IBM
Washington Systems Center
TechDocs

Configuring z/VM PerfKit for Performance Monitoring
z/VM 7.1 edition

February, 2019

Bruce Hayden

bjhayden@us.ibm.com

Notices

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not grant you any license to these patents. You can send license inquiries, in writing, to the IBM Director of Licensing, IBM Corporation, North Castle Drive, Armonk, NY 10504-1785.

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM websites are provided for convenience only and do not in any manner serve as an endorsement of those websites. The materials at those websites are not part of the materials for this IBM product and use of those websites is at your own risk.

The licensed program described in this document and all licensed material available for it are provided by IBM under terms of the IBM Customer Agreement, IBM International Program License Agreement or any equivalent agreement between us.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Statements regarding IBM's future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

This information may contain examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to actual people or business enterprises is entirely coincidental.

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corp., registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the web at IBM copyright and trademark information - United States (*www.ibm.com/legal/us/en/copytrade.shtml*).

Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both.

Other company, product, or service names may be trademarks or service marks of others.

z/VM 7.1 edition

This edition applies to z/VM Version 7 Release 1.

Find this document and other techdocs on the web at *http://www.ibm.com/support/techdocs/*

Comments may be addressed to:
Bruce Hayden
IBM Corporation
bjhayden@us.ibm.com

IBM may use or distribute any of the information you provide in any way it believes appropriate without incurring any obligation to you.

Abstract

This document is a step by step guide to configuring the IBM® Performance Toolkit for VM feature of z/VM® for your IBM Z® or IBM LinuxONE server. The configuration procedure is, of course, in the product documentation, but the steps listed here are the most straightforward method to get the product configured and working. If you are configuring a Single System Image (SSI) cluster of z/VM systems, the configuration requirements are also described in this document. After you get PerfKit running, a brief walk though of the product is also included. Finally, the steps to enable collection of Linux® on Z and LinuxONE data for either Red Hat®, SUSE® or Ubuntu® Linux is described.

The appendices describe how to collect raw monitor data using the MONWRITE user ID, how to process that data with PerfKit, and how to interface to PerfKit from another user ID to view real time performance data.

See Appendix D, “References” on page 43 for a list of web pages and documents for more information about z/VM, z/VM performance, and Performance Toolkit for VM.

Contents

Configuring z/VM PerfKit for Performance Monitoring

This document helps you configure the Performance Toolkit for VM performance monitoring feature. Running your system without knowing how it is performing is like driving a car without a dashboard. You know that you're moving, but you don't know how fast or how far you have gone. Plus, you have no idea if your car has any problems! By enabling and configuring PerfKit, you will have the tools and instruments needed to see what is going on.

Enabling and Configuring Performance Toolkit

The Performance Toolkit for VM is the performance data collection/analysis tool installed on your system as an optional priced pre-installed feature of z/VM. Since it is optional and licensed separately, it must be enabled and configured before it can be used. If you have not licensed this feature, then do not enable it on your system!

Enabling the Performance Toolkit for VM

The SERVICE command is used both to receive maintenance and to enable pre-installed program products in the SYSTEM CONFIG file. You should be logged on to the MAINT710 user ID to perform this task.

```
     Enter: SERVICE PERFTK ENABLE
            You will see several pages of messages ending with:
              ⋮
  Response: VMFSRV1233I The following products have been serviced.
            VMFSRV1233I PERFTK
            VMFSRV2760I SERVICE processing completed successfully
```

Do not continue with these instructions until you receive the VMFSRV2760I message indicating success and the CMS ready prompt. If it did not complete successfully, use the VMFVIEW command to view the log from the service command. Once you have fixed the problem, run the SERVICE command again and ensure it is successful.

Remember that the SERVICE command only needs to be run one time from any member of an SSI cluster. Therefore, you will not need to run the SERVICE command on another SSI member, if your system is in an SSI cluster.

Putting the Performance Toolkit into Production

The PUT2PROD command is used to update production disks by moving files updated by the SERVICE command to the production disks. From the MAINT710 user ID enter the following command:

```
     Enter: PUT2PROD PERFTK
            You will see several messages ending with:
              ⋮
  Response: VMFP2P1233I The following products have been put into production.
            Recycle the appropriate servers.
            VMFP2P1233I PERFTK
            VMFP2P2760I PUT2PROD processing completed successfully
```

Do not continue with these instructions until you receive the VMFSRV2760I message indicating success and the CMS ready prompt. If it did not complete successfully, use the VMFVIEW command to view the log from the PUT2PROD command. Once you have fixed the problem, run the PUT2PROD command again and ensure it is successful.

The PUT2PROD command only updates the production disks of the SSI member where the command is run. It must also be run on any other members to update the production disks on those members.

Configuring Performance Toolkit for VM

Modify the PROFILE EXEC of PERFSVM

The Performance Toolkit for VM uses the CP Monitor as its main source of performance and configuration data. The function of the PROFILE EXEC for the PERFSVM user ID is to issue the CP MONITOR commands required to select the appropriate data to be collected, starts the monitor, and starts the PERFKIT program. IBM supplies a sample PROFILE EXEC for PERFSVM that you modify to enable the collection of specific Monitor data domains.

You should still be logged on to the MAINT710 user ID to enter these commands. If the default Shared File System (SFS) selection was made for the PerfKit installation, then the PROFILE EXEC is found in SFS. Access this directory to edit the PROFILE EXEC.

Enter: **ACC VMSYS:PERFSVM. Z (FORCERW**

If SFS was not selected, the file exists on a minidisk. Link and access the disk.

Enter: **LINK PERFSVM 191 999 M**
Enter: **ACC 999 Z**

Now edit the PROFILE.

Enter: **X PROFILE EXEC Z**
Enter: **/CP MONITOR**
This command searches for this string in the exec

You will see several CP MONITOR commands that are inactive because they are inside comment delimiters. You will leave these lines alone (or delete them if you wish) and add the following lines:

```
'CP MONITOR SAMPLE ENABLE ALL'
'CP MONITOR EVENT  ENABLE ALL'
'CP MONITOR EVENT  DISABLE SCHEDULER ALL'
'CP MONITOR EVENT  DISABLE SEEKS     ALL'
```

We also want any virtual print files created by PerfKit automatically sent to MAINT710. Otherwise, these files just remain in the virtual printer queue of PERFSVM and never processed. On the blank line just before the PERFKIT MODULE is invoked, type in this text:

Enter: **'CP SPOOL PRT TO MAINT710'**

The end of file file should look like this:

```
/* 'CP MONITOR EVENT  ENABLE NETWORK'      */             /*@F1153MP*/
/* 'CP MONITOR EVENT  ENABLE ISFC'         */             /*@F1153MP*/
/* 'CP MONITOR EVENT  ENABLE SSI'          */             /*@F1153MP*/
'CP MONITOR SAMPLE ENABLE ALL'
'CP MONITOR EVENT  ENABLE ALL'
'CP MONITOR EVENT  DISABLE SCHEDULER ALL'
'CP MONITOR EVENT  DISABLE SEEKS     ALL'
'CP SPOOL PRT TO MAINT710'
'PERFKIT'                   /* Invoke the PERFKIT module   @FC012BD*/

Exit
```

You could have just removed the comment indicators from lines 40 to 52 and enabled the commands inside the comments. However, this may not enable all of the monitor settings. It is recommended to just enable all the domains, then disable ones that you want to be disabled. This way, if any new domains are added, they are automatically enabled. You may use whichever method you choose.

When you are finished, save your changes and exit from Xedit:

Enter: **FILE**

Create the configuration files

Before you can start the Performance Toolkit for VM, you will need to customize a few configuration files. Samples of these files are located on the 1CC minidisk of the user ID PERFSVM. The 191 minidisk is where you should store your own customized copies of these files. Copy the sample files from PERFSVM's 1CC disk to its “A” disk or directory. Continuing on the user ID MAINT710:

```
    Enter: VMLINK PERFSVM 1CC (IN COPY * * .FM = = Z (OLDDATE
 Response: DMSVML2060I PERFSVM 1CC linked as 0120 file mode X
           DMSVML2061I PERFSVM 1CC detached
```

Note: The VMLINK option “IN” is an abbreviation for INVOKE, which runs the COPYFILE command. The string “.FM” is the filemode of the PERFSVM 1CC disk after it is accessed by VMLINK.

Modify the FCONX $PROFILE

Now you will make a few changes to the primary configuration file of Performance Toolkit called FCONX $PROFILE. The changes activate three different interfaces to PerfKit: The VMCF interface, the APPC/VM interface, and the HTTP interface.

Enter: **X FCONX $PROFILE Z**
Enter: **/VMCF**

In order to enable the VMCF, APPC, or HTTP interfaces you must change the line that reads:

```
    *C MONCOLL VMCF ON
```

to

```
    FC MONCOLL VMCF ON
```

In order to activate the HTTP interface on port 81 you must change the line (about 6 lines farther down) that reads:

```
    *C MONCOLL WEBSERV ON TCPIP TCPIP 81
```
to
```
    FC MONCOLL WEBSERV ON TCPIP TCPIP 81
```

This example uses port 81, but you may choose any other port that is not already in use.

In PerfKit you can turn on the “emergency safeguard feature” (ESF) which enables PERFSVM to register to receive shutdown signals. This allows it to be notified when it is forced off of the system or z/VM is shutting down. PerfKit will automatically save to disk any data it has collected in memory before it terminates. For this example, the TREND and SUMMARY data are written to disk when PERFSVM is signaled.

In the sample file, the section that enables ESF is just below where the web server is enabled. If you do not see it on your screen, either scroll down or enter `/emergency` on the XEDIT command line. Change the line that reads:

```
    *C EMERGENC ORDER EXECPROC PRINT INTERIM TREND SUMMARY REMPRINT
```
to
```
    FC EMERGENC ORDER TREND SUMMARY
```

and the line that reads:

```
    *C EMERGENC ON
```
to
```
    FC EMERGENC ON
```

Save your changes and exit from Xedit:

Enter: **`FILE`**

Modify FCONX REPORTS

The default configuration of PerfKit creates reports every day at midnight. The reports are “printed” by PERFSVM to its virtual printer and placed in the spool with all the reports in a single spool file. The file FCONX REPORTS selects which reports are included in the spool file. The default selections in this file create every possible report, which can quickly fill up your spool space. This step changes the selection file so that no reports are created by default. Once you have your system set up, you will want to review the reports that are available and select reports you want created every day. You already included a command in the modifications made to the PROFILE EXEC on page 6 so that these reports are sent to the MAINT710 user when they are created.

Edit the FCONX REPORTS file and change every line to a comment:

Enter: **`X FCONX REPORTS Z`**
Enter: **`DOWN`**
`Moves to the first line of the file.`
Enter: **`CR *`**
`Uses the Column Replace command to put an asterisk in column 1.`
Enter: **`REPEAT *`**
`Repeats the column replace for all lines of the file.`
Enter: **`FILE`**
`Saves your changes and exits from Xedit.`

Create FCONRMT AUTHORIZ

In order any user to view performance data through any of the three interfaces (VMCF, APPC/VM, or HTTP), the user must be authorized. For the web interface to work properly, the PERFSVM service virtual machine must be authorized to function as a store and forward (S&F) server. Configure the FCONRMT AUTHORIZ file to provide that authorization and authorize the user MAINT710 the ability to request data from the Performance Toolkit for VM. You may authorize any other users that you wish to have access at this time by adding a line that gives the user DATA authority.

Enter: **XEDIT FCONRMT AUTHORIZ Z**
Enter: **INPUT**
Response: `DMSXMD573I Input mode:`

Enter the following lines into the file. The “VM01” and “VM02” are example names for 2 members of an SSI cluster. If your system is not an SSI cluster, only enter the lines with the system id VM01, but substitute your own system identifier. If your system is part of an SSI cluster, add lines for each cluster member.

```
*Node-ID User-ID  Authorized for ..
*|      |        |
VM01     PERFSVM  S&FSERV DATA CMD EXCPMSG
VM02     PERFSVM  S&FSERV DATA CMD EXCPMSG
VM01     MAINT710 DATA
VM02     MAINT710 DATA
```

Press Enter twice to leave Input mode and accept the input. Examine your screen and check that the lines match the example. (If it is all in upper case, that is OK.) Then enter `FILE` on the XEDIT command line to save the file.

Create FCONRMT SYSTEMS

In order for users to view performance data using the HTTP interface you need to create the FCONRMT SYSTEMS file. This file is necessary to identify each system, even if there is only one local system or cluster member.

Enter: **XEDIT FCONRMT SYSTEMS Z**
Enter: **INPUT**
Response: `DMSXMD573I Input mode:`

Enter the following lines into the file. Just like before, the “VM01” and “VM02” are example names for 2 members of an SSI cluster. Put in your correct system identifier. If you are only configuring a single system, just put in 1 line. If you have more than 2 SSI members, the nicknames for them are `FCXC1R03` and `FCXC1R04`.

```
*Node-ID PERFKIT-ID VM-Type Append Nickname
*|       |          |       |      |
VM01     PERFSVM    ZVM7.1  N      FCXC1R01
VM02     PERFSVM    ZVM7.1  N      FCXC1R02
```

Press Enter twice to leave Input mode and accept the input. Examine your screen and check that the lines match the example. (If it is all in upper case, that is OK.) Then enter `FILE` on the XEDIT command line to save the file.

Create UCOMDIR NAMES

You must also create a UCOMDIR NAMES file on the PERFSVM 191 disk. The default PerfKit resource names must be translated to unique resource names in the cluster. The UCOMDIR NAMES file specifies that translation. Each member in the SSI cluster has a unique UCOMDIR NAMES file that identifies the resource names for that member. If you are only configuring a single system, you still have to create a UCOMDIR NAMES file to translate the resource name.

Enter: **`XEDIT UCOMDIR NAMES Z`**
Enter: **`INPUT`**
Response: `DMSXMD573I Input mode:`

Enter the following lines into the file. The "*n*" on the :tpn. tag below must match the nickname you entered in the FCONRMT SYSTEMS file earlier for this system. For a single system "*n*" is always "1."

```
:nick.FCXRES00  :luname.*IDENT
                :tpn.FCXC1R0n
                :security.SAME
:nick.FCXSYSTM  :luname.*IDENT
                :tpn.FCXC1S0n
                :security.SAME
```

Press Enter twice to leave Input mode and accept the input. Examine your screen and check that the lines match the example. (If it is all in upper case, that is OK.) Then enter `FILE` on the XEDIT command line to save the file.

Now, release and detach the disk or directory of PERFSVM.

Enter: **`REL Z (DET`**

Start up PERFSVM

In order to use the HTTP interface of Performance Toolkit for VM, you must also have a PORT statement enabled in your PROFILE TCPIP that specifies the port to be used by PERFSVM. In this example, port 81 is used but it could be any port that is not already in use. If you have not reserved a port, you must configure it in TCPIP to continue. Log on to the user ID TCPMAINT and edit the PROFILE TCPIP file to add this PORT statement. It will look something like this:

```
PORT
  ⋮
  81   TCP PERFSVM   NOAUTOLOG ; Performance Toolkit for VM
  ⋮
```

TCPIP would need to be restarted for this change to take effect, but it can also be made dynamically using the NETSTAT command. TCPMAINT should be authorized to issue this command.

Enter: **`NETSTAT OBEY PORT 81 TCP PERFSVM NOAUTOLOG`**

After you have completed the changes to the configuration files above and released PERFSVM's mini-disks, you can start up the Performance Toolkit using the XAUTOLOG command.

Enter: **XAUTOLOG PERFSVM**

Automate the start-up of PERFSVM

You want PERFSVM to start up automatically each time z/VM starts up. To do this, you edit the PROFILE EXEC on the AUTOLOG1 191 disk. If RACF® for z/VM is also enabled on your system, the PROFILE EXEC on AUTOLOG2 191 is used instead. Use AUTOLOG2 for the user ID in the command below.

This example uses the VMLINK command to link and access the disk in one step. By adding the FILELIST option, it will link and access the disk, allow us to edit the file, and then release and detach the disk when you're finished.

Enter: **VMLINK AUTOLOG1 191 (WRITE FILELIST**

You are now in a FILELIST of the AUTOLOG1 191 disk. Since there should only be 1 file on the disk (the PROFILE EXEC), the cursor is already positioned on that file. Use the “XEDIT” function key to edit it.

Press: **PF11**

Find the area where you add “customer processing” statements, and add the start up of PERFSVM user. Add this line as shown:

Enter: **"CP XAUTOLOG PERFSVM"**

Save your changes:

Enter: **FILE**
Press: **PF3**
Response: `DMSVML2061I AUTOLOG1 191 detached`

PERFSVM is now configured

Log off of MAINT710 to finish.

Enter: **LOGOFF**

Configure PERFSVM on other SSI members

If you are configuring an SSI cluster, remember that each member is a unique z/VM host system with its own set of local resources. The PERFSVM service virtual machine you just configured on one member is not able to directly monitor any other members. You have to also set up PERFSVM on all other members so that each member is also monitored. You will be able to access PerfKit on any SSI member and see the performance data for all members once all members are set up.

Log on to each SSI member and repeat the steps from “Putting the Performance Toolkit into Production” on page 5 to “PERFSVM is now configured” on that member before continuing with these instructions. Here is a list of all the steps that must be completed:

__ 1. “Putting the Performance Toolkit into Production” on page 5

__ 2. “Configuring Performance Toolkit for VM” on page 6

Viewing Performance Data on PERFSVM

Open a 3270 emulator session to z/VM and logon to the user ID PERFSVM. You already started the server running with an XAUTOLOG command, so the first thing you see is PerfKit BASIC mode. You should see a fullscreen display that looks similar to this, although you may not see as many of these messages.

```
FCX001                 Performance Toolkit for VM               Autoscroll 12
 FCXBAS500I Performance Toolkit for VM FL710
 hh:mm:ss FCXAPP530I Connected to *IDENT for resource FCXC1R01
 hh:mm:ss FCXAPF530I Connected to *IDENT for resource FCXC1S01
 hh:mm:ss FCXTCP571I Connected to TCP/IP server TCPIP on path 0003
 hh:mm:ss FCXAPP527I User PERFSVM connected on path 0006
 hh:mm:ss FCXAPC535I Connected to resource FCXC1R01 on path 0005, for S&F-Coll
 hh:mm:ss FCXTCP575I WebServer host IP address is 192.168.18.nnn:00081
 hh:mm:ss FCXTCP590I WebServer interface activated
 hh:mm:ss Monitor event started -- recording is activated
 hh:mm:ss Monitor sample started -- recording is activated
 hh:mm:ss FCXAPP527I User PERFSVM connected on path 0007
 hh:mm:ss FCXAPC535I Connected to resource FCXC1R02 on path 0008, for S&F-Coll
 hh:mm:ss z/VM Version 7 Release 1, Service Level 1801 (64-bit),
 hh:mm:ss built on IBM Virtualization Technology
 hh:mm:ss There is no logmsg data
 hh:mm:ss FILES: nnnn RDR,   NO PRT,   NO PUN
 hh:mm:ss RECONNECTED AT hh:mm:ss EST FRIDAY mm/dd/yy




Command ===>
F1=Help  F2=Redisplay  F3=Quit  F12=Return
```

If all you see is a blank screen, pressing the `Enter` key should place you in PerfKit BASIC mode and then you should see the screen above. Your screen may not show all the messages listed above because some have already been hidden. The Redisplay function (PF2) allows you to review the console log for the PERFSVM virtual machine and see any hidden messages. Examine the PERFSVM console log to see what messages were produced when it started:

Press: **PF2**

Use PF7 to scroll backwards and PF8 to scroll forward. When you are finished looking through the log, pressing PF12 returns you to the initial BASIC mode screen. To begin looking at performance data from your z/VM SSI cluster, enter the MONITOR subcommand, which can be abbreviated as MON:

Press: **PF12** This will return you to the BASIC mode screen
On the command line:
Enter: **MON**

You should see the Performance Screen Selection menu for your system shown in Figure 1.

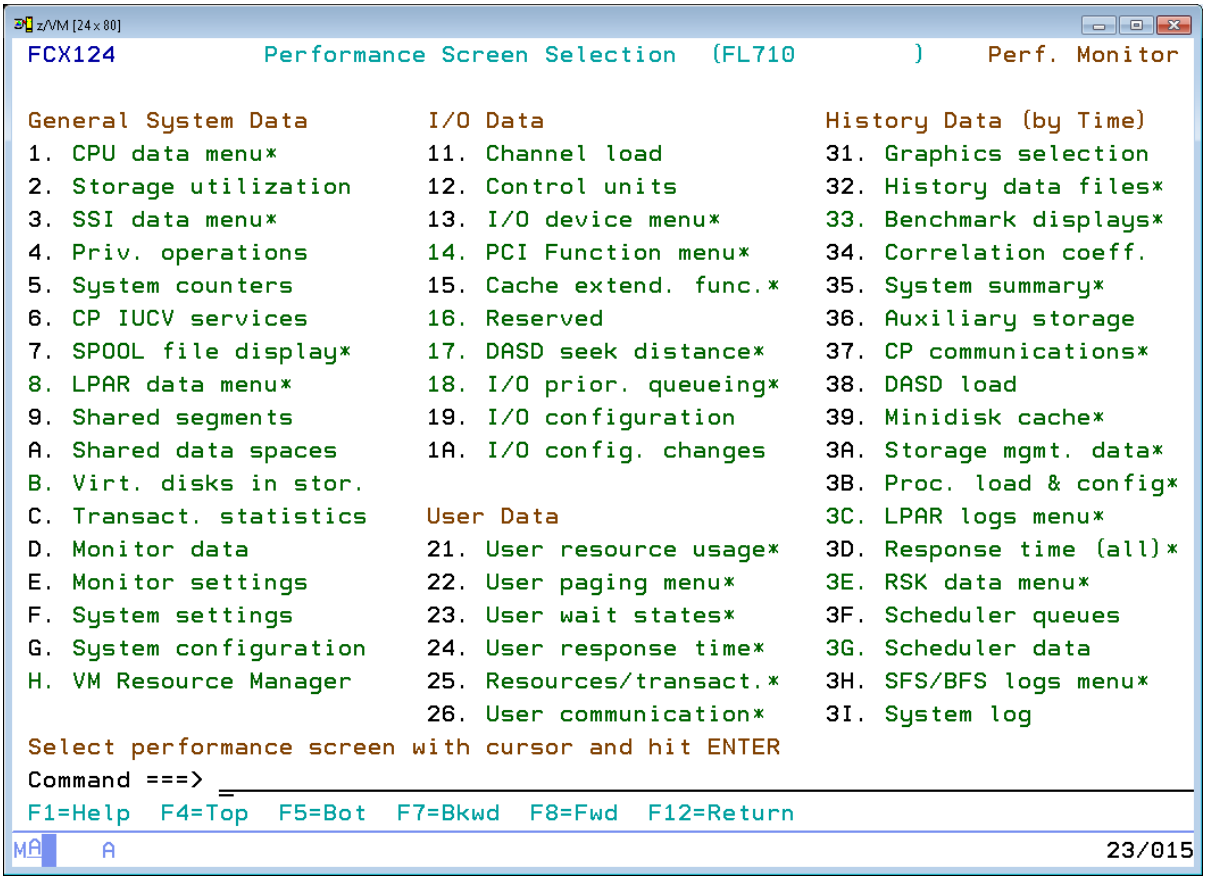

Figure 1. PerfKit 3270 menu

The number of lines shown in the examples in these instructions and the number of lines you see on your screen may be different because you have a larger emulated 3270 screen. The screens in these instructions assume a default 24 line screen. In the screen shown above, notice that F7 and F8 are displayed as active function keys. This indicates that the number of lines of information that PerfKit needs to display is more than the current screen size. You must use these keys to scroll forward and back to see all the reports available. If you have your 3270 screen emulating a larger model of 3270, then F7 and F8 may not be shown because all of the information fits on the current screen.

You may also notice on this screen that some of the reports are highlighted (white numbers on your screen, black numbers in the figure) and others are not (green numbers.) Highlighted reports contain data and can be selected for viewing. If a report is not highlighted, then data for that report is not being collected. This is due to CP MONITOR settings, virtual machine settings, or the configuration of PerfKit.

You can select a particular performance report in one of three ways:

1. Move the cursor so that it is positioned under the name of the report you wish to display and press `Enter`.
2. Enter the number of the report you wish to display in the command line and press `Enter`.
3. Enter the appropriate Performance Toolkit subcommand for the report you wish to display in the command line and press `Enter`. You can find the list of report names in the “Display Examples” section of the Performance Toolkit for VM manual or by using the HELP facility (PF1) and selecting help on “Performance monitor commands” in the “Sub-commands” section of the screen.

When investigating a performance problem, a good place to start is the “CPU load and trans.” screen. This selection gives you On this screen a good overall summary of the performance characteristics of the system and perhaps an idea of where to dig deeper to get to the root cause of a problem.

You select this screen by either typing in the report name on the command line or using the menus. This report is named CPU, so it is easy to remember the name. Use this method to display this screen, by entering the following on the command line and pressing `Enter`:

Enter: **`CPU`**

You will see a screen that looks similar to Figure 2.

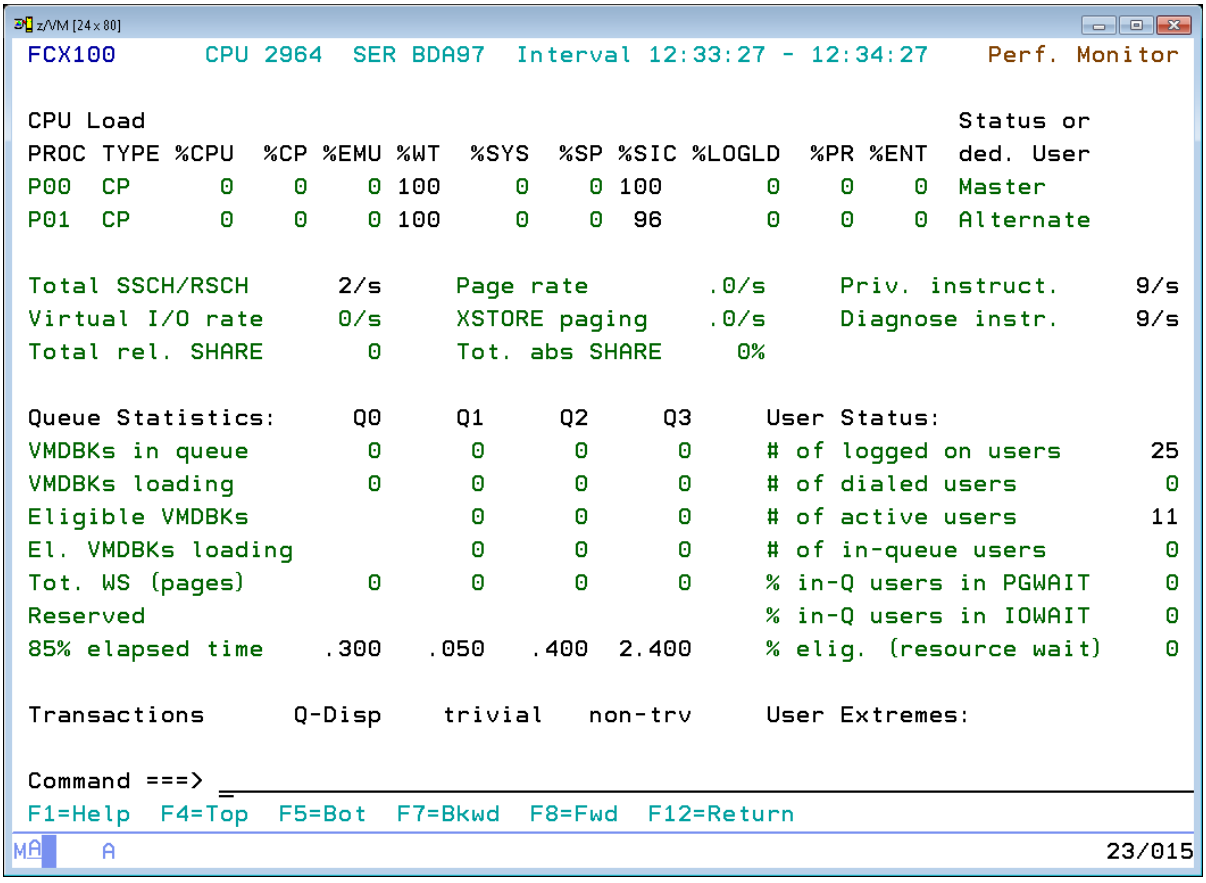

Figure 2. PerfKit CPU display

Again notice that if F7 and F8 are displayed as active keys, use PF7 and PF8 to scroll forward and backward to view the entire report.

It is possible to get HELP on any of the fields in the screen by moving the cursor under any of the field data labels and pressing PF1.

To see the definition of the data field named %CPU:

Cursor: Position under **%CPU**
Press: **PF1**

You will see a window that describes the %CPU and adjacent fields similar to this:

```
FCX100      CPU 2964  SER BDA97  Interval hh:mm:ss - hh:mm:ss    Perf. Monitor

CPU Load                                                          Status or
PROC TYPE %CPU  %CP %EMU %WT  %SYS  %SP %SIC %LOGLD  %PR %ENT  ded. User
P00  CP      0    0    0 100     0    0  98       0    0    0  Master
+-------------------------------------------------------------------------+
|                               Help Text                                 |
|                                                                         |
| Processor load fields                                                   |
|                                                                         |
| PROC              The processor number in the format 'Pnn'.  The first  |
|                   processor shown is the IPL processor.                 |
|                                                                         |
| TYPE              The processor type. The values are:                   |
|                                                                         |
|                    CP - Central Processor                               |
|                    ICF - Internal Coupling Facility Processor           |
|                    IFL - Integrated Facility for Linux Processor        |
|                    ZIIP - IBM System z Integrated Information           |
| F8=Forward   F12=Return                                                 |
+-------------------------------------------------------------------------+

Command ===>
F1=Help  F4=Top  F5=Bot  F7=Bkwd  F8=Fwd  F12=Return
```

Scroll through the help text with the PF8 key. Return to the Performance Screen Selection menu and select the “User Resource Usage” screen by doing the following:

Press: **PF12** (to exit the Help screen)
Press: **PF12** (to return to the main menu)
Enter: **21** (to select **User resource usage**)

You will see the User Resource Usage screen as shown below. Note that F7 and F8 are active. Also that F10 and F11 are active, indicating that the data to display is wider than the current 80 column screen width.

```
FCX112      CPU 2964  SER BDA97  Interval hh:mm:ss - hh:mm:ss    Perf. Monitor
________      .     .     .     .     .     .     .     .     .     .
          <----- CPU Load -----> <----- Virtual IO/s ----->
               <-Seconds->   T/V                  Diag
Userid    %CPU  TCPU  VCPU Ratio Total DASD Avoid   98   UR Pg/s  User Status
>>Mean>>   .00  .002  .002  1.06    .0   .0    .0   .0   .0   .0  ---,---,----
CLONEDDR     0     0     0  ....     0    0     0    0    0    0  ESA,---,DORM
CLONER       0     0     0  ....     0    0     0    0    0    0  ESA,---,DORM
DATAMOVE   .01  .004  .003  1.33    .4   .4    .0   .0   .0   .0  ESA,---,DORM
DIRMAINT   .01  .004  .004  1.00    .3   .2    .0   .0   .0   .0  ESA,---,DORM
DISKACNT     0     0     0  ....     0    0     0    0    0    0  ESA,---,DORM
DTCVSW1    .00  .000  .000   .00    .0   .0    .0   .0   .0   .0  ESA,---,DORM
DTCVSW2    .00  .000  .000   .00    .0   .0    .0   .0   .0   .0  ESA,---,DORM
DTCVSW3    .00  .000  .000   .00    .0   .0    .0   .0   .0   .0  ESA,---,DORM
DTCVSW4    .00  .000  .000   .00    .0   .0    .0   .0   .0   .0  ESA,---,DORM
EREP         0     0     0  ....     0    0     0    0    0    0  ESA,---,DORM
FTPSERVE   .00  .000  .000   .00    .0   .0    .0   .0   .0   .0  XC, ---,DORM
LINUX03    .05  .028  .028  1.00    .0   .0    .0   .0   .0   .0  EME,CL3,DISP
OPERATOR     0     0     0  ....     0    0     0    0    0    0  ESA,---,DORM
OPERSYMP     0     0     0  ....     0    0     0    0    0    0  ESA,---,DORM
PERFSVM    .00  .002  .001  2.00    .0   .0    .0   .0   .0   .0  EME,---,DORM
Select a user for user details or IDLEUSER for a list of idle users
Command ===>
F1=Help  F4=Top  F5=Bot  F7=Bkwd  F8=Fwd  F10=Left  F11=Right  F12=Return
```

To see the additional data available for each user displayed on this screen:

Press: **PF11**

You will now see the remaining columns of data for these users:

```
FCX112      CPU 2964  SER BDA97  Interval hh:mm:ss - hh:mm:ss    Perf. Monitor
________ >.                 .     .     .     .     .     .     .
         >                <UsrTime> <--Spool-->    MDC        VConf
         >                <Minutes> Total  Rate Insert        Rebal Nr of
Userid   >s  User Status  Logd Act. Pages SPg/s  MDC/s Share  Scat. Users
>>Mean>> >0  ---,---,----  1.0   .4    .0    .0     .0   ---    ---    21
CLONEDDR  0  ESA,---,DORM    1    0     0     0      0   100    ...
CLONER    0  ESA,---,DORM    1    0     0     0      0   100    ...
DATAMOVE  0  ESA,---,DORM    1    0     0     0      0   100    ...
DIRMAINT  0  ESA,---,DORM    1    0     0     0      0   100    ...
DISKACNT  0  ESA,---,DORM    1    0     0     0      0   100    ...
DTCVSW1  .0  ESA,---,DORM    1    1    .0    .0     .0  3000    ...
DTCVSW2  .0  ESA,---,DORM    1    1    .0    .0     .0  3000    ...
DTCVSW3  .0  ESA,---,DORM    1    1    .0    .0     .0  3000    ...
DTCVSW4  .0  ESA,---,DORM    1    1    .0    .0     .0  3000    ...
EREP      0  ESA,---,DORM    1    0     0     0      0   100    ...
FTPSERVE .0  XC, ---,DORM    1    1    .0    .0     .0   100    ...
LINUX03  .0  EME,CL3,DISP    1    1    .0    .0     .0   100    ...
OPERATOR  0  ESA,---,DORM    1    0     0     0      0  STOP    ...
OPERSYMP  0  ESA,---,DORM    1    0     0     0      0   100    ...
PERFSVM  .0  EME,CL0,DISP    1    1    .0    .0     .0 3.0%A    ...
Select a user for user details or IDLEUSER for a list of idle users
Command ===>
F1=Help  F4=Top  F5=Bot  F7=Bkwd  F8=Fwd  F10=Left  F11=Right  F12=Return
```

More detail for an individual user can be seen by placing the cursor under a user ID on the display and pressing `Enter`. You may have to use PF8 to scroll forward to find the user ID.

Cursor: `Position under the user` **`TCPIP`**
Press: **`Enter`**

You will now see the User Detail display that looks something like this:

```
FCX115      CPU 2964  SER BDA97  Interval hh:mm:ss - hh:mm:ss    Perf. Monitor

Detailed data for user TCPIP
Total CPU      :   .0%     Storage def.   :      128MB  Page fault rate:   .0/s
Superv. CPU    :   .0%     Resident <2GB  :     3518    Page read rate :   .0/s
Emulat. CPU    :   .0%     Resident >2GB  :       23    Page write rate:   .0/s
I/O rate       :   .0/s    Proj. WSET     :     3219    Pgs moved >2GB>:   .0/s
DASD IO rate   :   .0/s    Reserved pgs   :        0    Main > XSTORE  :   .0/s
UR I/O rate    :   .0/s    Locked pages   :      322    XSTORE > main  :   .0/s
Diag. X'98'    :   .0/s    XSTORE dedic.  :        0MB  XSTORE > DASD  :   .0/s
*BLOCKIO       :   .0/s    XSTORE pages   :        0    SPOOL pg reads :   .0/s
Last IPL       : CMS       DASD slots     :        0    SPOOL pg writes:   .0/s
Config mode    : ESA390    IUCV X-fer/s   :       .0/s  MDC insert rate:   .0/s
Base CPU type  : CP        Share          :     3000    MDC I/O avoided:   .0/s
Base CPU affin.: ON        Max. share     :      ...

#I/O active    :    0      Active   :   0%    PSW wait :  ..%   I/O act. :  ..%
Stacked blk    :   ..      Page wait:  ..%    CF wait  :  ..%   Eligible :  ..%
Stat.: ESA,QDS,DORM        I/O wait :  ..%    Sim. wait:  ..%   Runnable :  ..%

Data Space Name            Size Mode  PgRd/s PgWr/s XRd/s XWr/s Migr/s Steal/s

Command ===>
F1=Help  F4=Top  F5=Bot  F7=Bkwd  F8=Fwd  F10=Left  F11=Right  F12=Return
```

Return to the Performance Screen Selection menu by pressing PF12 twice.

Press: **`PF12`**
Press: **`PF12`**

Performance data about your network interfaces and TCPIP can also be viewed by the Performance Toolkit for VM. When you create a VSWITCH on your z/VM system, data about its operation and performance is is included in the monitor data. The z/VM TCP/IP stack is also able to include performance data in the CP monitor records that can be viewed in PerfKit. You get this TCPIP data by adding the `MONITORRECORDS` statement to PROFILE TCPIP. This allows you to view basic z/VM TCP/IP stack performance data. To view the z/VM TCP/IP data that is available on your system:

Cursor: `Position under the line for screen` **`3K`**
`(you may have to scroll down first using the PF8 key)`
Press: **`Enter`**

You will see the following TCP/IP Report Selection menu. The QDIO and VSWITCH displays are created automatically; the remaining performance reports are only shown if the `MONITORRECORDS` statement is included in PROFILE TCPIP.

```
FCX203      CPU 2964  SER BDA97          TCP/IP Displays         Perf. Monitor
  ______    .
  Server    Log File
S Userid    Name       Description
. System    QDIO       QDIO device activity
. System    VNIC       Virtual Network Device activity
. System    VSWITCH    Virtual Switch activity
. TCPIP     TCPACTLG   General TCP/IP activity log
. TCPIP     TCPBPLOG   TCP/IP buffer pools log
. TCPIP     TCPCONF    TCP/IP server configuration
. TCPIP     TCPDATLG   General TCP/IP data transfer log
. TCPIP     TCPDOSLG   TCP/IP denial of service log
. TCPIP     TCPICMP    TCP/IP ICMP messages log
. TCPIP     TCPIOLOG   TCP/IP I/O activity log
. TCPIP     TCPLINKS   TCP/IP links activity log
. TCPIP     TCPSESS    TCP/IP TCP and UDP sessions log
. TCPIP     TCPUSERS   TCP/IP users activity log



Select performance screen with cursor and hit ENTER
Command ===>
F1=Help  F4=Top  F5=Bot  F7=Bkwd  F8=Fwd  F12=Return
```

Take a look at some of these reports to see what networking performance data is provided. For instance, move the cursor to the period in front of the line `System  VNIC  Virtual Network Device activity` to see the virtual NICs defined on your system. When you are finished, return to the PerfKit main menu.

Press: **PF12**

Printing Performance Data from the Performance Toolkit

You can print individual reports manually using the PRINT subcommand. To print a performance report, enter the PRINT subcommand along with the name of the report and the user ID you want the report sent to. For example, to print the CPU Load and Transaction report and send it to MAINT710, enter the following in the command line on the Performance Screen Selection menu:

Enter: **PRINT CPU (TO MAINT710**

This causes the CPU Load and Transaction report to be printed on the virtual printer of the user PERFSVM and sent to the virtual reader of the MAINT710 user ID. Print a few additional reports as follows:

Enter: **PRINT PROCLOG (TO MAINT710**
Enter: **PRINT SYSSUM (TO MAINT710**
Enter: **PRINT DASDLOG (TO MAINT710**
Enter: **PRINT PAGELOG (TO MAINT710**

Once you have finished “printing” the reports, disconnect from the PERFSVM user ID. Use disconnect so that PerfKit stays up and running and continues to collect performance data.

Press: **PF12**
Press: **PF12** (Only if you are not on the BASIC screen)
Enter: **CP DISC**
Enter the CP DISC on the BASIC mode command line.

Accessing the Performance Toolkit through a Web Browser

Perhaps the most easy to use and useful of the various interfaces to the Performance Toolkit for VM is the HTTP interface. This allows any authorized user to display performance data using a standard web browser. This interface has all of the capabilities provided by the APPC/VM interface, without the limitations of the 3270 display, such as a limited number of display columns.

Start a web browser on your workstation, and direct it to port 81 of the IP address on the TCP/IP stack of your system. If you have an SSI cluster of systems, you can choose any system that has PerfKit running. If the system has a registered DNS name, you can use that instead of the IP address. In the address area of the browser:

Enter: **http://nnn.nnn.nnn.nnn.:81/**

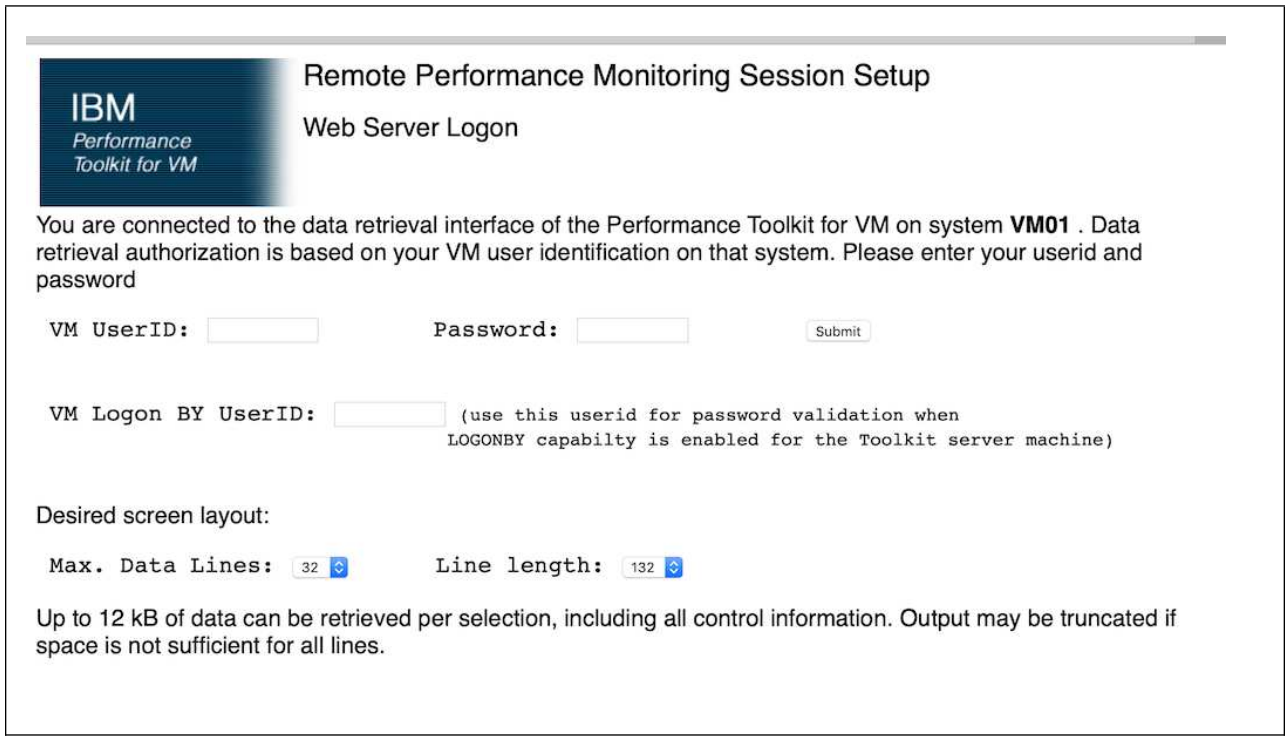

Figure 3. PerfKit Web Logon page

After a brief display of the Performance Toolkit for VM banner screen, you will see the Performance Toolkit for VM web interface logon screen. It should look just like Figure 3. The screen contains both a user ID and password field. It also allows you to select the width of the display in characters and the length of the display in lines. Enter the user ID that you authorized for PerfKit along with its password and click on SUBMIT.

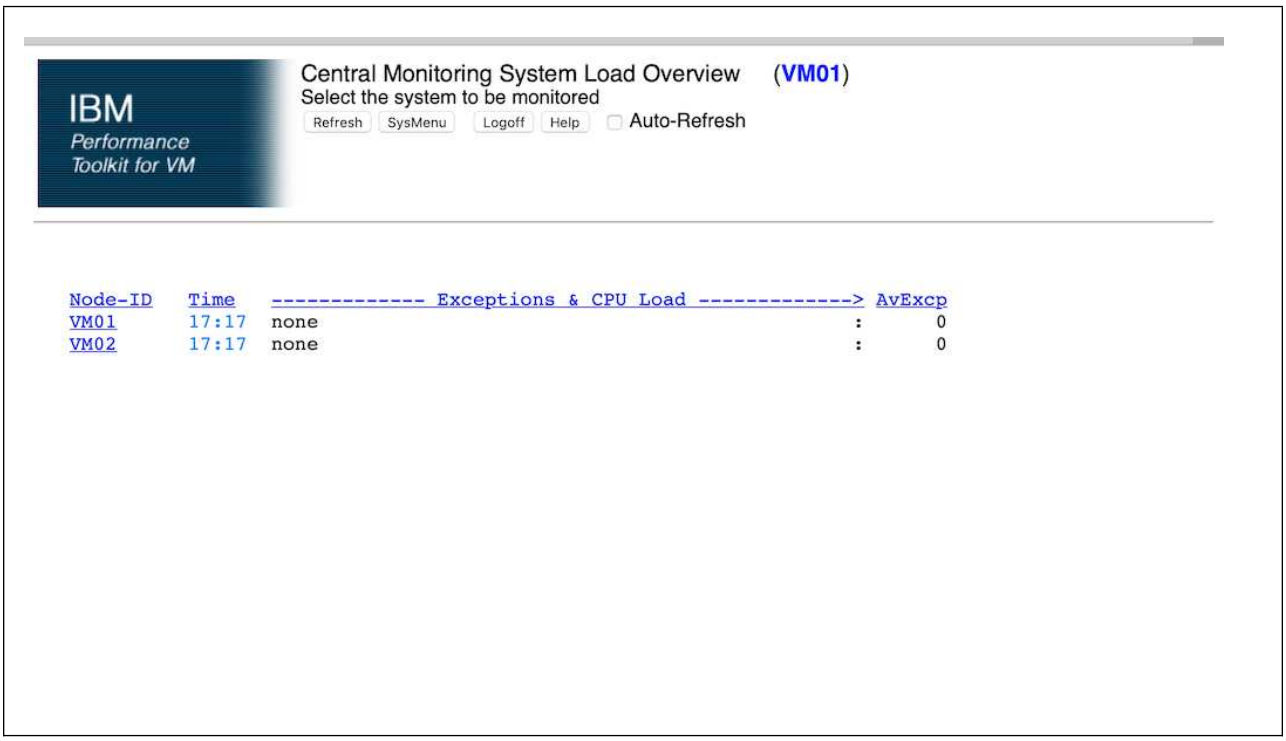

Figure 4. PerfKit System Selection page

The Systems Selection Screen is now shown on your browser, as shown in Figure 4. It shows all systems you configured in step hdref refid=pssi26.. Click on one of the system names shown on your screen. In the figure, systems VM01 and VM02 are examples of a 2 member SSI cluster.

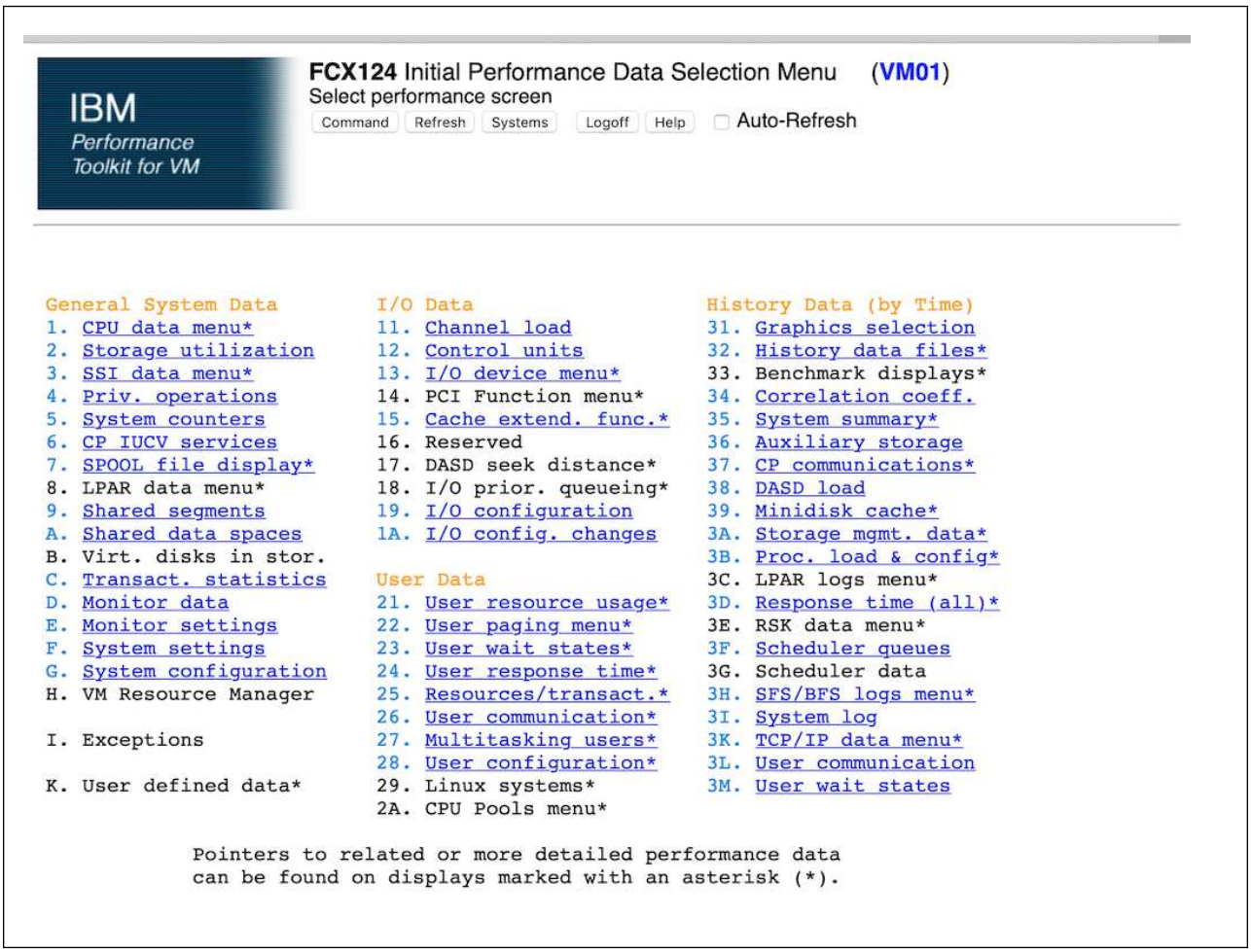

Figure 5. PerfKit Performance Selection Menu page

The Performance Screen Selection menu is displayed as shown in Figure 5. This screen contains the same report selections as you saw on the 3270 display. Available reports are selectable via active hyperlinks.

Note the row of buttons across the top of the screen. You can enter any Performance Toolkit subcommand (performance report name) by clicking on the `COMMAND` button and entering a command. You can return to the Systems Selection Screen with the `SYSTEMS` button. And you can manually refresh the screen with the `REFRESH` button. You can also click the `AUTO-REFRESH` check box to eliminate the need to manually refresh the data displayed in your browser.

Now select the CPU Load and Transaction report by doing the following:

Click on: **`1. CPU data menu*`**

A small menu will appear like the example below.

```
  CPU activity reports
S Command     Description
_ CPU         CPU Load and Transactions
_ DSVBKACT    Dispatch Vector Activity
_ LOCKACT     Spin Lock Collision Activity
```

Click on **CPU** to see the CPU Load and Transactions page.

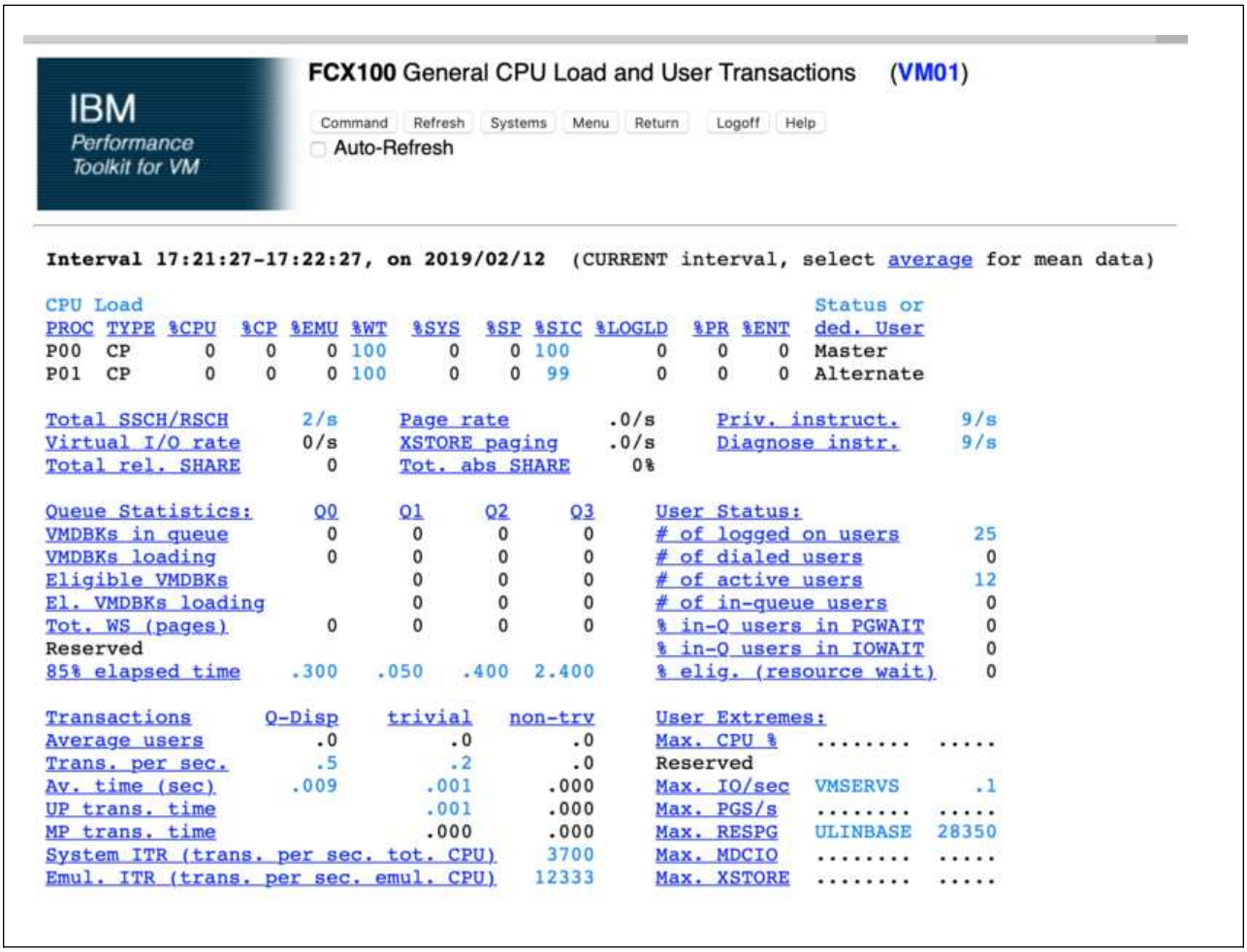

Figure 6. PerfKit CPU Load and Transactions page

You will see the CPU Load and Transaction display as shown in Figure 6. Notice that the row of buttons at the top of the display now includes a `Menu` button. This button will take you back to the Performance Screen Selection Menu.

It is still possible to get help on any of the field definitions just as you did with the 3270 interface. To see the definition of the field “Total SSCH/RSCH”:

Click on: **`Total SSCH/RSCH`**

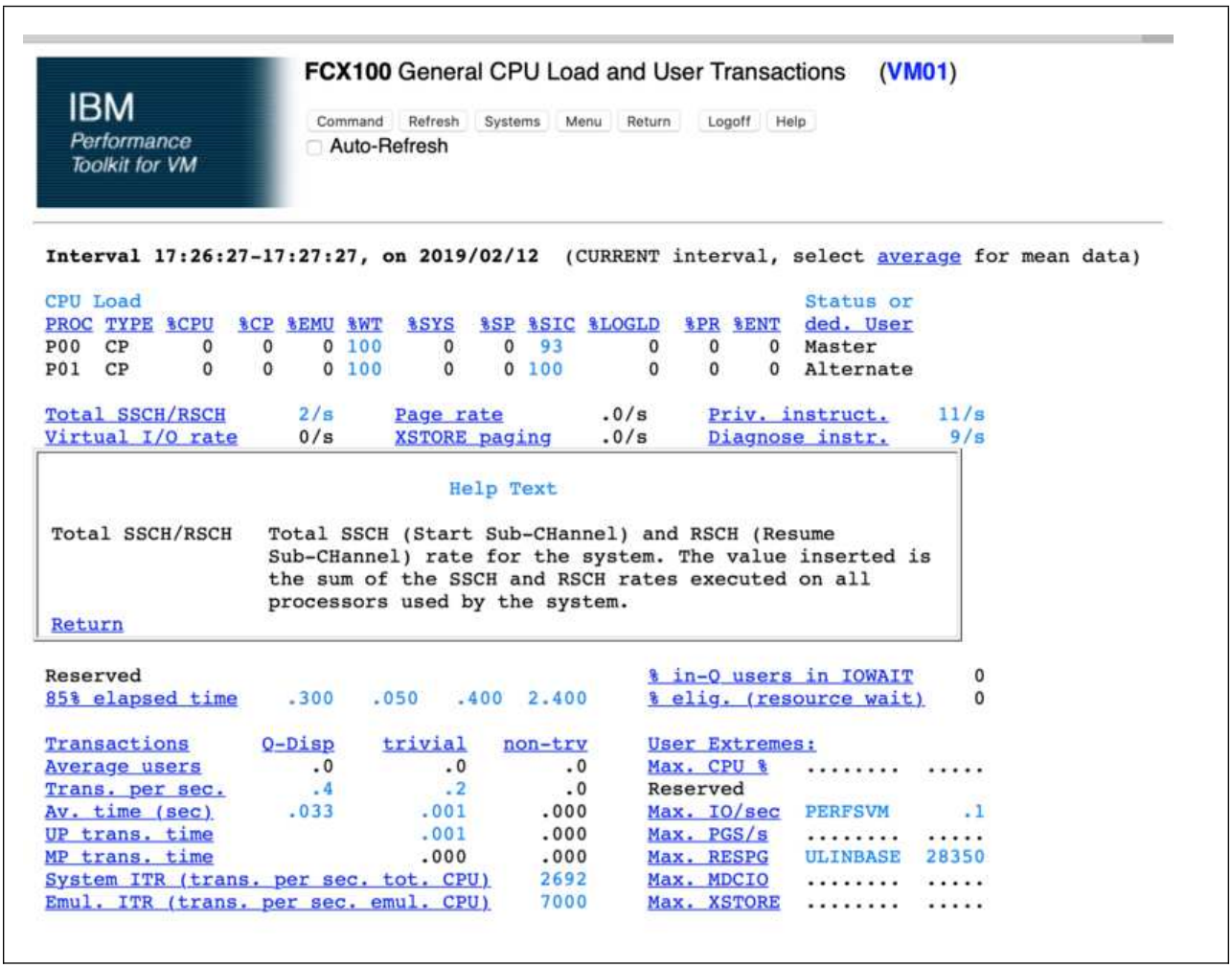

Figure 7. PerfKit Help on CPU Load and Transactions page

The CPU Load and Transaction screen should now look as shown in Figure 7. To remove the help box from the display:

Click on: **RETURN**

Next select the I/O Device Load screen by doing the following:

Click on: **MENU**
Click on: **I/O Device Menu***
Click on: **DEVICE** (I/O device load selection)

You should now see the I/O Device Load display. Many of the report display screens allow you to sort the data by a specific column. To sort the I/O Device Load by I/O Rate:

Click on: the single period above the heading **"**Rate/s**"**

You should now see the display sorted by I/O rate. To get more detail on a particular device you can click on the device address. Take a look at the detail information for the common DASD volume (VMCOM1 address D003) by doing the following:

Click on: **D003**

You are now looking at the I/O Device Details display for device address selected. Note that the lower part of the display contains a list of all of the minidisks on the volume that have had I/O done to them and the owning user IDs. The presence of the FORW button at the top of this screen indicates that the list is longer than will fit in the default 32 lines that are displayed. Click the FORW button to move the screen up and the BACK button to move the screen down. Note that there is also a RETURN button to take you back to the I/O Load display.

At this point, take a look at the remainder of the display and feel free to explore other performance reports from the web session. You can terminate your web browser session when you are finished exploring by clicking on the LOGOFF button at the top of the web session screen:

Click on: **LOGOFF**

Congratulations, you now have a working Performance Toolkit for VM!

Collecting and Viewing Linux Performance Data in PerfKit

The CP monitor is an excellent choice for collecting z/VM guest performance data and statistics for your virtual server farm. The Linux kernel can collect and export performace data to CP by creating APPLDATA monitor records. A virtual CPU timer on the monitored Linux server controls when data is collected. The timer accounts for busy time only to avoid unnecessarily waking an idle guest.

This function requires configuration changes on both VM and on Linux. In the VM directory, the user must have the directory option APPLMON enabled. On Linux, the “appldata” modules must be loaded and configured.

Collecting the data

Follow the steps below to enable collecting of the Linux performance data.

VM Directory changes

In the directory entry for each Linux server or in an included profile, add the line

```
OPTION APPLMON
```

If the directory entry already has an OPTION line, just add the keyword APPLMON to the existing line. Save your changes and use DIRECTXA to update the object directory on the system.

If you are using DirMaint to manage your directory, use this command to add the option to the directory entry or the profile:

```
DIRMAINT FOR linuxid SETOPT ADD APPLMON
```

To actually enable this option on the user, the user must be logged off and then back on. There is no command to enable this option dynamically.

Enabling APPLDATA in SUSE Linux

SUSE for Linux on Z (SLES 11 and 12) includes a startup script and a configuration file to set the values for the data you want to collect. The configuration file is `/etc/sysconfig/appldata` and the values in there are sufficient to get you started. You can edit this file and make any changes you need.

To enable the data collection each time Linux starts up, use either the `insserv` or `chkconfig` command. These commands are still valid on SLES 12 where they just enable the correct systemd service. For instance, to enable it as root, enter:

```
insserv appldata
```

You can also use the YaST screens to enable this service. To start the service immediately from the command line, enter `rcappldata start`.

Enabling APPLDATA in Red Hat Linux

Red Hat for Linux on Z supplies the appldata driver in the default kernel, but does not supply any scripts to enable it. The commands to enable it can be placed in a local startup script, such as the example `/etc/rc.d/rc.local` supplied by Red Hat. Here is an example of the lines to add to an existing file:

```
# Load appldata if kernel enabled for it.
if [ -e /proc/sys/appldata/interval ]; then
   modprobe appldata_mem
   modprobe appldata_os
   modprobe appldata_net_sum
   echo 1 >/proc/sys/appldata/mem
   echo 1 >/proc/sys/appldata/os
   echo 1 >/proc/sys/appldata/timer
fi
```

Make sure this file is executable by also entering "`chmod +x /etc/rc.d/rc.local`" at a shell prompt. Note that this example does not set the sample interval time; the default of 10000 milliseconds (10 seconds) is used. The time can be changed by adding the line "`echo interval >/proc/sys/appldata/interval`" where *`interval`* is the number of milliseconds of the interval.

Enabling APPLDATA in Ubuntu Linux

Ubuntu for Linux on Z supplies the appldata driver in the default kernel, but does not supply any scripts to enable it. The commands to enable it can be placed in a local startup script. If the file `/etc/rc.local` exists, a systemd service will execute this script. Here is an example of an rc.local file:

```
#!/bin/bash
# Load appldata if kernel enabled for it.
if [ -e /proc/sys/appldata/interval ]; then
   modprobe appldata_mem
   modprobe appldata_os
   modprobe appldata_net_sum
   echo 1 >/proc/sys/appldata/mem
   echo 1 >/proc/sys/appldata/os
   echo 1 >/proc/sys/appldata/timer
fi
```

Make sure this file is executable by also entering "`chmod +x /etc/rc.d/rc.local`" at a shell prompt. Note that this example does not set the sample interval time; the default of 10000 milliseconds (10 seconds) is used. The time can be changed by adding the line "`echo interval >/proc/sys/appldata/interval`" where *`interval`* is the number of milliseconds of the interval.

Viewing Linux performance data in PerfKit

The data Linux puts into the monitor stream is viewed on PerfKit the same way you view z/VM data. Access the PerfKit main menu using the 3270 or web interfaces like you did before. The Linux data is found on menu selection 29 or by typing LINUXM or LINUXMEN on the command line. You should see a selection screen similar to this:

```
FCX242      CPU 2964  SER BDA97          Linux Displays         Perf. Monitor



  Linux screens selection
S Display     Description
. LINUX       RMF PM system selection menu
. LXCPU       Summary CPU activity display
. LXMEM       Summary memory util. & activity display
. LXNETWRK    Summary network activity display









Select performance screen with cursor and hit ENTER
Command ===>
F1=Help  F4=Top  F5=Bot  F7=Bkwd  F8=Fwd  F12=Return
```

The menu selections **LXCPU**, **LXMEM**, and **LXNETWRK** should be highlighted on your screen. If these items are not highlighted, then no Linux data has been collected. If you just enabled Linux data collection or PerfKit was recently started, then wait a few minutes to see if the data will be collected. Otherwise, review the instructions in this section to enable Linux to send data to the CP monitor. The selection LINUX is not highlighted because collecting data using the RMF PM collection process is deprecated and should not be used.

The default configuration of the appldata Linux driver only collects CPU and memory data. Select either LXCPU or LXMEM to see the data that Linux collects. Both of these selections show all of the Linux guests that are enabled for appldata collection. Put the cursor on one of the items in the column header and press the help key (PF1) to see a description of the numbers in that column. For instance, putting the cursor on “Kernel” on the LXCPU screen and pressing PF1 shows this help:

```
FCX243      CPU 2964  SER BDA97  Interval hh:mm:ss - hh:mm:ss    Perf. Monitor
______      .      .     .      .     .     .       .      .     .      .
              <------------------- Total CPU --------------------------> <---
Linux    Virt <---------------- Utilization (%) ----------------------> <---
Userid   CPUs TotCPU  User Kernel  Nice   IRQ SoftIRQ IOWait  Idle Stolen Runa
>System<  1.9     .0    .0     .0    .0    .0      .0     .0 188.9     .0    2
*-------------------------------------------------------------------------------*
|                                Help Text                                      |
|                                                                               |
| Kernel               Percent kernel mode CPU utilization.                     |
|                                                                               |
| F12=Return                                                                    |
*-------------------------------------------------------------------------------*




Command ===>
F1=Help  F4=Top  F5=Bot  F7=Bkwd  F8=Fwd  F10=Left  F11=Right  F12=Return
```

Also use the sort selection row (the second line of the display) to sort the data in the columns differently.

Reports using the Linux data

You can create reports from the Linux data just like you can from any PerfKit data. The report names are LXCPU, LXMEM, and LXNETWRK. Enable these reports in the FCONX REPORTS file to create these reports along with any other reports.

Appendix A. Collecting z/VM Monitor Data using MONWRITE

This appendix describes how to set up the process for starting and stopping CP Monitor data collection using the MONWRITE user ID. You will set up its PROFILE EXEC so that it will automatically define the data collection parameters and start and stop the collection. MONWRITE will run as a disconnected service virtual machine while it is collecting data.

Setting up the MONWRITE Service Virtual Machine

In order for the MONWRITE service virtual machine to issue the CP MONITOR command, it must be authorized to issue CP privilege class A or E commands. The default CP directory only allows MONWRITE to issue unprivileged (class G) commands. If you are using DIRMAINT on your system, it is easy to add a privilege to a user. Enter this DIRMAINT command to add privilege class E to MONWRITE.

Enter: **DIRM FOR MONWRITE CLASS ADD E**

Watch the DirMaint responses and look for the RC=0.

If you are not using DIRMAINT, you must edit the directory file to add the privilege class. Find the entry `IDENTITY MONWRITE` and change the privilege class of the user to be `EG` instead of `G`. Save your changes and run `DIRECTXA` to place the changes online.

You added class E to MONWRITE instead of Class A because for these instructions, MONWRITE does not need the ability to issue all of the other Class A commands. Class E is sufficient for MONWRITE to control the CP MONITOR. This is always a good practice to follow when adding privilege class authorizations to z/VM user IDs.

The next step is to create a PROFILE EXEC on MONWRITE's 191 or A disk. No default profile is provided, so you will create one that:

- Specifies the sampling rate and reporting intervals
- Specifies the types of monitor data to be collected
- Starts the CP Monitor
- Starts the MONWRITE program

  The MONWRITE program collects data for as long as you let it run. Once you tell it to stop collecting data, the MONWRITE program ends and allows the rest of the PROFILE to run these remaining steps:

- Stop the CP Monitor
- Logoff the MONWRITE user ID

Here are the steps to set up MONWRITE:

Enter: **LINK MONWRITE 191 999 M**
Enter: **ACC 999 Z**
Enter: **X PROFILE EXEC Z**
Enter: **SET CASE UPPER**
Enter: **INPUT**

At this point, you are in XEDIT Input mode. Type in the following lines on the screen to create the profile. Since you entered the XEDIT command `SET CASE UPPER`, you do not need to enter the following lines in upper case. XEDIT will translate all of your input to upper case when you press `Enter`.

Note: If you would like to save yourself some typing, you can use the Xedit *duplicate line* prefix command (which is a double quote ") to duplicate similar lines, such as lines that start with `'CP MONITOR`.

```
Enter:  /** Profile exec for MONWRITE **/
Enter:  'CP SET RUN ON'
Enter:  'CP MONITOR SAMPLE RATE 1 SEC'
Enter:  'CP MONITOR SAMPLE INTERVAL 1 MIN'
Enter:  'CP MONITOR SAMPLE ENABLE ALL'
Enter:  'CP MONITOR EVENT ENABLE ALL'
Enter:  'CP MONITOR EVENT DISABLE SCHEDULER ALL'
Enter:  'CP MONITOR EVENT DISABLE SEEKS ALL'
Enter:  'CP MONITOR START'
Enter:  'MONWRITE MONDCSS *MONITOR DISK'
Enter:  'CP LOGOFF'
Press:  Enter (to accept input)
Press:  Enter (to end input mode)
```

Verify that the file has the following content and that none of the single quotes are missing. You may want to enter the `TOP` command on the Xedit command line to show the entire file.

```
/** PROFILE EXEC FOR MONWRITE **/
'CP SET RUN ON'
'CP MONITOR SAMPLE RATE 1 SEC'
'CP MONITOR SAMPLE INTERVAL 1 MIN'
'CP MONITOR SAMPLE ENABLE ALL'
'CP MONITOR EVENT ENABLE ALL'
'CP MONITOR EVENT DISABLE SCHEDULER ALL'
'CP MONITOR EVENT DISABLE SEEKS ALL'
'CP MONITOR START'
'MONWRITE MONDCSS *MONITOR DISK'
'CP LOGOFF'
```

Note: If Performance Toolkit for VM is already running on your system then you may not need or want the CP MONITOR commands in this PROFILE EXEC because the monitor settings have already been done by the performance monitor user ID. On the other hand, if no other performance monitor is running, you should add the line `'CP MONITOR STOP'` right before the `'CP LOGOFF'` line in the exec.

Save the file and exit Xedit, then release and detach MONWRITE's 191 disk:

```
Enter:  FILE
Enter:  RELEASE Z (DET
```

The PROFILE EXEC you just created enables all SAMPLE monitor domains and all EVENT domains except SCHEDULER and SEEKS. This is the recommended initial monitor configuration. Because there are many sample and event domains, it is easier to first enable all domains then disable the ones that you do not want active. On your system, you may want to disable some domains or disable ranges of I/O devices not used by your system. This can help keep the monitor files that you collect from becoming too large.

Event monitoring can result in large volumes of data generated and an increased CP overhead, particularly in the SEEKS and SCHEDULER domains. For this reason, these two domains should be enabled only when needed. The SEEKS domain records data about a DASD device “seeking” a specific cylinder

on the device. Modern DASD controllers read and write data from cache, so there is no useful data to be collected. The SCHEDULER domain should only be enabled if the data is needed, and can be limited to specific user IDs.

Starting and Stopping Monitor Data Collection

You can now start the process of collecting monitor data:

Enter: **XAUTOLOG MONWRITE**
Response:
```
AUTO LOGON  ***       MONWRITE USERS = nn
HCPCLS6056I XAUTOLOG information for MONWRITE: The IPL command is verified
by the IPL command processor.
```

Use the QUERY MONITOR command to ensure that monitor data collection is taking place:

Enter: **Q MONITOR**
Response:
```
MONITOR EVENT ACTIVE    BLOCK    4     PARTITION    8192
MONITOR DCSS NAME - MONDCSS
CONFIGURATION SIZE       68 LIMIT         1 MINUTES
CONFIGURATION AREA IS FREE
USERS CONNECTED TO *MONITOR - MONWRITE
MONITOR   DOMAIN ENABLED
PROCESSOR DOMAIN ENABLED
STORAGE   DOMAIN ENABLED
SCHEDULER DOMAIN DISABLED
SEEKS     DOMAIN DISABLED
USER      DOMAIN ENABLED
   ALL USERS ENABLED
I/O       DOMAIN ENABLED
   PCIF CLASS ENABLED
   ALL DEVICES ENABLED
NETWORK   DOMAIN ENABLED
ISFC      DOMAIN ENABLED
APPLDATA  DOMAIN ENABLED
   ALL USERS ENABLED
SSI       DOMAIN ENABLED
MONITOR SAMPLE ACTIVE
               INTERVAL    1 MINUTES
               RATE     2.00 SECONDS
MONITOR DCSS NAME - MONDCSS
CONFIGURATION SIZE     4096 LIMIT         1 MINUTES
CONFIGURATION AREA IS FREE
USERS CONNECTED TO *MONITOR - MONWRITE
MONITOR   DOMAIN ENABLED
SYSTEM    DOMAIN ENABLED
PROCESSOR DOMAIN ENABLED NOCPUMFC
STORAGE   DOMAIN ENABLED
USER      DOMAIN ENABLED
   ALL USERS ENABLED
I/O       DOMAIN ENABLED
   PCIF CLASS ENABLED
   ALL DEVICES ENABLED
NETWORK   DOMAIN ENABLED
IFSC      DOMAIN ENABLED
APPLDATA  DOMAIN ENABLED
   ALL USERS ENABLED
SSI       DOMAIN ENABLED
Ready; T=0.01/0.01 hh:mm:ss
```

Look carefully to verify that the response you received is identical to that shown above, particularly the lines highlighted that verify the monitor DCSS (segment) name as MONDCSS and one user connected to the monitor system service (*MONITOR) is MONWRITE. If your system is not part of an SSI cluster, then the SSI domain for both EVENT and SAMPLE will be disabled. You may see other users connected to the *MONITOR service also, such as PERFSVM or PERSMAPI, if those user IDs are running on your system.

MONWRITE is now collecting all monitor data produced by CP and writing those records to disk. This can be a lot of data, depending on how busy your system is and how many I/O devices it has. The default size of the 191 disk of MONWRITE is not big enough to collect data for an extended period of time, so unless you previously increased the size of the disk, you may want to only collect data for a short period of time.

Stop MONWRITE by sending it a MONWSTOP command to its console. It stops collecting data and the MONWRITE program ends. Then the PROFILE EXEC will complete by logging off the MONWRITE user ID.

```
     Enter: CP SEND MONWRITE MONWSTOP
  Response: USER DSC    LOGOFF AS  MONWRITE USERS = nn
```

Now look at the files on MONWRITE's 191 disk to see if a Monitor data file has been created. By default, the monitor data files created by MONWRITE have a CMS file name of **D***mmddyy*, where *mmddyy* is the month, day and year the file was created, and a file type of **T***hhmmss*, where *hhmmss* is the hour, minute, and second that the file was created. Use the VMLINK command with the FILELIST option as an easy way to look at this disk.

```
     Enter: VMLINK MONWRITE 191 (FILEL
```

Verify that a MONITOR data file exists. Do not attempt to Xedit the file since it does not contain readable data. Performance Toolkit for VM is used to view the data in this file. Another part of these instructions in Appendix B, “Processing Previously Collected Monitor Data” on page 33 shows you how to look at the collected data and create reports from it.

```
     Press: PF3 to exit Filelist
```

Appendix B. Processing Previously Collected Monitor Data

If you collected data with MONWRITE, how do you process it? PerfKit can be used to scan through it or to create reports.

Using the MONSCAN Function

In addition to looking at performance data in real time, the Performance Toolkit for VM can also process CP Monitor data that has been collected by the MONWRITE service virtual machine. You may have used the instructions in Appendix A, “Collecting z/VM Monitor Data using MONWRITE” on page 29 to collect monitor data, and this section shows you how to view that data.

You do not use the PERFSVM user ID to process saved monitor data. You run the PERFKIT command in another virtual machine that has access to the saved file. In these instructions, you will use the MAINT710 user ID to process the data you created earlier.

Logon to your z/VM system where you customized the MONWRITE service virtual machine and collected CP Monitor data. You will need to switch to z/CMS and then link to PERFSVM's 201 disk to access the PERFKIT command and MONWRITE's 191 disk to access the CP Monitor data you collected earlier.

```
    Enter: IPL ZCMS
 Response: z/CMS V7.1.0    yyyy-mm-dd hh:mm
    Enter: (Remember to first press ENTER when the status is VM READ)
 Response: Ready; T=0.01/0.01 hh:mm:ss
    Enter: VMLINK MONWRITE 191
 Response: DMSVML2060I MONWRITE 191 linked as 0120 file mode Z
    Enter: LIST D* * Z
 Response: Dmmddyy  Thhmmss Z1
           Ready; T=0.01/0.01 hh:mm:ss
```

Note the filename and filetype of the monitor data file in the LISTFILE output. Invoke the PERFKIT command and use the MONSCAN subcommand to process the monitor data file:

```
    Enter: VMLINK PERFSVM 201
 Response: DMSVML2060I PERFSVM 201 linked as 0121 file mode X
    Enter: PERFKIT MONSCAN Dmmddyy Thhmmss Z
           Substitute your data filename and filetype.
```

You will see the Performance Screen Selection Menu as follows:

```
FCX124          Performance Screen Selection  (FL710       )    Monitor Scan

General System Data        I/O Data                   History Data (by Time)
1. CPU data menu*          11. Channel load           31. Graphics selection
2. Storage utilization     12. Control units          32. History data files*
3. SSI data menu*          13. I/O device menu*       33. Benchmark displays*
4. Priv. operations        14. PCI Function menu*     34. Correlation coeff.
5. System counters         15. Cache extend. func.*   35. System summary*
6. CP IUCV services        16. Reserved               36. Auxiliary storage
7. SPOOL file display*     17. DASD seek distance*    37. CP communications*
8. LPAR data menu*         18. I/O prior. queueing*   38. DASD load
9. Shared segments         19. I/O configuration      39. Minidisk cache*
A. Shared data spaces      1A. I/O config. changes    3A. Storage mgmt. data*
B. Virt. disks in stor.                               3B. Proc. load & config*
C. Transact. statistics    User Data                  3C. LPAR logs menu*
D. Monitor data            21. User resource usage*   3D. Response time (all)*
E. Monitor settings        22. User paging menu*      3E. RSK data menu*
F. System settings         23. User wait states*      3F. Scheduler queues
G. System configuration    24. User response time*    3G. Scheduler data
H. VM Resource Manager     25. Resources/transact.*   3H. SFS/BFS logs menu*
                           26. User communication*    3I. System log

Command ===>
F1=Help  F4=Top  F5=Bot  F7=Bkwd  F8=Fwd  F12=Return
```

Note that the heading in the upper right corner says “Monitor Scan.” Now take a look at the CPU Load screen:

On the command line
Enter: **CPU**

This shows the following Initial CPU Load and Transaction report:

```
FCX100      Data for yyyy/mm/dd        Initial  hh:mm:ss         Monitor Scan

CPU Load                                                        Status or
PROC TYPE %CPU  %CP %EMU %WT  %SYS  %SP %SIC %LOGLD  %PR %ENT  ded. User
P00  CP    ...  ...  ...  ...  ...  ...  ...    ...  ...  ...  Master
P01  CP    ...  ...  ...  ...  ...  ...  ...    ...  ...  ...  Alternate

Total SSCH/RSCH   ..../s     Page rate     ...../s     Priv. instruct.  ..../s
Virtual I/O rate     0/s     XSTORE paging ...../s     Diagnose instr.  ..../s
Total rel. SHARE       0     Tot. abs SHARE     0%

Queue Statistics:     Q0     Q1     Q2     Q3     User Status:
VMDBKs in queue        0      0      0      0     # of logged on users   .....
VMDBKs loading         0      0      0      0     # of dialed users      .....
Eligible VMDBKs                0      0      0     # of active users          0
El. VMDBKs loading             0      0      0     # of in-queue users        0
Tot. WS (pages)        0       0      0      0     % in-Q users in PGWAIT   ...
Reserved                                         % in-Q users in IOWAIT   ...
85% elapsed time    .798   .133  1.064  6.384     % elig. (resource wait)  ...

Transactions      Q-Disp    trivial   non-trv     User Extremes:
Average users        ...        ...       ...     Max. CPU %   ........  .....
Command ===>
F1=Help  F4=Top  F5=Bot  F7=Bkwd  F8=Fwd  F12=Return
```

Note that many of the fields do not contain data (a series of dots) since you are viewing data from the initial collection interval. Move forward through the data to the next collection interval by entering the NEXTSAMP subcommand:

Enter: **NEXTSAMP**

You can go directly to a specific time period or the end of the data collection period by entering one of the following two operands along with the NEXTSAMP subcommand:

Enter: **NEXTSAMP** *nn:nn* (Pick a time a couple of minutes later)
Enter: **NEXTSAMP EOF**
Response: FCXWRF449I End of data reached
Enter: **AVERAGE**

Entering AVERAGE after scanning to the end of the monitor file shows the average values of the entire file on the screen. This is just an example of how you can use the scan function to view performance data from the past.

View other time periods and other display screens if you wish and when you are finished exploring, you can terminate MONSCAN by issuing the following:

Press: **PF12** (to return to the Performance Screen Selection Menu)
Press: **PF12** (to exit from MONSCAN mode)
Press: **PF12** (to exit from PerfKit)

Creating Batch Reports

It is also possible to create batch reports from CP Monitor data with the Performance Toolkit for VM. Once again this should be done from a virtual machine other than PERFSVM. To ensure the environment is correct for creating the reports, begin by starting ZCMS.

```
    Enter: IPL ZCMS
 Response: z/CMS V7.1.0    yyyy-mm-dd hh:mm
    Enter: (Remember to first press ENTER when the status is VM READ)
 Response: Ready; T=0.01/0.01 hh:mm:ss
    Enter: VMLINK MONWRITE 191
 Response: DMSVML2060I MONWRITE 191 linked as 0120 file mode Z
    Enter: VMLINK PERFSVM 201
 Response: DMSVML2060I PERFSVM 201 linked as 0121 file mode X
```

Create a control file to select which reports to produce. You can put an entry in this file to point to the file FCONX REPORTS on PERFSVM's “A” disk and take the defaults that are provided in that file. PerfKit will find the first file named FCONX REPORTS in the CMS search order. If you want to create a customized list of reports, you could copy FCONX REPORTS from the “A” disk of PERFSVM to the “A” disk of MAINT710.

For these instructions, the file on PERFSVM's “A” disk has been customized to not produce any reports. To see the reports that are available, copy the sample file from the PERFSVM 1CC disk that selects all of the reports. You used VMLINK earlier in these instructions to copy the file. Once it is copied, create the BATCH MASTER file.

```
    Enter: VMLINK PERFSVM 1CC (IN COPY FCONX REPORTS .FM = = A
 Response: DMSVML2060I PERFSVM 1CC linked as 0124 file mode W
           DMSVML2061I PERFSVM 1CC detached
    Enter: X BATCH MASTER A
           On the Xedit command line:
    Enter: SET CASE U
    Enter: I REPORTS FCONX REPORTS
```

Verify that the file has the following content:

```
REPORTS FCONX REPORTS
```

Save the file and exit:

```
    Enter: FILE
```

Create the batch reports using the PERFKIT command with the BATCH option. The LISTFILE command is used to show the name of the monitor data file.

```
    Enter: L D* * Z
 Response: Dmmddyy  Thhmmss Z1
           Ready; T=0.01/0.01 hh:mm:ss
    Enter: PERFKIT BATCH BATCH MASTER A DISK Dmmddyy Thhmmss Z
           Substitute your data filename and filetype.
```

Because the reports are wider than a default 3270 screen, it is easier to view the file using the BROWSE command instead of XEDIT.

Enter: **BROWSE FCONX LISTING**
Press: **PF7 / PF8** (to scroll forward/backward in the reports)
Press: **PF10 / PF11** (to scroll right/left in the reports)
Press: **PF3** (to exit BROWSE)

Note: On your own system and especially if you've collected a larger amount of monitor data, you will want to produce only selected reports and probably limit the size of the output file. You can edit FCONX REPORTS and put a comment in column 1 (an asterisk) for any reports you want to skip.

Appendix C. Viewing Performance Data from another Virtual Machine

It is often desirable to allow multiple users on the system access data from the Performance Toolkit for VM without having to logon directly to the PERFSVM virtual machine. The Performance Toolkit provides several methods for doing just that. This appendix shows how to use the VMCF and APPC interfaces to view or obtain data from PerfKit.

Using the VMCF Interface

The VMCF interface allows an authorized user on the same z/VM system to request a “screen” of data from Performance Toolkit. The term “screen” is used because the data returned is the same data you view when you are logged on to the PERFSVM user ID. There are two ways to use the VMCF interface. The first, and probably the most useful, is the CMS Pipelines stage named VMC. The VMC pipeline stage requires two arguments, the name of the Performance Toolkit virtual machine and the PerfKit data to return. It requests the data from the PERFSVM service virtual machine and passes the results to the next stage in the pipeline. This makes it easy to take advantage of the full power of CMS Pipelines to manipulate the data. The VMC interface is limited in the amount of data it returns for each request. Each returned line is limited to 80 bytes and the number of lines returned may also be limited. There are advanced methods that can be used to capture all of the data, but that is beyond the scope of these instructions.

To use the VMC interface, you must be logged on to a user who is authorized to connect to PerfKit. If you configured PerfKit as described in these instructions, then log on to the MAINT710 user ID. Display the data shown on the CPU Load and Transaction screen on the console by entering the following:

Enter: **`PIPE VMC PERFSVM CPU | CONSOLE`**

Note that only the first 80 bytes of each line of the CPU report is displayed on the MAINT710 virtual console. Clear the screen to see all of the lines returned by the VMC stage.

CMS Pipelines has very powerful facilities to work with data. Instead of just displaying all of the returned data on the console, you can use pipelines stages to just look at part of the data:

Enter: **`PIPE VMC PERFSVM CPU|DROP 3|TAKE 3|SUBSTR W1-7|CONSOLE`**

You should see a response similar to the following:

```
PROC  TYPE %CPU  %CP %EMU  %WT %SYS
P00   CP      1    0    0   99    0
P01   CP      1    0    0   99    0
Ready; T=0.01/0.01 hh:mm:ss
```

This PIPE command selects only specific information fields from the CPU report. It ignored (dropped) the header lines (3 lines), and then only read (take) the next 3 lines. For these 3 lines, only the first 7 “words” of the line are selected, and that is shown on your console. Note that if your LPAR had more CPUs, you'd want to increase the “take” number to see those additional CPUs. You can see how this can make the retrieved data more useful and much easier to read.

The other method that uses the VMCF interface uses a CMS command named VMCX. This command is used the same way to to communicate with the PERFSVM service virtual machine. The VMCX module

resides on PERFSVM's 201 disk. In order for multiple users to use this command, you must either copy the module to a common minidisk or each user must link to the PERFSVM 201 disk before issuing the command. The VMCX module takes the same two arguments, the virtual machine name and the subcommand, but displays the information in a semi full-screen mode. This provides a full screen of data, formatted in a similar fashion to what is shown on the PERFSVM virtual console, but does not give you all of the interactive capabilities. You cannot scroll, get help for individual fields, request more detailed displays, etc. You can only enter Performance Toolkit for VM subcommands or QUIT to terminate the VMCX session with the PERFSVM service virtual machine.

To get the CPU Load and Transaction display on MAINT710's virtual console using VMCX, enter the following:

Enter: **VMLINK PERFSVM 201**
Enter: **VMCX PERFSVM CPU**

You will see the CPU Load and Transaction screen displayed as follows:

```
FCX100      CPU 2964  SER BDA97  Interval hh:mm:ss - hh:mm:ss     Remote Data

CPU Load                                                          Status or
PROC TYPE %CPU  %CP %EMU %WT  %SYS  %SP %SIC %LOGLD  %PR %ENT  ded. User
P00  CP      0    0    0 100     0    0  87       0    0    0  Master
P01  CP      0    0    0 100     0    0  99       0    0    0  Alternate

Total SSCH/RSCH      2/s     Page rate        .0/s     Priv. instruct.     5/s
Virtual I/O rate     0/s     XSTORE paging    .0/s     Diagnose instr.     4/s
Total rel. SHARE    3100     Tot. abs SHARE     0%

Queue Statistics:     Q0     Q1     Q2     Q3     User Status:
VMDBKs in queue        1      0      0      1     # of logged on users      22
VMDBKs loading         0      0      0      0     # of dialed users          0
Eligible VMDBKs               0      0      0     # of active users         10
El. VMDBKs loading            0      0      0     # of in-queue users        2
Tot. WS (pages)     3198      0      0  76784     % in-Q users in PGWAIT     0
Reserved                                         % in-Q users in IOWAIT     0
85% elapsed time   5.742   .957  7.656  45.94     % elig. (resource wait)    0

Transactions      Q-Disp    trivial   non-trv     User Extremes:
Average users         .4         .0        .0     Max. CPU %   LINUX03      .1
>>>>>>>>>> Enter next command, or 'QUIT' to exit <<<<<<<<<<

                                                          VM Read   VM01
```

Feel free to experiment viewing other PerfKit screens by entering their names. Some examples are USER (User Resource Details), STORAGE (Storage Utilization), UPAGE (User Page Data), and USTAT (User Wait States.) To terminate the VMCX session:

Enter: **QUIT**

Using the APPC/VM Interface

The APPC/VM interface allows authorized users to get a real full screen interactive display identical to the PERFSVM virtual machine console. This screen is much easier to use than the VMCX interface because it allows you to use the function keys, the help, and highlighting. This capability is very handy for support personnel and it eliminates contention for directly logging onto the PERFSVM user ID. To use the APPC/VM interface the user must be identified in the PERFSVM FCONRMT AUTHORIZ file and be able to access the PERFKIT command, which is located on the 201 minidisk of user PERFSVM. PerfKit runs under the z/Architecture enabled z/CMS, so you must switch over to that environment, access the PERFSVM 201 disk again and issue the PERFKIT command:

```
    Enter: IPL ZCMS
 Response: z/CMS V7.1.0    yyyy-mm-dd hh:mm
    Enter: (Remember to first press ENTER when the status is VM READ)
 Response: Ready; T=0.01/0.01 hh:mm:ss
    Enter: VMLINK PERFSVM 201
 Response: DMSVML2060I PERFSVM 201 linked as 0120 file mode Z
    Enter: PERFKIT
```

The PerfKit Basic Mode Menu will be displayed:

```
FCX001                  Performance Toolkit for VM              AUTOSCROLL 10
 FCXBAS500I Performance Toolkit for VM FL710 (64-bit)









Command ===>
F1=Help  F2=Redisplay  F3=Quit  F12=Return
```

To connect PerfKit running on your user ID with PERFSVM, activate the APPC/VM interface by entering the FCONAPPC command on this screen. You must specify the correct global resource name of the system you want to look at. You can find out the active resource names using the command QUERY RESOURCE or QUERY RESOURCE USER PERFSVM. The default resource name is FCXC1R01 for a single system.

```
    Enter: FCONAPPC FCXC1R01
```

You will see the PerfKit Performance Screen Selection Menu from the system you specified, as follows:

```
FCX124          Performance Screen Selection  (FL710        )    VM01

General System Data        I/O Data                   History Data (by Time)
1. CPU data menu*          11. Channel load           31. Graphics selection
2. Storage utilization     12. Control units          32. History data files*
3. SSI data menu*          13. I/O device menu*       33. Benchmark displays*
4. Priv. operations        14. PCI Function menu*     34. Correlation coeff.
5. System counters         15. Cache extend. func.*   35. System summary*
6. CP IUCV services        16. Reserved               36. Auxiliary storage
7. SPOOL file display*     17. DASD seek distance*    37. CP communications*
8. LPAR data menu*         18. I/O prior. queueing*   38. DASD load
9. Shared segments         19. I/O configuration      39. Minidisk cache*
A. Shared data spaces      1A. I/O config. changes    3A. Storage mgmt. data*
B. Virt. disks in stor.                               3B. Proc. load & config*
C. Transact. statistics    User Data                  3C. LPAR logs menu*
D. Monitor data            21. User resource usage*   3D. Response time (all)*
E. Monitor settings        22. User paging menu*      3E. RSK data menu*
F. System settings         23. User wait states*      3F. Scheduler queues
G. System configuration    24. User response time*    3G. Scheduler data
H. VM Resource Manager     25. Resources/transact.*   3H. SFS/BFS logs menu*
                           26. User communication*    3I. System log
Select performance screen with cursor and hit ENTER
Command ===>
F1=Help  F4=Top  F5=Bot  F7=Bkwd  F8=Fwd  F12=Return
```

From this screen you can select any of the highlighted reports just as you did from the PERFSVM virtual console. When you are finished reviewing performance data, return to the basic mode screen and then and then exit from PerfKit.

Press: **PF12** (to exit the Performance Screen Selection Menu)
Press: **PF12 or PF3** (to exit the Basic Mode Menu)

If you have an SSI cluster, you can view performance data any member without needing to log on to that member. This shows an example of viewing the data on a second member of an SSI cluster. The example uses SSI cluster member names VM01 and VM02.

Enter: **PERFKIT**
Enter: **FCONAPPC FCXC1R02**

Exit this screen the same way you did before. You can also connect to the system selection menu and then select any system that is configured for remote monitoring.

Enter: **PERFKIT**
Enter: **FCONAPPC FCXC1S01**

You should see the System Selection menu that looks like this:

```
FCX198       Performance Toolkit Remote Monitoring Facility      VM01

  Node-ID   Time   ------------- Exceptions & CPU Load -------------> AvExcp
  VM01      hh:mm  none                                                 :      0
  VM02      hh:mm  none                                                 :      0









Select the system to be monitored
Command ===>
F1=Help  F4=Top  F5=Bot  F7=Bkwd  F8=Fwd  F12=Return
```

Move your cursor to under the cluster member name you are interested in, or type the cluster member name you are interested in on the command line, and press `Enter`. You will once again see the Performance Screen Selection menu from that cluster member.

Once you are done looking at the PerfKit screens, you can return to CMS by pressing PF12.

Appendix D. References

The following web pages and documents will give you more information about configuring and using Performance Toolkit for VM , as well as more information about performance on z/VM systems.

- The z/VM Home Page
  http://www.vm.ibm.com
- z/VM Performance Resources
  http://www.vm.ibm.com/perf/

  The 2 most important links on this page are:

  – z/VM Performance Reports
    http://www.vm.ibm.com/perf/reports/

  – z/VM Performance Tips or FAQs
    http://www.vm.ibm.com/perf/tips/
- Performance Toolkit for VM Feature
  http://www.vm.ibm.com/related/perfkit/
- z/VM Documentation
  http://www.vm.ibm.com/library/index.html

  Look for these documents:

  – SC24-6208 *z/VM Performance*

  – SC24-6209 *z/VM Performance Toolkit Guide*

  – SC24-6210 *z/VM Performance Toolkit Reference*