - LTP JOB STATUS : C
EQQN133I - CP1 JOB NAME   :
EQQN133I - CP1 JOB ID     :
EQQN133I - CP1 JOB STATUS :
```

On the backup controller, the following messages are shown in EQQMLOG:

```
BACKUP CONTROLLER INFO:
CP INFO:
- CP PLAN AVAILABLE            : Y
- CP PLAN DDNAME               : EQQCP1DS
- CP PLAN RUN NUMBER           : 00000004
- CP PLAN TOD KEY              : CDDD39D2CA9AB661
LTP INFO:
- LT PLAN AVAILABLE            : Y
- LT PLAN RUN NUMBER           : 00000002
- LT PLAN TOD KEY              : CDDD39D526710741
LATEST WRITTEN JT EVENT INFO:
- JT TYPE                      : 29
- JT SEQNO                     : 00000C15
- JT TIMESTAMP                 : 141006/16264299
SYNCHRONIZATION INFO:
- SYNC IS IN PROGRESS          : N
- SYNC TYPE                    :
- NCP STATUS                   : restore not needed
```

```
- CP1 STATUS                  : restore not needed
- CP2 STATUS                  : restore not needed
- LTP STATUS                  : restore not needed
LATEST RESTORE PLAN INFO:
- NCP JOB NAME                : ROZSENCP
- NCP JOB ID                  : STC00805
- NCP JOB STATUS              : N
BKTAKEOVER INFO:
- POSTPONED                   : N
-----------------------------------------------------
```

BKTAKEOVER
Orders a backup controller to take over the functions of the primary controller. Issue this command on the backup controller.

Specify the option `BKTAKEOVER,FORCE` to force the backup controller takeover, even when the connection between the controllers is apparently up and running. Specify the option `BKTAKEOVER,NOSUB` to deactivate the job-submit option, even if JTOPTS JOBSUBMIT(YES) is set.

Note: The backup controller takeover can occur if you have set the appropriate parameters in BKPTOPTS and TRROPTS initialization statements. For details about these statements, see the *Customization and Tuning*.

CPQSTA=ON
Activates the STATMSG(CPLOCK) message.

CPQSTA=OFF
Deactivates the STATMSG(CPLOCK) message.

DEPLOYCF
Use this keyword to manually start the deployment process that refreshes the trackers event configuration file (member EQQEVLST of the EQQJCLIB data set) according to the current content of the controller EQQEVLIB data set.

The process can update the event configuration file for the trackers that are currently connected. At the end of the deployment process, each connected tracker monitors for the events that match the refreshed data, based on an in-storage copy of the configuration file.

If a tracker destination is referenced in the controller routing options (ROUTOPTS initialization statement), but it is not currently connected, the tracker acquires the configuration file data when the connection is restored.

DSPDEST
Lists the HTTP destinations that are currently used by the controller. The list is stored in the message log.

DSPPRODD
Lists the DD names for data sets that cannot be discarded. The list can be obtained in one of the following ways:

- In the initial parameter statements: RCLOPTS DDPROT or DDPRMEM
- With the MODIFY command `/F procname,PROT(DD=member)`

DSPPRODS
Lists the data sets that cannot be discarded. The list can be obtained in one of the following ways:

- In the initial parameter statements: RCLOPTS DSNPROT or DSNPRMEM
- With the MODIFY command `/F procname,PROT(DS=member)`

DSPSTA
Displays, in message EQQZ095, the status of statistics messaging. The message indicates whether messaging is active for EVENTS, CPLOCKS, GENSERV, and WSATASK. It also gives the values currently set for EVELIM and STATIM. For details, refer to *Messages and Codes*.

EVELIM=*nnnn*
Sets the new value of the EVELIM keyword of the JTOPTS statement. Allowed values are 0 to 9999.

EVESTA=ON
Activates the STATMSG(EVENTS) message.

EVESTA=OFF
Deactivates the STATMSG(EVENTS) message.

GENSTA=ON
Activates the STATMSG(GENSERV) message.

GENSTA=OFF
Deactivates the STATMSG(GENSERV) message.

JCLDBG=ON
Activates the single JCL trace. For each job handled by WSA task information, such as the elapsed time in milliseconds needed to handle the job, retrieve the JCL, access the JS VSAM, or whatever else, will be shown.

This is a powerful trace and should be activated only for short periods of time to identify possible performance problems.

JCLDBG=OFF
Deactivates the single JCL trace.

LSTNOERR
The controller lists the NOERROR table content. An example of the command output follows:

```
EQQZ024I Current NOERROR table content:
EQQZ024I !-----------------------------------------!----------!
EQQZ024I ! Statement                               ! Member   !
EQQZ024I !-----------------------------------------!----------!
EQQN067I ! ABC123.*.*.0016.GE                      ! STDCWSN  !
EQQN067I ! ABC123.*.*.0012.NE                      ! STDCWSN  !
EQQN067I ! ABC123.*.*.0016.EQ                      ! STDCWSN  !
EQQN067I ! ABC123.*.*.0500.TO.0610                 ! NOERR2   !
EQQN067I ! ABC123.*.*.0200.TO.0210                 ! NOERR2   !
EQQN067I ! ABC123.*.*.0005.LT                      ! NOERR    !
EQQZ024I !-----------------------------------------!----------!
```

The information returned in the `Member` column can help you locate members to be updated.

MAXSUB=*nnnn*
Sets the new value of the MAXSUBJOBS keyword of the OPCOPTS statement. Allowed values are 0 to 9999.

MCPDSSTART
Use this command to create and use an MCP data space. This overrides MCPDATASPACE(NO) in the JTOPTS statement.

MCPDSSTOP
Use this command to stop using and delete the MCP data space. This overrides MCPDATASPACE(YES) in the JTOPTS statement.

NEWDSLST
Use this command on the tracker side to rebuild the triggering selection table. The new table is read from member EQQEVLST (or EQQDSLST, if EQQEVLST does not exist) of the data set referenced by the EQQJCLIB DD name in the started task JCL for the tracker. The new table replaces the table in ECSA.

Note: If EQQJCLIB contains both EQQEVLST and EQQDSLST member, the resulting triggering selection table is the union of EQQEVLST and EQQDSLST. In this case, EQQEVLST data is processed first.

NOERROR
You can use the commands NEWNOERR and NOERRMEM() only if NOERROR entries are coded under the LIST() keyword of the NOERROR initialization statement.

For a description of the NOERROR statement, see *Customization and Tuning*.

When you enter a NEWNOERR command, the program searches the controller PARMLIB member only for NOERROR init statements. If none are found, an empty table is created, thus deleting the entries which were loaded when the CONTROLLER started. Do not use the NEWNOERR command if the NOERROR list is coded under the NOERROR() keyword of the JTOPTS initialization statement. If you enter a NOERRMEM(*membername*) command, the current table is deleted and created again. The entries that had already been specified for *membername* are replaced with the entries found in the updated member of the EQQPARM library.

When using NOERROR, consider the following:
- Use this keyword only if you are sure you can stop the controller before updating the NOERROR data.
- Initialization statements cannot exceed 32 KB or 455 72-character lines. The available space for NOERROR entries in the initialization statement is more limited compared with using this keyword in the JTOPTS statement.
- Do not mix the three options for defining NOERROR entries:
  - JTOPTS NOERROR ()
  - NOERROR LIST () in the main parmlib member
  - NOERROR LIST () in separate parmlib members identified by the INCLUDE() initialization statement

  The options for dynamically updating controller data are mutually exclusive and using them incorrectly might cause the deletion of the active table.
- If you must dynamically update the NOERROR data without stopping the controller, and the NOERROr entries are defined in a separate parmlib member, place all NOERROR entries in a

single parmlib member. In this way, you can use only one member name in the NOERRMEM command.

NEWNOERR
Orders a controller to rebuild the NOERROR table, in the case NOERROR statements have been modified in the parameter library member that contains the JTOPTS statement.

NOERRMEM(*member***)**
Orders a controller to rebuild the NOERROR table, in the case NOERROR statements have been modified in a parameter library member that was specified in an INCLUDE statement.

NOERRMEM(M1)
Order a controller to delete all NOERROR codes defined by member M1, once you have previously changed M1 to contain only comments. The modified member can contain a different number of NOERROR codes than the original member.

Note: The scheduler opens the EQQPARM library when IBM Workload Scheduler for z/OS is started and parameter library members (residing in library extents), that have been created, cannot be accessed, after have been opened. To avoid this problem, the data sets that define the EQQPARM library should be allocated without any secondary extents.

PROT ([DD=*mem1***], [DS=***mem2***])**
Replaces the currently used list contents of the members (*mem1* and *mem2*) inside the PDS parameter library, if DD or DSN is protected. At least one of the two keywords DD or DS must be specified. The list of protected DD and DSN is dropped when *mem1* or *mem2* is blank. Also, the keywords DD and DS remove the list of protected DD names and DS names.

For example, if DDPROT is used in the parameter library at startup of the controller, the command drops this list and replaces it with the contents of *mem1*.

QUELEN=*nnnn*
Sets the new value of the QUEUELEN keyword of the JTOPTS statement. Allowed values are 0 to 9999, but a minimum value of 5 is forced.

RFRDEST
If you modify, add, or delete an HTTP or HTTPS destination in ROUTOPTS while IBM Workload Scheduler for z/OS is running, makes your changes immediately effective. This command does *not* update any changes you make to the PROXY parameter in ROUTOPTS.

RFRDEST manages up to a total of 100 new destinations, regardless if you add them at once or at different times. For detailed information about the destinations set by ROUTOPTS, see *Customization and Tuning*.

RFRUSER
If you modify the USRREC statement while IBM Workload Scheduler for z/OS is running, makes your changes immediately effective. For detailed information, see *Scheduling End-to-end with z-centric Capabilities*.

RFRUX14T

If you modify the criteria table pointed by the UX14IN DD name in the controller started task while the controller is running, makes your changes effective for the operations that become ready after modifying the table.

To make the changes effective also for the operations that were ready before you modified the table, you must replan the current plan.

For detailed information about the time-dependent-operation exit, see *Customization and Tuning*.

SKIPINC(*member name***)**

Replaces the currently used list of INCLUDEs that are to be left at the beginning of a JCL by the JCL tailoring process of Restart and Cleanup. *member name* can be:

- The name of a member inside the PDS parameter library
- Blank or absent

When a member name is specified, the current SKIPINCLUDE list is deleted and a new SKIPINCLUDE list is built by applying the syntax described for the RCLSKIP statement to the specified member. When no member name is specified, the current SKIPINCLUDE list is removed.

For details about RCLOPTS(SKIPINCLUDE) and the RCLSKIP statement, see *Customization and Tuning*.

STATIM=*nn*

Sets the new value of the STATIM keyword of the JTOPTS statement. Allowed values are 0 to 99.

STATUS

Returns a message on the system log with the status of IBM Workload Scheduler for z/OS subsystem. The status can be one of the following:

FULLY_OPERATIONAL

Everything is active and is working properly.

PARTIALLY_OPERATIONAL

The scheduler subsystem has limited functionality. For example, if a controller ER is stopped, the controller can still schedule jobs but cannot receive their statuses.

NOT_OPERATIONAL

The major subsystem functionality is not available. For example, a controller is not able to execute a plan or to submit a job.

STATUS, DD=*ddname*

Checks for the status of IBM Workload Scheduler for z/OS data set associated with the specified *ddname*. *ddname* can be a specific DD name, such as EQQWSDS, EQQCP1DS, or EQQLTDS, or it can assume the value ALL, CP, DB, LTP, or JTL. It returns the return code of the last I/O operation performed on that *ddname*. The status of the data set can be one of the following:

NORMAL
WARNING
SEVERE

CRITICAL
UNKNOWN

STATUS, {OP_COMP | OP_ERR}, "*destination name***"**
Returns the number of completed operations (OP_COMP) or the number of ended-in-error operations (OP_ERR) for the specified tracker (*destination name*).

Note:

1. If more than one workstation is defined for tracker *tracker name*, the number of completed or in-error operations is the sum of the operations on all the workstations defined on that tracker.
2. *destination name* is the destination name of a tracker, as specified in the ROUTOPTS keyword in the initialization statements.

STATUS, SUBTASK
Lists all subtasks with their statuses. The status can be ACTIVE or INACTIVE.

SWITCHMLOG
If the MLOG switching feature is in use, forces the switch to the alternate data set (EQQMLOG or EQQMLOG2), regardless of the number of currently logged records, and starts counting from 0 again.

TAKEOVER
Orders a standby controller to take over the functions of the controller. This command is valid only when both systems are part of the same XCF group, and no controller is active. You can use this command only for IBM Workload Scheduler for z/OS address spaces where OPCHOST(STANDBY) is specified on the OPCOPTS initialization statement.

Note: Takeover can occur automatically if you have specified the TAKEOVER keyword on the XCFOPTS initialization statement of a standby system. For details about the XCFOPTS statement, see *Customization and Tuning*.

TRYNOERR(*member name***)**
Start a trial processing of the NOERROR statements contained in *member name*. The controller issues all the normal processing messages in EQQMLOG. At the end of the trial processing, the controller issues message EQQN099I, leaving unchanged the NOERROR table.

member name is a member of the EQQPARM library.

VSTRC=START
Starts a trace on the message log of all VSAM I/O requests. In a busy scheduler system, you will need a large message-log data set, and the trace will affect the performance of IBM Workload Scheduler for z/OS system.

VSTRC=STOP
Stops a VSAM I/O request trace on the message log.

WSASTA=ON
Activates the STATMSG(WSATASK) message.

WSASTA=OFF
Deactivates the STATMSG(WSATASK) message.

After the STOP command is entered, the MODIFY command no longer functions, and issues the following message on SYSLOG:

```
IEE324I MODIFY REJECTED - TASK BUSY
```

Modifying the data store

Use the MODIFY command to supply information to IBM Workload Scheduler for z/OS data store after it has started. The syntax of the MODIFY command is:

```
/F procname,modifyoption
```

where:

procname
The IBM Workload Scheduler for z/OS JCL procedure name.

modifyoption
Can be one of the following:

S=*taskname*
Start the specified data store subtask.

P=*taskname*
Stop the specified data store subtask.

taskname can be one of the following:

ARRD
Reader task.

ARCU Cleanup task.

ARCM
Communication.

ARDYWR
Display number of active writers.

ARDYTW
Display WINTERVAL value.

ARDYNY
Display MAXSTOL value.

ARDYNS
Display MAXSYSL value.

ARDYTU
Display CINTERVAL value.

ARDYNS
Display MAXSYSL value.

ARDYPM
Display all initialization parameters values.

ARSTKW O=[owner],K=[keyword]
Display the statistical data for a specific owner or single keyword. The following describes the keyword and owner combinations:

Table 54. Keyword and owner combinations

Owner	Keyword	Meaning
JESQUEUE	COUNTJOB	Number of jobs still in the JES Queue control block
JESQUEUE	JOBINSQU	Number of jobs inserted in the JES Queue control block
JESQUEUE	DSIDINSQ	Number of DS IDs (sysout) inserted in the JES Queue control block
JESQUEUE	JOBRQUEU	Number of jobs re-queued: deleted from the JES Queue control block after the store
JESQUEUE	JOBDISCA	Number of jobs discarded: deleted from the JES Queue control block because of an error during the store in the database
DATAFILEnnnn	CNTDPAGE	Number of data pages for the data file specified
READER	JOBRQSDB	Number of jobs requested directly to the database
READER	JOBRQJES	Number of jobs requested to JES Queue because they are not stored in the database yet
COMMUNICATION	INPUTMSG	Number of input messages received
COMMUNICATION	OUTPTMSG	Number of output messages sent

ARSTGN
Display all the statistics for the data store.

ARMDWR
Modify number of active writers.

ARMDTW=n
Modify WINTERVAL value (seconds).

ARMDNY=n
Modify MAXSTOL value (number of lines).

ARMDNS=n
Modify MAXSYSL value (number of lines).

ARMDTU=n
Modify CINTERVAL value (seconds).

ARMDNS=n
Modify MAXSYSL value (number of lines).

ARDGCM=on/off
Activate or deactivate Communication task traces.

ARDGWR=on/off
Activate or deactivate Writer task traces.

ARDGRD=on/off
Activate or deactivate Reader task traces.

ARDGJQ=on/off
Activate or deactivate JES Queue task traces.

ARDGDB=on/off
Activate or deactivate Database task traces.

Appendix E. Status, error, and reason codes

This appendix lists status, error, and operation reason codes.

The scheduler assigns a status code to every occurrence and every operation in the current plan. An error code is also assigned for any operation that ends in error. You can see the status of operations by using the WORKSTATION COMMUNICATION panel or the QUERY CURRENT PLAN panel.

The codes assigned by IBM Workload Scheduler for z/OS are not just for documentation purposes. They report the *real* status of the operation and are used by several scheduler functions to make important decisions about the running of the operation.

Occurrence status codes

The following is a list of the occurrence status codes:

C Complete

D Deleted

E An operation in the occurrence has ended-in-error

P A pending predecessor exists for the occurrence

S Started

U Undecided (the status is not known)

W No operations in the occurrence have started

Operation status codes

When IBM Workload Scheduler for z/OS displays the status of an operation, it uses the format *xy*, where *x* is the status code and *y*, if present, is the extended status code. For quick recognition of the operation status, each status has a default color. You can customize the status color in the ISPF options (see "Setting options" on page 32).

The following is a list of the operation status codes and the corresponding default colors:

A Arriving; the operation is ready for processing; no predecessors were defined. The default status color is green.

C Complete. The default status color is blue.

D Deleted. The default status color is blue.

E The operation has ended-in-error. The default status color is red.

I The operation is interrupted. The default status color is blue.

R Ready for processing; all predecessors are complete. The default status color is green.

S Started. The default status color is turquoise.

U Undecided; the operation status is not known. The default status color is red.

W The operation is waiting for a predecessor to complete. The default status color is yellow.

X The operation is suppressed by condition. The default status color is blue.

***** Ready; at least one predecessor is defined on a nonreporting workstation; all predecessors are complete. The default status color is green.

Extended status codes

Together with the normal status codes, IBM Workload Scheduler for z/OS maintains extended status codes that provide additional information about the status of operations. The extended status code is not always present.

The following is a list of the extended status codes:

3 The scheduler is sending an HTTP or HTTPS request to bind the shadow job to a real instance in the remote plan.

4 The scheduler is waiting to receive the result of the HTTP or HTTPS request that was sent to bind the shadow job to a real instance in the remote plan.

5 The bind between the shadow job and a real instance in the remote plan was established.

8 The job execution has been suspended.

A The job is waiting for a manual cleanup action to be initiated or discarded by a panel user (the cleanup type is manual).

B The job is waiting for a cleanup action to be started (the cleanup type is automatic or immediate).

C A restart and cleanup process is in progress (data set cleanup or step restart, or both). The job is waiting for the process to be completed.

D Close down is in progress.

E An error occurred during job submission or release.

G The operation is running on a WAIT workstation (it is a dummy operation waiting for the delay period to elapse).

H A panel user has used the HOLD command on the operation.

L The operation is a late time-dependent operation with the suppress-if-late attribute.

M The status of the operation has been manually set.

N A panel user has used the NOP command on the operation.

O Workstation is offline.

Q For z/OS jobs the job has been added to the JES job queue. For fault-tolerant workstations, it is waiting for submission.

R The operation has ended in error but was automatically reset (the completion code is defined in the installation options to be automatically reset).

S The job or started task is executing.

T Waiting until a particular time.

U Submit is in progress.

V The limit value of this fault-tolerant workstation was reached.

W Waiting for scheduling environment.

X Waiting for resource.

Y The job ended with an error code matching a NOERROR entry.

For operations on computer workstations, a blank extended status has a particular meaning for the following statuses:

Arrived (A) or Ready (* or R)
The scheduler is in the process of submitting this job. The scheduler is waiting for the availability of a parallel server or a critical resource, or the operation is not to be submitted automatically.

Started (S)
The job has been successfully submitted but has not yet been reported as added to the JES job queue.

Error codes

The scheduler assigns error codes to certain operations and to job and started task steps. These codes are used by the automatic job recovery function to decide a recovery action.

CAN The job or started task was canceled by the operator or by a TSO user before execution. This code is also possible if the job-termination event (type 3P) is missing.

CCUN
The completion code is unknown. The job or started task has ended, but no completion code is available. This code is also possible if the job-end event (type 3J) is missing.

Check the job log and SYSLOG.

CLNA
A failure occurred when IBM Workload Scheduler for z/OS attempted to complete the JCL tailoring during the restart and cleanup process.

CLNC
A failure occurred when IBM Workload Scheduler for z/OS attempted to execute the data set cleanup during the restart and cleanup process.

CLNO
A failure occurred when IBM Workload Scheduler for z/OS attempted to retrieve the historical job log data during the restart and cleanup process. *nnnn* Step return code. **S** *xxx* System abend code. **U** *xxx* User abend code in hexadecimal notation. For example, user abend 2750 is represented in IBM Workload Scheduler for z/OS as UABE. *xxxx* User-defined error code.

CLNP A failure occurred in the EQQCLEAN step, during the run of a restarted job.

JCCE An error during JCC (job completion checker) processing prevented the JCC from determining an error code for the operation.

FBND
The request to bind the shadow job with a real instance of the remote plan failed.

JCL A JCL error was recognized after the job or started task began to execute, or a JCL error was recognized after syntax checking in the internal reader.

JCLI A JCL error occurred immediately; that is, the error was detected before the job or started task began. This code is also possible when both the job-start event (type 2) and the job-end event (type 3J) are missing. On IBM Workload Scheduler for z/OS Agent workstations, this code is returned when a parsing error occurs in the JOBREC statement.

LOOP
The workstation analyzer task has tried to start the same operation repeatedly and message EQQW534E has been stored in the controller MLOG to signal a loop. To stop the loop, the operation was set to error with error code LOOP.

MCP The operation was manually set to error in the MCP panel.

OAUT
While running the System Automation command specified with the operation, the System Automation exit EQQUXSAZ issued a return code different from 0. The operation status is set to E. Check for System Automation messages in the log specified in the AUTOMATIONMSG parameter of the OPCOPTS statement.

OF*xx* The system that the operation is defined on has gone offline. The WSOFFLINE parameter on the JTOPTS initialization statement specifies that started operations should be marked as ended-in-error. *xx* is the status and extended status of the failing operation. Operations that were running (status SS) have a step-code error status of OFFL.

OJCV
An error occurred during JCL-variable substitution when the job or started task was submitted, or IBM Workload Scheduler for z/OS detected an error in the RECOVER statement during automatic recovery. Browse the JCL for the operation or the EQQMLOG data set to find more information about the failure.

This error code can also be issued when an error occurred during variable substitution in a System Automation command text. The operation status could be set to E, based on the SAVARFAIL parameter set in the OPCOPTS initialization statement. To identify the variables not resolved and the type of error occurred, check for the messages related to occurrence variable substitution in EQQMLOG.

OSEQ
A job or started task began to execute before all its predecessors have completed. This can occur only if the job was not submitted by IBM Workload Scheduler for z/OS and if either HOLDJOB(NO) or HOLDJOB(USER) is specified for IBM Workload Scheduler for z/OS event writer options. For fault-tolerant agents, the OSEQ code can indicate that a dependency on another operation or a special resource was added after the job started, but before the event reached the controller. See *Customization and Tuning*.

OSUB
A failure occurred when IBM Workload Scheduler for z/OS attempted to submit a job or start a started task. In the case of a started task, it could be

that the started task is a subsystem that is not started by JES, or IBM Workload Scheduler for z/OS subsystem EQQSTC ddname is not allocated to a JES-defined procedure library. The operation should be marked as ended-in-error.

For jobs running on IBM Workload Scheduler for z/OS Agent workstations and z/OS shadow jobs, OSUB indicates that the job submission failed.

OSUF

A failure occurred when IBM Workload Scheduler for z/OS attempted to retrieve the JCL for a job or started task. This code is set if the SUBFAILACTION keyword of the JTOPTS initialization statement specifies that the operation should be marked as ended-in-error. This code is also caused if you have JOBCHECK(SAME) and the job name in the application description does not match the one on the job card. Another reason for this code is a job is missing JCL that was packed by ISPF in EQQJBLIB.

In end-to-end scheduling with fault tolerance capabilities, this code indicates that an error occurred while the scheduler was queuing the submission event for the job. For jobs with centralized scripts it might also show that IBM Workload Scheduler for z/OS could not download the script to the distributed agent.

OSUP

A time operation is late, and the SUPPRESSACTION parameter of the JTOPTS initialization statement specified that the operation should be marked as ended-in-error. **OS***xx* The system on which the operation is defined has failed. The WSFAILURE parameter on the JTOPTS initialization statement specifies that started operations should be marked as ended-in-error. *xx* is the status and extended status of the failing operation. Operations that were running (status SS) have a step-code error of OSYS.

OS*xx* The system on which the operation is defined has failed. The WSFAILURE parameter on the JTOPTS initialization statement specifies that started operations should be marked as ended-in-error. *xx* is the status and extended status of the failing operation. Operations that were running (status SS) have a step-code error of OSYS.

PCAN

A print operation was canceled by the operator.

nnnn Step return code.

SERC An operation submitted in a Restart and Clean up path (via dialogue but also automatically, for example, when clean up was set to AUTOMATIC) was not submitted because the required scheduling environment was not available..

SEUN An operation required a scheduling environment that is unknown to WLM; for this reason it was not submitted.

SHPF The request to bind the shadow job is rejected.

S*xxx* System abend code.

U*xxx* User abend code in hexadecimal notation. For example user abend 2750 is represented in IBM Workload Scheduler for z/OS as UABE.

xxxx User-defined error code.

Job log retrieval status codes

When the job log retrieval function is used, IBM Workload Scheduler for z/OS maintains status information to report on the retrieval of the log. The following status codes are possible:

C Completed; the controller has received the log.

E Error. There was an error retrieving the log.

I Initiated. The controller has sent a retrieval request to the tracker, but the tracker has not yet processed the request.

S Started. The controller has sent a retrieval request to the tracker, and the tracker has started to retrieve the log.

blank The controller has not sent any retrieval request to the tracker.

Operation reason codes

If your ready list layout includes the RSNC field, you can see these operation reason codes. Note that the codes are listed in hierarchical order. For example, if job submission failed, and job submission is deactivated, code D is obtained, not code F.

A Automatic reset error condition
C Workstation is closed
D Job submission deactivated
F Job submission failed
H Closedown in progress
J No automatic job submission
L Job is late
O Work station is offline
P All parallel servers in use
S Waiting for special resource
T Start time not reached
U Work station is unlinked
W Waiting for scheduling environment
1 Not enough free WS resource 1
2 Not enough free WS resource 2

Appendix F. Fields displayed in ready and error lists

This appendix contains a list of fields that you can display in the ready list and the error handling list. In this table, the Length column is the maximum length (in bytes) of the data in the field.

Table 55. Fields available for display in ready and error lists

Column title	Length	Description of column contents
PR#	04	Number of predecessor operations
PS#	03	Number of parallel servers required by the operation
UPR#	04	Number of uncompleted predecessor operations
R1#	03	Number of 1st WS resources required by the operation
R2#	03	Number of 2nd WS resources required by the operation
SR#	03	Special resources referenced by the operation
SU#	04	Number of successor operations
Arrived	08	Operation arrival date, actual if arrived
Ard	03	Operation arrival day, actual if arrived
time	05	Operation arrival time, actual if arrived
Application	16	Application ID
Act dur	07	Actual duration of the operation
A	01	Automatic error-completion indicator, Y or N
Ended	08	End date of the operation, or blank
End	03	End day of the operation, or blank
time	05	End time of the operation, or blank
H	01	Automatic hold/release indicator, Y or N
Owner	16	Application owner ID
Started	08	Actual start date of the operation
Std	03	Actual start day of the operation
time	05	Actual start time of the operation
S	01	Automatic job submission, Y or N
Application text	24	Verbal description of the application
JLOG	01	Status of job log retrieval
CLN_Ty	01	Cleanup type
CLN_Re	01	Cleanup result
RC_St	01	Internal restart and cleanup status, for debugging only
C	01	Critical path, F-1st (Y=on path, N=not)
S	01	Current status of the operation
T	01	Dependency type, P=predecessor, S=successor
W	01	Deadline WTO, Y or N
E dur	05	Estimated duration of the operation
Errc	04	Error code of the operation, otherwise blank
FTW Return Code	11	The return code for jobs on fault-tolerant workstations
Destination	08	Execution destination ID
Form no.	08	Form number or blank
Authgrp	08	Authority group
Ia date	08	Application input arrival date (after MCP)
Ia day	03	Application IA day, (<) preceding month, (>) next
Ia time	05	Application input arrival time (after MCP)
I start	08	Intermediate start date after interrupt
ISt	03	Intermediate start day after interrupt
time	05	Intermediate start time after interrupt
Jobname	08	Job name

Table 55. Fields available for display in ready and error lists (continued)

Column title	Length	Description of column contents
C	01	Job, SYSOUT class, or blank
Job id	08	JES job ID
S	01	Job status (I) init, (H) held, (Q) released
L	01	Latest out time passed
Last out	08	Latest out date of the operation
Lo	03	Latest out day of the operation
time	05	Latest out time of the operation
Last upd	08	Time stamp of last MCP update in the format MMDDHHmm (month, day, hour and minutes)
H	01	Operation manually HELD by user
N	01	Operation NOPed by user
no.	03	Operation number
Deadline	08	Deadline date of the operation
Dl	03	Deadline day of the operation
time	05	Deadline time of the operation
Plan ia	08	Planned input arrival date of operation
Ia	03	Planned input arrival day of operation
Oi	01	Operator instructions available
time	05	Planned input arrival time of operation
Plan end	08	Planned end date of the operation
End	03	Planned end day of the operation
time	05	Planned end time of the operation
P	01	On preparation workstation, Y or N
P	01	Priority of the operation
Pl start	08	Planned start date of the operation
St.	03	Planned start day of the operation
time	05	Planned start time of the operation
Transp	06	Transport time, from previous WS to this WS
Rdr date	08	Date the reader recognized the job card
Rdr t	05	Time the reader recognized the job card
L	01	Time job suppressed if late, Y or N
R	01	Reroutable operation, Y or N
R	01	Restartable operation, Y or N
RSNC	01	Reason code
St	02	Operation status, current and extended status
T	01	Time job indicator, Y or N
Operation text	24	Verbal description of the operation
User data	16	Operation user data
U	01	Urgency indicator
RE	01	Operation rerouted, Y or N
ws	04	Workstation
T	01	Workstation type
WTO ws	01	Workstation is a WTO
Dur.	07	Actual duration, if completed, otherwise estimated
Inp arr	08	Operation IA date, actual if arrived
Ia	03	Operation IA day, actual if arrived, otherwise planned
time	05	Operation IA time, actual if arrived
X	01	Extended status of the operation
Ended	08	End date, actual if ended, otherwise planned
End	3	End day, actual if ended, otherwise planned
time	05	End time, actual if ended, otherwise planned
Start	08	Operation start date, actual if started
St	03	Operation start day, actual if started

Table 55. Fields available for display in ready and error lists (continued)

Column title	Length	Description of column contents
time	05	Operation start time, actual if started
Actual dur	10	Actual duration of the operation in seconds
Est dur	08	Estimated duration of the operation in seconds
Duration	10	Actual duration, if completed, otherwise estimated in seconds

Appendix G. Defining event rules and invoking EQQLSENT macro

This chapter contains the following sections:

- "Syntax to define event rules"
- "Event rule examples" on page 852
- "Invoking the EQQLSENT macro" on page 854

Syntax to define event rules

This section describes the syntax to edit the EVLIB.XML data set, that is referenced as SYSIN in the EQQTRBLS skeleton (produced when running EQQJOBS).

While editing the EVLIB.XML data set, consider using the HILITE ON XML or HILITE LOGIC XML editor commands. They require a record length equal to 255, as specified in the EQQPCS01 sample.

The following is a list of all the language elements used for defining an event rule. Table 56 explains the meaning of the notation that follows each language element. *n* represents an unbounded number.

Table 56. Valid number of occurrences for a language element

Notation	Meaning
(0, 1)	0 indicates that the language element is optional. 1 indicates that if coded, only 1 occurrence is allowed.
(0, n)	0 indicates that the language element is optional. n indicates that if coded, multiple occurrences are allowed.
(1, 1)	The first 1 indicates that the language element is required. The second 1 indicates that only 1 occurrence is allowed.
(1, n)	1 indicates that the language element is required. n indicates that multiple occurrences are allowed.

- eventRule name=" " ruleType=" " isDraft=" " (1, 1)
  - description (0, 1)
  - eventCondition eventProvider=" " eventType=" " (1, 1)
    - filteringPredicate (1,1)
      - attributeFilter name=" " operator="eq" (1, n)
        - value (1, 15)
  - action actionProvider=" " actionType=" " responseType=" " (1,1)
    - description (0, 1)
    - parameter name=" "(0, n)
      - value (0, 1)

Event rule definitions are grouped into event rule sets.

- eventRuleSet (1, 1)
  - eventRule (1, n)

Use the `eventRuleSet` language element also if you have to enclose a single rule definition.

To include comments in the XML file, use the form `<!--text-->`.

Arguments

The keywords describing an event rule are the following XML tags:

eventRule

It includes:
- A number of required and optional rule attributes.
- One event condition.
- One action.

The rule attributes are:

- Required attributes:

  name The name of the event rule. You can specify up to 40 characters, blank and special characters included. It is a label making easier to identify each rule in the XML file. Configuration files do not contain this data.

  ruleType
  Always set to `filter`.

  isDraft
  Values can be **yes** or **no**. Specify **no** to activate the corresponding rule definition. Specify **yes** to deactivate the corresponding rule definition or to check its syntax without activating it. The default is **no**.

- Optional attributes:

  description
  A description of the rule. It can be of up to 120 characters.

eventCondition
The event condition is made up by the following attributes:

eventProvider
Identifies the event monitoring provider that can capture a type of event. `SMF` only is currently supported.

eventType
Specifies the type of event that is to be monitored. Table Table 57 lists the valid types. Click the event types to see their properties.

Table 57. `SMF` events

Event type	Event trigger
ReadCompleted	A data set is closed after it was opened in read mode.
ModificationCompleted	A data set is closed after it was opened in write mode. This event is sent also when you create an empty data set.

filteringPredicate
To filter the event conditions that are to be monitored. It is made up by:

attributeFilter
The attribute filter is a particular attribute of the event that is to be monitored:

- It is defined by the following elements:

  name The attribute, or property name, of the event that is to be monitored. Refer to Table 58 for a list of the supported property names.

  operator
  Always set to `eq` (equal).
- It includes a list of:

  value The value on which the operator must be matched. You can specify up to 15 values.

  Items in the `value` list works with the same behavior as the OR operator in the boolean logic.

Items in the `attributeFilter` list works with the same behavior as the AND operator in the boolean logic.

action The action that is to be triggered if the event is detected. Event rule definitions with events but no actions are syntactically accepted, although they may have no practical significance. You may save such rules as draft, by specifying isDraft="yes", and add actions later before they are deployed.

- Is defined by the following required attributes:

  actionProvider
  The name of the action provider that can implement one or more configurable actions. `Tracker` only is currently supported.

  actionType
  Specifies the type of action that is to be triggered when a specified event is detected. `SpecialResourceEvent` only is currently supported.

  responseType
  Specifies when the action is to run. Always set to `onDetection`, meaning that the action starts as soon as all the events defined in the rule have been detected.
- Includes the following optional attributes:

  description
  A description of the action. It can be of up to 120 characters. It is a label making easier to identify each action in the XML file. Configuration files do not contain this data.
- Includes a list of one or more parameters, or property names. Every parameter is defined by:

  parameter name=" "
  See Table 59 on page 851 for a list of the supported parameters, or property names.

  value See Table 59 on page 851 for a list of possible values or value types.

Table 58 shows the relationship between name and value of `attributeFilter` .

Table 58. Parameters of ReadCompleted and ModificationCompleted event types

attributeFilter name	Type	Required	Wilcard allowed	Length (min-max)		Default value
FileName	string	✓	✓	1	44	
Destination	string	✓		1	8	

Table 58. Parameters of ReadCompleted and ModificationCompleted event types (continued)

attributeFilter name	Type	Required	Wilcard allowed	Length (min-max)		Default value
Userid	string		✓	1	8	*
Jobname	string		✓	1	8	*

Note: For parameters with wildcard allowed, you can use the following wildcards:

***** To match any sequence of characters.

? To match any single character. For example, if you specify AB?, ABC is a match, AB or ABCD are not a match.

% For compatibility with earlier versions, it is supported for the same function as ?.

The following list provides a detailed description of the parameters:

FileName
Specifies the data set name to be monitored for actions on special resources. For details about how the tracker requests to change the resource availability, based on the specified `FileName` value, see "Effects on special resource availability" on page 475.

Destination
The destination of the action provider, that is the tracker where the specified data sets are located. Specify $$$$$$$$ to identify a local destination.

Userid
Specifies a generic character string to be compared with the SMF*xx*UID field, which contains the user identification associated with the job, started task, or TSO user that requested the activity against the data set that resulted in the data set close.

Note: The SMF user ID field may contain a blank value. Refer to *z/OS System Management Facilities* for more information about the SMF*xx*UID or SMF*xx*UIF field.

If you need to control SR availability events based on the user ID and the SMF value is blank in your installation, consider using the IEFUJI exit to insert the user ID. You are recommended to specify SETUID=YES on the EQQEXIT macro when you generate the IEFUJI exit: this sets the JMRUSEID field, which SMF then copies to the SMF user ID field.

If you want to update the JMRUSEID field yourself, the user ID is most easily taken from the ACEEUSRI field in the ACEE, pointed to from the ASXB, pointed to from the ASCB. This can be located as follows:

```
PSAAOLD  ===> ASCB
ACSBASXB ===> ASXB
ASXBSENV ===> ACEE
ACEEUSRI ===> userid
```

The DSECTs needed are mapped by these macros:

Area	Macro	Library
PSA	IHAPSA	SYS1.MACLIB

Area	Macro	Library
ASCB	IHAASCB	SYS1.MACLIB
ASXB	IHAASXB	SYS1.MODGEN
ACEE	IHAACEE	SYS1.MACLIB

The JMR, mapped by IEFJMR, is already available in the EQQEXIT expansion in IEFUJI.

Jobname
Specifies a generic character string to be compared with the SMF14JBN, SMF15JBN, or SMF64JMN field, which contains the name of the job, started task or TSO user that requested the activity against the data set that resulted in the data set close.

If the data set is to be processed by FTP, JOBNAME corresponds to the ** USERID ** under which the data set is received. That is, the USERID supplied when the remote host opened the FTP session to PUT the data set, or when a local user (or batch job) opened the FTP session to GET the data set.

Table 59 shows the parameters for `SpecialResourceEvent` action type. All of them are optional.

Table 59. Parameters of SpecialResourceEvent action type

Property name	Type	Default value
Availability	string Value can be Yes or No	Yes
LifeSpanAction	string Value can be Yes, No, or Reset	Reset
LifeSpanTime	numeric (1–999999)	

Detailed parameter descriptions follow:

Availability
Specifies that the special resource, which the action refers to, must be set to available (Yes) or unavailable (No).

LifeSpanAction
Specifies the value to which the global availability of the special resource is reset, after the interval of time specified by LifeSpanTime has expired. Allowed values are:

Yes Sets the global availability to Yes

No Sets the global availability to No

Reset Sets the global availability to blank

This keyword is valid only if LifeSpanTime is specified.

LifeSpanTime
Specifies the interval of time, in minutes, after which the global availability of the special resource is reset to the value specified by LifeSpanAction.

Event rule examples

The following examples show how to combine language elements and use wildcards.

Basic scenario

It applies to the scenario described in "Business scenario" on page 471.

```
<?xml version="1.0"?>
<eventRuleSet>
        <eventRule name="Monitor_FTP" ruleType="filter" isDraft="no">
          <description>To monitor data sent by FTP</description>
          <eventCondition eventProvider="SMF" eventType="ModificationCompleted">
            <FilteringPredicate>
                <attributeFilter name="FileName" operator="eq">
                    <value>TWSDEV.FALSI.TWS</value>
                </attributeFilter>
                <attributeFilter name="Destination" operator="eq">
                    <value>destX</value>
                </attributeFilter>
            </filteringPredicate>
          </eventCondition>
          <action actionProvider="Tracker" actionType="SpecialResourceEvent"
                  reponseType="onDetection"
            <description>Set TWSDEV.FALSI.TWS special res to available</description>
            <parameter name="Availability">
              <value>Yes</value>
            </parameter>
            <parameter name="LifeSpanAction">
              <value>No</value>
            </parameter>
            <parameter name="LifeSpanTime">
              <value>60</value>
            </parameter>
          </action>
        </eventRule>
</eventRuleSet>
```

Using wildcards

Suppose that:

- TWSDEV.AB.TWS, TWSDEV.AB1.TWS, TWSDEV.OLDAB.TWS, TWSDEV.NEWAB.TWS, TWSDEV.OLDAB1.TWS, and TWSDEV.NEWAB1.TWS are data sets shared among trackers with DEST1, DEST2 and DEST3 destinations.
-

  TWSDEV.AB.TWS and TWSDEV.AB1.TWS are not defined in the current plan or special resource database.

  The controller RESOPTS statement specifies DYNAMICADD(EVENT).

Consider the following XML data:

```
<?xml version="1.0"?>
<eventRuleSet>
        <eventRule name="Monitor_MultipleTriggers1" ruleType="filter" isDraft="no">
          <description>Monitor data set changes at DEST1 or DEST2</description>
          <eventCondition eventProvider="SMF" eventType="ModificationCompleted">
            <FilteringPredicate>
                <attributeFilter name="FileName" operator="eq">
                    <value>TWSDEV.AB*.TWS</value>
                </attributeFilter>
                <attributeFilter name="Destination" operator="eq">
                    <value>dest1</value>
                    <value>dest2</value>
```

```
            </attributeFilter>
          </filteringPredicate>
        </eventCondition>
        <action actionProvider="Tracker" actionType="SpecialResourceEvent"
                reponseType="onDetection"
        <parameter name="Availability">
          <value>Yes</value>
        </parameter>
        <parameter name="LifeSpanAction">
          <value>No</value>
        </parameter>
        <parameter name="LifeSpanTime">
          <value>60</value>
        </parameter>
        </action>
      </eventRule>
      <eventRule name="Monitor_MultipleTriggers2" ruleType="filter" isDraft="no">
        <description>Monitor data set changes at DEST3</description>
        <eventCondition eventProvider="SMF" eventType="ModificationCompleted">
          <FilteringPredicate>
              <attributeFilter name="FileName" operator="eq">
                  <value>TWSDEV.???AB*.TWS</value>
              </attributeFilter>
              <attributeFilter name="Destination" operator="eq">
                  <value>dest3</value>
              </attributeFilter>
          </filteringPredicate>
        </eventCondition>
        <action actionProvider="Tracker" actionType="SpecialResourceEvent"
                reponseType="onDetection"
        </action>
      </eventRule>
</eventRuleSet>
```

According to the previous event rules:

- At DEST1 or DEST2 destination, when SMF writes records that trace TWSDEV.AB.TWS or TWSDEV.AB1.TWS as closed data sets, the tracker requests the controller to define TWSDEV.AB.TWS or TWSDEV.AB1.TWS as available special resources.
- At DEST3 destination, when SMF writes records that trace TWSDEV.OLDAB.TWS, TWSDEV.NEWAB.TWS, TWSDEV.OLDAB1.TWS, and TWSDEV.NEWAB1.TWS as closed data sets, the tracker requests the controller to update the definition of TWSDEV.OLDAB.TWS, TWSDEV.NEWAB.TWS, TWSDEV.OLDAB1.TWS, and TWSDEV.NEWAB1.TWS special resources, setting them to available.

Setting isDraft to yes

Setting to "yes" the isDraft attribute in all the rules defined in “Using wildcards” on page 852 deactivates the trigger definitions for DEST1, DEST2, or DEST3 destinations.

Selecting EQQEVLIB members to be updated

To update specific EQQEVLIB members, run EQQRXTRG by using an input XML file that references only those Destination values corresponding to the members to be updated. For example, suppose that EQQEVLIB contains DEST1, DEST2, and DEST3 members defined according to “Using wildcards” on page 852. To update the LifeSpanTime value for DEST2 only, use an XML file with the following data:

```
<?xml version="1.0"?>
<eventRuleSet>
      <eventRule name="Monitor_MultipleTriggers3" ruleType="filter" isDraft="no">
        <description>Monitor data set changes at DEST2</description>
```

```
            <eventCondition eventProvider="SMF" eventType="ModificationCompleted">
              <FilteringPredicate>
                  <attributeFilter name="FileName" operator="eq">
                      <value>TWSDEV.AB*.TWS</value>
                  </attributeFilter>
                  <attributeFilter name="Destination" operator="eq">
                      <value>dest2</value>
                  </attributeFilter>
              </filteringPredicate>
            </eventCondition>
            <action actionProvider="Tracker" actionType="SpecialResourceEvent"
                    reponseType="onDetection"
              <parameter name="Availability">
                <value>Yes</value>
              </parameter>
              <parameter name="LifeSpanAction">
                <value>No</value>
              </parameter>
              <parameter name="LifeSpanTime">
                <value>30</value>
              </parameter>
            </action>
          </eventRule>
</eventRuleSet>
```

A rule definition specifying isDraft="yes" produces members containing no data set list.

Invoking the EQQLSENT macro

The following procedure is supported only for compatibility with earlier versions. To exploit the current support for data set triggering, refer to Chapter 24, "Running event-driven workload automation," on page 471.

When the data set triggering function is used, you specify the data sets for which you want events generated by building the data set selection table EQQDSLST. The EQQDSLST is created by invoking the EQQLSENT macro. The following sections describe how you invoke the EQQLSENT macro. This appendix contains General-use Programming Interface and Associated Guidance Information.

Note: The current support for data set triggering is based on the EQQEVLST configuration file. If EQQJCLIB contains both EQQEVLST and EQQDSLST, the resulting triggering selection table is the union of EQQEVLST and EQQDSLST. In this case, EQQEVLST data is processed first. If EQQJCLIB contains only EQQDSLST, the tracker loads it as triggering selection table.

Invoking EQQLSENT to create EQQDSLST

The EQQLSENT macro is used to create entries in the data set triggering selection table. The selection table is loaded into ECSA when the IBM Workload Scheduler for z/OS event writer is started.

The sample EQQLSJCL in the SEQQSAMP library can be used to invoke the EQQLSENT macro.

Macro invocation syntax for EQQLSENT
Purpose

EQQLSENT produces an entry in the data set triggering selection table, EQQDSLST. EQQDSLST is used in SMF exit IEFU83 by the data set triggering

function to decide which SMF records to process. When an SMF 14, 15, or 64 record matches a condition in EQQDSLST, a special resource availability event is created and broadcast to all IBM Workload Scheduler for z/OS subsystems defined on the system where the SMF record was created.

Syntax

STRING= *string* | **LASTENTRY**
POS= *numeric position*
USERID= *user ID filter criteria*
JOBNAME= *jobname filter criteria*
AINDIC={Y | **N}**
LIFACT={Y | **N** | **R}**
LIFTIM=*interval*

Parameters

STRING=*string* | **LASTENTRY**

Required keyword specifying the character string to be searched for. The string can be 1 to 44 characters long. To identify the fully-qualified last level of a data set name, add a space as the last character and enclose the string in single quotation marks. Consider this example. You have two data sets:

```
DSN.NAME.AB
DSN.NAME.ABC
```

Specify `STRING=DSN.NAME.AB,POS=1` if you want SR availability events created for both data sets. Specify `STRING='DSN.NAME.AB ',POS=1` if you want events created only for the first data set.

When EQQLSENT is invoked with STRING=LASTENTRY it generates an end of table indicator. After having invoked EQQLSENT with keyword parameters STRING and POS a number of times, EQQLSENT must be invoked one last time with STRING=LASTENTRY in order to complete the table.

To create an empty EQQDSLST, just invoke EQQLSENT once, with STRING=LASTENTRY. When an empty list is used by IEFU83, no SR events are created.

POS=*numeric position*

A required keyword specifying the numeric position where the string begins.

USERID=*string*

Optional keyword specifying a generic character string to be compared with the SMF*xx*UID field, which contains the user identification associated with the job, started task, or TSO user that requested the activity against the data set that resulted in the data set close. The string can be 1 to 8 characters long.

Note: The SMF user ID field may contain a blank value. Refer to *z/OS System Management Facilities* for more information about the SMF*xx*UID or SMF*xx*UIF field.

If you need to control SR availability events based on the user ID and the SMF value is blank in your installation, consider using the IEFUJI exit to insert the user ID. You are recommended to specify SETUID=YES on the

EQQEXIT macro when you generate the IEFUJI exit: this sets the JMRUSEID field, which SMF then copies to the SMF user ID field.

If you want to update the JMRUSEID field yourself, the user ID is most easily taken from the ACEEUSRI field in the ACEE, pointed to from the ASXB, pointed to from the ASCB. This can be located as follows:

```
  PSAAOLD  ===> ASCB                  ACSBASXB ===>
ASXB                               ASXBSENV ===> ACEE
                                           ACEEUSRI ===> userid
```

The DSECTs needed are mapped by these macros:

Area	Macro	Library
PSA	IHAPSA	SYS1.MACLIB
ASCB	IHAASCB	SYS1.MACLIB
ASXB	IHAASXB	SYS1.MODGEN
ACEE	IHAACEE	SYS1.MACLIB

The JMR, mapped by IEFJMR, is already available in the EQQEXIT expansion in IEFUJI.

JOBNAME=*string*
Optional keyword specifying a generic character string to be compared with the SMF14JBN, SMF15JBN, or SMF64JMN field, which contains the name of the job, started task or TSO user that requested the activity against the data set that resulted in the data set close. The string can be 1 to 8 characters long.

If the data set is to be processed by FTP, JOBNAME corresponds to the ** USERID ** under which the data set is received. That is, the USERID supplied when the remote host opened the FTP session to PUT the data set, or when a local user (or batch job) opened the FTP session to GET the data set.

AINDIC={Y|N}
Optional keyword specifying that the special resource is available (Y) or unavailable (N). The default is that the resource available.

LIFACT={Y|N|R}
Optional keyword specifying the value to which the global availability of the special resource is reset, after the interval of time specified by LIFTIM has expired. Allowed values are:

Y Sets the global availability to Yes

N Sets the global availability to No

R Sets the global availability to blank

This keyword is valid only if LIFTIM is specified. The default is R.

LIFTIM=*interval*
Optional keyword specifying the interval of time, in minutes, after which the global availability of the special resource is reset to the value specified by LIFACT. The allowed range is from 1 to 999999.

Note:

1. The output from assembling the EQQLSENT macro must be placed in the EQQDSLST member in the data set referenced by the ddname EQQJCLIB.

2. Generation Data Group data sets are specified by the group name. For example, when a GDG data set with the name 'DSN.OPCSUBS.GDG.G0001V00' is closed the special resource event contains resource name 'DSN.OPCSUBS.GDG'.
3. For a partitioned data set, the member name is not part of the resource name in the SR event.
4. For VSAM data sets the resource name in the SR event is the cluster name (without the DATA or INDEX suffix).

Example

```
EQQLSENT STRING=SYS1.MAN,POS=1
EQQLSENT STRING='TEST.DSCLOSE ',POS=1,USERID=SYSOP
EQQLSENT STRING=CP2,POS=12
EQQLSENT STRING=EQQDATA.EXCL,POS=5
EQQLSENT STRING='DSN.OPCSUBS.GDG ',POS=1
EQQLSENT STRING=LASTENTRY
END
```

In this example, SMF records with:
- A data set name beginning with SYS1.MAN, or
- Data set name TEST.DSCLOSE and user ID SYSOP
- Records with CP2 in position 12, such as DSN.OPCSUB.CP2, or
- Records that have EQQDATA.EXCL starting in position 5
- The root of a GDG data set name

will cause SR availability events to be generated.

Messages

The following messages can be generated at assembly time:
- KEYWORD STRING IS REQUIRED
- KEYWORD POS IS REQUIRED
- POSITION MUST BE BETWEEN 1 AND 43
- NULL NAME NOT VALID
- NAME (STRING) GREATER THAN 44 CHARACTERS
- POSITION INVALID FOR NAME (STRING)
- USERID STRING NOT VALID
- JOBNAME STRING NOT VALID
- AINDIC MUST BE EITHER Y OR N
- POSITION NOT VALID FOR NAME (STRING)
- LIFACT MUST BE Y, N, OR R
- LIFTIM LENGTH NOT VALID
- LIFTIM VALUE NOT VALID
- LIFTIM VALUE 0 NOT ALLOWED

Return codes:
The following return code can be generated at assembly time:
12 Input invalid, check error messages.

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