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iSeries

Performance Tools for iSeries

Version 5

SC41-5340-01

iSeries

Performance Tools for iSeries

Version 5

SC41-5340-01

Note

Before using this information and the product it supports, be sure to read the general information under "Notices" on page ix.

Second Edition (May 2001)

This edition applies to the licensed programs IBM Performance Tools for iSeries (Program 5722-PT1), Version 5 Release 1 Modification 0; IBM Operating System/400 (Program 5722-SS1), Version 5 Release 1 Modification 0, and to all subsequent releases and modifications until otherwise indicated in new editions.

This edition replaces SC41-5340-00. This edition applies only to reduced instruction set computer (RISC) systems.

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Programming Interface Information

This publication is intended to help you to achieve high system performance. This publication documents General-Use Programming Interface and Associated Guidance Information provided by IBM Performance Tools for iSeries (5722-PT1).

General-Use programming interfaces allow the customer to write programs that obtain the services of IBM Performance Tools for iSeries and IBM Operating System/400 licensed programs.

This publication documents Product-Sensitive Programming Interface and Associated Guidance Information.

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About Performance Tools (SC41-5340)

This book explains how to use performance tools to collect data about the performance of a system, job, or program. It also explains how to analyze and print the data to help identify and correct any problems. Beginning in V5R1, you should also refer to the Performance overview topic in the iSeries Information Center.

The book addresses both the Manager feature and the Agent feature. Most sections are marked to indicate the feature to which the information applies. If a section is not marked as Manager feature or Agent feature, the section applies to both.

Who should read this book

This book is intended for anyone who has to perform data collections and analyze performance data.

The performance estimates presented are approximations which are believed to be sound. The degree of success that you may achieve in the use of IBM equipment and programs depends on a number of factors, many of which are not under IBM's control. Thus, IBM neither warrants nor guarantees that you can or will achieve similar results. It is your responsibility to validate the estimates furnished and to determine their relevance to your operation.

Any configuration recommended by the capacity planner of the Manager feature should be verified with your marketing representative because the capacity planner does not consider all attachable devices.

Prerequisite and related information

You should be familiar with the information about performance analysis as described in the *Work Management* book before using this book. You should also refer to the Work Management topic in the iSeries Information Center.

The menus and displays shown in this book are used by the Manager feature. Displays used by the Agent feature may contain fewer options than those shown for the Manager feature.

For a list of related publications, see the "Bibliography" on page 379.

Use the iSeries Information Center as your starting point for looking up iSeries and AS/400e technical information. You can access the Information Center two ways:

- From the following Web site:

  `http://www.ibm.com/eserver/iseries/infocenter`
- From CD-ROMs that ship with your Operating System/400 order:

  iSeries Information Center, SK3T-4091-00. This package also includes the PDF versions of iSeries manuals, *iSeries Information Center: Supplemental Manuals*, SK3T-4092-00, which replaces the Softcopy Library CD-ROM.

The iSeries Information Center contains advisors and important topics such as CL commands, system application programming interfaces (APIs), logical partitions, clustering, Java, TCP/IP, Web serving, and secured networks. It also includes links to related IBM Redbooks and Internet links to other IBM Web sites such as the Technical Studio and the IBM home page.

With every new hardware order, you receive the following CD-ROM information:

- *iSeries 400 Installation and Service Library*, SK3T-4096-00. This CD-ROM contains PDF manuals needed for installation and system maintenance of an IBM @server iSeries 400 server.
- *iSeries 400 Setup and Operations CD-ROM*, SK3T-4098-00. This CD-ROM contains IBM iSeries Client Access Express for Windows and the EZ-Setup wizard. Client Access Express offers a powerful set of client and server capabilities for connecting PCs to iSeries servers. The EZ-Setup wizard automates many of the iSeries setup tasks.

For related information, see the "Bibliography" on page 379.

Operations Navigator

Operations Navigator is a powerful graphical interface for managing your iSeries and AS/400e servers. Operations Navigator functionality includes system navigation, configuration, planning capabilities, and online help to guide you through your tasks. Operations Navigator makes operation and administration of the server easier and more productive and is the only user interface to the new, advanced features of the OS/400 operating system. It also includes Management Central for managing multiple servers from a central server.

For more information on Operations Navigator, see the iSeries Information Center.

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Be sure to include the following:

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- The publication number of a book.
- The page number or topic of a book to which your comment applies.

Summary of Changes

Changes to this book reflect the coding enhancements for V4R4, V4R5, and V5R1:

- A list of the required authorities to the main Performance Tools menu and menu options was added as Appendix A.
- The Collection Services QAPMxxxx files are available from the Performance overview topic in the iSeries Information Center. These files previously resided in the *Work Management* book, Appendix A.
- In some occurrences in the book we mention both the performance monitor file and the Collection Services file. Prior to V5R1, the performance monitor used the QAPMJOBS file for storing data. Collection Services does not create the QAPMJOBS file. Instead, the QAPMJOBL file is provided for compatibility with the performance monitor and combines data from the QAPMJOBMI file and the QAPMJOBOS file. The QAPMJOBS file is created when the performance monitor database files are migrated with the Convert Performance Data (CVTPFRDTA) command to a newer release. Therefore, you will find occurrences where we refer to both the QAPMJOBS file and the QAPMJOBL file.
- Support for the performance monitor commands was withdrawn; therefore, all references to these commands were removed:
  - Start Performance Monitor (STRPFRMON)
  - End Performance Monitor (ENDPFRMON)
  - Start Performance Collection (STRPFRCOL)
  - End Performance Collection (ENDPFRCOL)
  - Work with Performance Collection (WRKPFRCOL)
  - Add Performance Collection (ADDPFRCOL)
  - Change Performance Collection (CHGPFRCOL)

  Note: You can still use the Performance Tools reports for data that was collected by the performance monitor in releases prior to V5R1.
- Options were added or deleted to the Performance Tools main menu
  - Option 2 (Collect performance data)
    - Shows the status of Collection Services.
    - Does not refer to working with collection objects.
    - These menu options on the Collect performance data display were changed:
      - Option 1 (Start collecting data) shows you Start Collecting Data display for Collection Services.
      - Option 2 (Stop collecting data) was not changed.
      - Option 3 (Work with Performance Collections) was removed.
  - Option 3 (Print performance report)
    - Supports individual views to print reports for sample data and trace data. Press F20 to toggle between the two views.
  - Option 5 (Performance utilities)
    - Shows two new commands: Start Performance Trace (STRPFRTRC) and End Performance Trace (ENDPFRTRC).
  - Option 6 (Configure and manage tools)
    - Added interface to Create Performance Data (CRTPFRDTA) command

- Changes to all reports:
  - Includes the partition ID in which the collection was run. This change accommodates the logical partition implementation. Here are some of the values that you might see:
    - If your system is not partitioned (which is the default) or you used Collection Services to collect and print the performance data for the primary partition of a logical partition system, this value is 00.
    - If you collected data with the Start Performance Monitor (STRPFRMON) command in a previous release, the value for the partition ID is 00.
    - If you used Collection Services to collect and print the performance data in any secondary partition of a logical partition system, this value is the same as the partition ID that is shown on the Work with System Partitions display under the Start Service Tools (STRSST) command.
  - Includes the Interactive feature code values for 7xx servers. For 7xx servers, the report heading for the feature code will read: Feature Code 208D-2064-1505.
- Changes to System Report
  - A column for faults in the Resource Utilization and Resource Utilization Expansion sections is added.
  - A report for batch statistics, including batch, spool, autostart, and evoke job types, was added in the Resource Utilization and Resource Utilization Expansion sections.
- Changes to Component Reports
  - An exception type, Teraspace EAO, was added to the Exception Occurrence Summary and Interval Counts section.
- The Component Report (Job Workload Activity), Transaction Report (Job Summary), and Job Interval Report (Interactive Job Detail and Non-Interactive Job Detail) were enhanced to provide information on either a thread-level basis or a job-level basis.
- The B-channel name is included in the Resource Interval Report for the IDLC protocol in the Communications Line Detail section.
- Performance Tools CL commands
  - All PT1 commands are shipped with *PUBLIC *EXCLUDE authority.
  - The PT1 commands that were part of Appendix A were removed from this document and now reside in the iSeries Information Center in the CL commands topic.
  - The number of pools to be selected or omitted (SLTPOOLS and OMTPOOLS) parameter was increased to 64 for all print report commands.
  - A thread identifier element was added to the Select jobs (SLTJOB) and Omit jobs (OMTJOB) parameters for these commands: PRTCPTRPT, PRTJOBRPT, and PRTTNSRPT.
  - A Report detail (DETAIL) parameter was added to the PRTCPTRPT and PRTJOBRPT commands.
  - A Type of information (TYPE) parameter was added to the PRTCPTRPT and PRTRSCRPT commands.
  - The option to print a report at the thread level or job level is available for these commands: PRTCPTRPT, PRTJOBRPT, and PTRTNSRPT.
  - The option to print specific sections of the report is available for these commands: PRTCPTRPT and PRTRSCRPT.

– You should not use the Analyze Access Group (ANZACCGRP) command or the Display Access Group (DSPACCGRP) command because the Licensed Internal Code no longer uses process access groups for caching data that is used by a job. Based on this implementation, the value on the report will always show as 0.
– The Work with System Activity (WRKSYSACT) command supports three additional values for the Sequence (SEQ) parameter. You can use the SEQ parameter rather than F16 (Resequence). Prior to V4R4 the SEQ parameter supported only *CPU or *IO values. You can sort the jobs or tasks according to the following values:
  - Storage allocated (*STGALC)
  - Storage deallocated (*STGDLC)
  - Difference of storage allocated and storage deallocated (*STGNET)

Chapter 1. Introduction to Performance Tools

Performance Tools helps you gain insight into the many built-in performance management features already working for you in OS/400. These features include dynamic tuning, expert cache, job priorities, activity levels, and pool sizes. You can also identify ways to use these services better. You might find specific actions for your system that the "built-in" OS/400 features do not address.

Manager Features and Agent Features

The Performance Tools Manager feature is a full-function package, intended to be used on the central site system in a distributed environment or on a single system.

The Performance Tools Agent feature, with a subset of the Manager function, is a lower-priced package with the more basic functions. In a distributed environment, the Agent feature works well for managed systems in the network because the data can be sent to the Manager if detailed analysis is required. It is also an effective tool for sites that need a reasonable level of self-sufficiency but have no expert skills available.

Capacity Planning—Manager Feature

To estimate your system resource utilization as your workload or environment grows, use the capabilities of the BEST/1 capacity planning tool. Following BEST/1 recommendations will help you maintain satisfactory system performance and system resource utilizations.

Do capacity planning before you make changes, such as adding new applications or altering the system configuration. See the *BEST/1 Capacity Planning Tool* book for more information.

Capacity Planning—Agent Feature

The Agent feature provides the ability to create BEST/1 models from performance data. These models can be analyzed by using the BEST/1 support in the Manager feature.

See the *BEST/1 Capacity Planning Tool* book for more information.

Performance Analysis—Manager Feature

After you review the performance measurements, you might want to see more detailed performance data. Use the Print System Report (PRTSYSRPT) and Print Component Report (PRTCPTRPT) commands to help you decide if further analysis is necessary. Chapter 7. Performance Reports—Manager Feature shows examples of these reports.

To provide more detail, you can also produce reports that use trace data by using the Start Performance Trace (STRPFRTRC) command. Use the Print Transaction Report (PRTTNSRPT) command to help you do further analysis of performance problems you may be experiencing.

The advisor, that is described in Chapter 4. Advisor, analyzes collected performance data and produces conclusions and recommendations for improving system performance. You can have the advisor put the recommendations into effect. You can use the conclusions and recommendations to help you decide how to adjust system tuning values.

See Chapter 10. Performance Utilities—Manager Feature, for an explanation and examples of other utilities you can use to analyze the performance of applications on your system. See Chapter 5. Displaying Performance Data, for an explanation on interactively displaying performance data.

The performance explorer is a tool that finds the causes of performance problems that cannot be identified by using tools that do general performance monitoring. Chapter 11. Performance Explorer describes the performance explorer.

"Summary of Data Collection and Report Commands—Manager Feature" on page 12 provides a summary of data collection commands and reporting commands.

Performance Analysis—Agent Feature

The advisor, that is described in Chapter 4. Advisor, analyzes collected performance data and produces conclusions and recommendations for improving system performance. You can have the advisor put the recommendations into effect. You can use the conclusions and recommendations to help you decide how to adjust system tuning values.

See Chapter 5. Displaying Performance Data, for an explanation on interactively displaying performance data.

The performance explorer is a tool that finds the causes of performance problems that cannot be identified by using tools that do general performance monitoring. Chapter 11. Performance Explorer describes the performance explorer.

See Chapter 14. Working with Historical Data—Agent Feature, for an explanation on how to use the option to create historical data from performance data. The historical data will help show the trends in your system performance.

Chapter 2. Starting Performance Tools

This chapter explains how to install and set up your Performance Tools. Information on how to use the Start Performance Tools (STRPFRT) command is also provided.

Installing Performance Tools

To install the Performance Tools product, you need a user profile with save system (*SAVSYS) authority. You can use the system operator profile to obtain this authority.

Performance Tools must run in a library named QPFR. If a library by this name is on your system, rename it before you install Performance Tools, using the Rename Object (RNMOBJ) command. This step will ensure the proper operation of the Performance Tools.

Use the following command to place the Performance Tools in library QPFR:

```
RSTLICPGM  LICPGM(5722PT1)  DEV(NAME)   OPTION(*BASE)
```

You must then perform one of the following:

- If you have purchased the Manager feature, use the following command:
  ```
  RSTLICPGM  LICPGM(5722PT1)  DEV(tape-device-name)  OPTION(1)
  ```
- If you have purchased the Agent feature, use the following command:
  ```
  RSTLICPGM  LICPGM(5722PT1)  DEV(NAME)  OPTION(2)
  ```

If you have several CD-ROMs to install, the following situation may occur. After installing the first one, you may receive a message saying that the licensed product is restored but no language objects were restored. If this occurs, load the next one and enter the following:

```
RSTLICPGM  LICPGM(5722PT1)  DEV(NAME)  RSTOBJ(*LNG)  OPTION(*BASE)
```

Another method for installing the Performance Tools product is to type *GO LICPGM* and use the menu options.

How Performance Tools Counts Users

Performance Tools is a processor-based product. The usage type is concurrent. The product is installed with a usage limit *NOMAX.

Printer File and Output Queues

The Performance Tools printer files have a default forms size of 8-1/2 x 11 inches, an overflow line number of 60, and a characters-per-inch setting of 10 or 15 (this setting depends on whether the report is 80 or 132 characters wide). If the printer file characteristics you want are different from the supplied printer file characteristics, use the Change Printer File (CHGPRTF) command to alter them. Use of the generic name, QP*, on this command changes all printer files in library QPFR to the new form size.

The default output queue on the performance job description (QPFRJOBD) is QPFROUTQ. Reports, submitted as batch jobs, use this job description as the default. If you want to use a different output queue from the queue established by Performance Tools, use the Change Job Description (CHGJOBD) command. Specify the output queue you want to use for the OUTQ parameter on the CHGJOBD command.

Start Performance Tools (STRPFRT) Command

Use the STRPFRT command to start Performance Tools. After you enter the command, the IBM Performance Tools menu for your Manager feature or Agent feature appears. From this display, you can either choose one of the menu selections, or enter a command:

```
PERFORM                IBM Performance Tools for AS/400
                                                            System:   ABSYSTEM
Select one of the following:

     1. Select type of status
     2. Collect performance data
     3. Print performance report
     4. Capacity planning/modeling
     5. Performance utilities
     6. Configure and manage tools
     7. Display performance data
     8. System activity
     9. Performance graphics
    10. Advisor

    70. Related commands


Selection or command
===>

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F16=System main menu
```

Press F3 (Exit) or F12 (Cancel) to exit the IBM Performance Tools menu.

Enter commands on the command line. Use F4 (Prompt) and F9 (Retrieve) to prompt for or retrieve commands that you enter on the command line.

To review any messages that are returned to you on the message line, position the cursor on the message line and press the Help key for additional detail. Pressing F10 (Display messages in job log) from this detail display allows you to view all of the messages currently in the job log.

Each time you use STRPFRT, the following occurs:
- The library QPFR is added to the library list (between the system and user positions of the library list).
- The IBM Performance Tools menu appears.

When you finish using Performance Tools, press F3 (Exit). When you do so, the library QPFR is removed from the job's library list.

Once you use the STRPFRT command to start the Performance Tools, any further attempt to use the command from within the operating environment for Performance Tools fails. If you try to start the Performance Tools program when it is already operating from your job, a message appears that indicates that the operating environment for Performance Tools is already active. Multiple jobs may use Performance Tools at the same time but only one data collection job can be active at any given time.

Displaying the System or Job Status—Manager Feature

If you choose option 1 (Select type of status) on the IBM Performance Tools menu, the Select Type of Status display appears:

```
                       Select Type of Status to Display

 Select one of the following:

      1. Work with system status
      2. Work with subsystem
      3. Work with current job
      4. Work with submitted job(s)
      5. Work with specified job(s)
      6. Work with active jobs
      7. Work with disk status
```

On the Select Type of Status display, you can use a set of OS/400 commands to provide you with information about the performance of the system or a particular job.

Each option on the Select Type of Status display has a corresponding command associated with it, as shown in the following list. To use a function, such as working with the system status, either enter option 1 on the command line of the Select Type of Status display *or* enter WRKSYSSTS on any command line.

Table 1. Type of Status Option with Corresponding Command

Type of Status Option	Corresponding Command	Corresponding function in Operations Navigator
Work with system status	WRKSYSSTS	Management Central (System monitors)[1]
Work with subsystem	WRKSBS	Work Management[2]
Work with current job	WRKJOB	You can use the Include options that are available for Active Jobs in the Work Management function.[2]
Work with submitted job(s)	WRKSBMJOB	There is no equivalent function.
Work with specified job(s)	WRKJOB	Work Management[2]
Work with active job(s)	WRKACTJOB	Work Management[2]
Work with disk status	WRKDSKSTS	Hardware[3]

1 Here is the path in Operations Navigator: Expand Management Central, expand **Monitors**, select **Systems**.

2 Here is the path in Operations Navigator: Under your connections, expand the system that you want to work with and select **Work Management**.

3 Here is the path in Operations Navigator: Under your connections, expand the system that you want to work with. Next expand **Configuration and Service** and select **Hardware**.

Chapter 3. System Performance Data

The Performance Tools program uses data that is collected by Collection Services. Collection Services tracks the activity on the system and collects relative data. After you collect data, Collection Services provides a set of files that contain data about the performance of the system. In a distributed client/server environment, this data can be collected on managed (or remote, distributed) systems. You can then send the data to the central site system where the skills and the tools exist to analyze the collected data.

This chapter describes how to collect data using the Start Performance Tools (STRPFRT) command. For the Manager feature, other ways of collecting data using Performance Tools are described in Chapter 10. Performance Utilities—Manager Feature and Chapter 6. System Activity. The figures shown in the sections following "Summary of Data Collection and Report Commands—Manager Feature" on page 12 show the Performance Tools data collection commands, and describe when you use each in analyzing the performance of your system.

Collection Services is used by both the Agent feature and the Manager feature. Collection Services is important in the overall analysis of your system. Use it to collect data about resources that influence the performance of your system (processing unit, main storage, auxiliary storage, and communications). Collection Services is provided with the OS/400 licensed program. The Performance overview topic in the iSeries Information Center contains additional information on collecting performance data with Operations Navigator. The data files that were previously documented in Appendix A of the Work Management book are now available from the iSeries Information Center.

Collecting Sample or Trace Data

Collection Services provides for the collection of sample data. You must use the Start Performance Trace (STRPFRTRC) command to collect trace data.

Trace Trace data is detailed, and can be collected when detailed applications or job analysis is required. Trace data is collected as it happens for each transaction and results in a large amount of very detailed data that is useful in problem analysis. When you collect trace data, it places additional demands on your system. You generally choose to collect trace data to gain additional detailed information about specific jobs and transactions. By collecting trace data, you can often gain insight into other problems involving resource contention, program resource use, transaction delays, and so on.

Note: When you issue the STRPFRTRC SIZE(*CALC) command, it collects the same trace data that was collected previously by the STRPFRMON (TRACE(*ALL)) command. You can use the Transaction Report to process the data.

Sample

Also called summary data or system data, this data is collected for normal trend analysis and performance analysis. The data relates to the following:

- All jobs on the system
- Devices attached to the system

- Storage pools
- Communications I/O processors
- Disk I/O processors
- Local workstation I/O processors
- Workstation response times

Sample data is collected at system, resource, job, and device levels and on an interval basis. The recommended default collection interval is 15 minutes, but the interval can range from 0.25 - 60 minutes. This means that a performance data record is produced for each job and resource on the system at each interval. For example, once every 15 minutes. Valid values for the collection intervals are:

- 0.25 (15 seconds)
- 0.5 (30 seconds)
- 1, 5, 15, 30, and 60 minutes

The Manager feature allows you to use the Print System Report (PRTSYSRPT) and Print Component Report (PRTCPTRPT) commands to print the sample data you collect. To review examples of these reports, see “System Report” on page 73 and “Component Report” on page 82.

With the Manager feature, you can use the Print Transaction Report (PRTTNSRPT), the Print Lock Report (PRTLCKRPT), and the Print Trace Report (PRTTRCRPT) commands to see the data collected through trace. Refer to “Transaction Report” on page 95 and to “Lock Report” on page 120 to review the information provided from trace data collection.

For the Manager feature, some of the commands described in Chapter 10. Performance Utilities—Manager Feature, make use of trace data collected using the STRPFRTRC command. See “Summary of Data Collection and Report Commands—Manager Feature” on page 12 for more information on the commands that use the trace data.

For the Agent feature, you will need to use the Performance Tools Manager feature to analyze trace data. See Appendix C. Comparison of Performance Tools, for more information.

For the Manager feature, the Performance Tools program has additional functions to analyze performance data, including printing of performance reports and performance utilities. See Appendix C. Comparison of Performance Tools, for more information.

Collecting sample data with the STRPFRT command

To collect sample data, follow these steps:

1. Enter the Start Performance Tools (STRPFRT) command on any command line to show the IBM Performance Tools menu.

```
PERFORM                IBM Performance Tools for AS/400
                                                            System:   ABSYSTEM
Select one of the following:

     1. Select type of status
     2. Collect performance data
     3. Print performance report
     4. Capacity planning/modeling
     5. Performance utilities
     6. Configure and manage tools
     7. Display performance data
     8. System activity
     9. Performance graphics
    10. Advisor

    70. Related commands


Selection or command
===>

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F16=System main menu
(C) COPYRIGHT IBM CORP.
```

2. Choose the `Collect performance data` option on the IBM Performance Tools menu, and press Enter. The Collect Performance Data display appears. This display shows you the status of Collection Services.

```
                           Collect Performance Data                 ABSYSTEM
                                                            02/22/01  12:41:48
Collection Services status:
  Status  . . . . . . . . . . . . :   Stopped











Select one of the following:

     1. Start collecting data
     2. Stop collecting data

Selection or command
===>

F3=Exit   F4=Prompt   F5=Refresh   F9=Retrieve   F12=Cancel
```

3. Choose the `Start collecting data` option, and press Enter. The Start Collecting Data display appears.

```
                            Start Collecting Data

Type choices, press Enter.

  Library . . . . . . . . . . . . . .   QMPGDATA     Name
  Collection interval (minutes) . . .   5.00         0.25, 0.5, 1, 5, 15, 30,
                                                       60
  Retention period:
    Days . . . . . . . . . . . . . . .  7            *PERM, 0-30
    Hours . . . . . . . . . . . . . .   0            0-23
  Cycling:
    Time to synchronize cycle . . . .   00:00:00     HH:MM:SS
    Frequency to cycle collections . .  24           1-24
  Create database files . . . . . . .   *YES         *YES, *NO
  Collection profile . . . . . . . . .  *STANDARDP   *MINIMUM, *STANDARD,
                                                       *STANDARDP, *ENHCPCPLN






F3=Exit   F12=Cancel
```

On this display, refer to the online help for a description of each field. Most of the Performance Tools reports use performance data that is contained in a set of OS/400 database files that begin with the prefix QAPMxxxx. You must place the performance data from a collection object into the appropriate database file before you can run the Performance Tools report. You can create these database files by using any of the following methods:

- Specify *YES for the Create database files field shown in the previous display.
- Use the Create Performance Data (CRTPFRDTA) command.
- Specify Create database files during collection when starting Collection Services in Operations Navigator.
- Select Create database files now for the collection object in Operations Navigator.

Using the STRPFRTRC command to collect trace data

If you type `STRPFRTRC` from the command line, the Start Performance Trace (STRPFRTRC) display is shown.

```
                    Start Performance Trace (STRPFRTRC)

Type choices, press Enter.

Size . . . . . . . . . . . . . .   *CALC         128-998000, *CALC, *MAX
Omit trace points  . . . . . . .   *NONE         *NONE, *RSCMGT

                         Additional Parameters

Job types  . . . . . . . . . . .   *DFT          *NONE, *ALL, *DFT, *ASJ...
               + for more values
Job trace interval . . . . . . .   0.5           .1 - 9.9 seconds










                                                                       Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

On this display, refer to the online help for a description of each field.

You must use the End Performance Trace (ENDPFRTRC) command to stop the collection of performance trace data and then optionally write performance trace data to a database file before you can print the Transaction reports.

Printing sample and trace data

Option 3 (Print performance report) of the Performance Tools menu shows you two views of performance data: sample data and trace data. Press F20 to toggle back and forth between the sample and trace data views. You see F20 only if both trace data and sample data exist in the current library. For each display, only valid Performance Tools commands are listed as options to process the performance collections. For sample data, you see these options:

- System report
- Component report
- Job report
- Pool report
- Resource report

For trace data, you see these options:

- Transaction report
- Lock report
- Batch job trace report

See Figure 13 on page 63 and Figure 14 on page 70 for examples of these displays.

Because the sample data and trace data collections are separate, you must coordinate the start/stop times between the sample data and trace data collections. You must also coordinate the trace database file member name (MBR) and file library name (LIB) on the ENDPFRTRC command with that of the sample data member name and file library.

Summary of Data Collection and Report Commands—Manager Feature

Table 2 through Table 5 in the following sections present the commands for various levels of data collection. These figures also show the related report commands, show the type of data collected, provide a summary of the information contained in the reports, and describe when you might use these commands.

Refer to the figures indicated for information on the following data collection levels:

- System (Table 2)
- Job (Table 3 on page 14)
- File use and structure (Table 4 on page 15)
- Application (Table 5 on page 15)

If you use the Performance Tools menus and displays to collect data and produce reports, these figures may help you understand, at a glance, the capabilities of Performance Tools. If you bypass the menus and displays by entering commands on the available command entry lines, these figures may serve as a reference for the available commands.

System-Level Analysis—Manager Feature

System-level data collection and analysis provides you with a comprehensive view of how the system operates. This information ranges from a system operational overview to an analysis of individual transactions. System-level data collection and analysis also provides you with system modeling functions for capacity planning and performance prediction.

Use system-level data to identify what additional collection and analysis should be done.

A summary of system data collection and report commands is shown in Table 2.

Table 2. System Data Collection and Report Commands

Level of Data	Type of Data	Report Command	Information Shown on the Reports	When to Use the Command
Job Disk System	Sample data	ANZPFRDTA	Contention analysis and recommendations	Processing trends System model Workload projection Hardware growth Processing unit Main storage Disk
Job Disk System	Sample data	PRTSYSRPT PRTCPTRPT	Workload Utilization Processing unit Disk Main storage Communications Model parameters External response times	Processing trends System model Workload projection Hardware growth Processing unit Main storage Disk

Table 2. System Data Collection and Report Commands (continued)

Level of Data	Type of Data	Report Command	Information Shown on the Reports	When to Use the Command
System Job Program	Trace data	PRTTNSRPT	Workload Utilization Processing unit Exceptional waits Transaction detail Top ten reports Object contention Concurrent batch jobs System model parameters Transaction summary and detail	Workload projection Hardware growth Pool configuration Overcommitment Application design File contention Transaction Significance Classification Program use System model Processing trends
System Job Program Files Disk	Trace data	PRTTRCRPT	Resources used Exceptions State transitions	Progression of batch jobs traced through time
Job Program Files Disk	Sample data	STRBEST	System performance projections Capacity planning Configuration planning	Before installing When growth is anticipated, either in hardware or workload When a new application is to be installed Performance analysis
Job Program Files Disk	Trace data	PRTLCKRPT	File, record, or object contention by: Object name Holding or requesting job Time	To reduce or remove object contention Problem analysis
Job Program Files Disk	Sample data	PRTJOBRPT	Utilization Processing unit Disk Communications Workload	Problem analysis
Job Program Files Disk	Sample data	PRTPOLRPT	Utilization Main Storage Workload Subsystem	Problem analysis
Job Program Files Disk	Sample data	PRTRSCRPT	Utilization I/O Processing unit Disk External response times	Problem analysis

Table 2. System Data Collection and Report Commands (continued)

Level of Data	Type of Data	Report Command	Information Shown on the Reports	When to Use the Command
Application or Program	Statis-tics Profile Trace	PRTPEXRPT	Program and procedure statistics on calls, CPU usage and I/O Sampling of CPU usage of program and procedure instructions Detailed record of performance related events as they occurred	When general performance monitoring cannot find problems Problem analysis

For more information on the report commands shown in this figure, see Chapter 7. Performance Reports—Manager Feature. All of the Performance Tools command descriptions and syntax diagrams are available from the iSeries Information Center. The PRTLCKRPT command is described in "Lock Report" on page 120.

Job Trace Analysis—Manager Feature

Job trace analysis enhances the operating system's standard trace job reports and provides a summary of job operation and transaction processing. The primary use for job trace analysis is to determine application flow. You can determine what parts of a job use the most resources, and measure the effect of program changes relative to previous trace data. Do not use job trace analysis to determine accurate job or transaction processing times.

A summary of job trace data collection and report commands is shown in Table 3 on page 14.

For more information about the data collection or report commands, see Chapter 10. Performance Utilities—Manager Feature.

Table 3. Job Trace Data Collection (STRJOBTRC Command) and Report Commands

Level of Data	Type of Data	Report Command	Information Shown on the Reports	When to Use the Command
Job Program Files	Trace data	PRTJOBTRC ENDJOBTRC	Program name Control flow I/O operations Full/shared opens Exceptions Message handling Disk I/O summary	For program development To identify jobs or programs that perform poorly

File Use and Database Structure Analysis—Manager Feature

The commands shown in Table 4 on page 15 provide an overview of the program file use and the database file structure of an application.

The following contain information for analyzing file use database structure:

- "Analyze Program (ANZPGM) Command" on page 277

- “Analyze Database File (ANZDBF) Command” on page 279
- “Analyze Database File Keys (ANZDBFKEY) Command” on page 281

Table 4. File Use and Structure Data Report Commands

Level of Data	Report Command	Information Shown on the Reports	When to Use the Command
Program File use structure	ANZPGM	Program file	For application use analysis
Program File use structure	ANZDBF	Physical file structure	For application analysis
Program File use structure	ANZDBFKEY	Logical file structure	For file analysis

Job Analysis

Job analysis provides you with a view of the operational environment for all jobs, or a group of jobs, in the system at a given time. Use the information from a specific process analysis to improve the performance of the process. This analysis can help you improve the program environment to reduce the number of the following:

- Open files
- File buffer and work space sizes
- File open placement in a program
- Active programs

A summary of job data collection and report commands is shown in Table 5.

Table 5. Process Data Collection (DSPACCGRP Command) and Report Commands

Level of Data	Report Command	Information Shown on the Reports	When to Use the Command
Job Program Files	DSPACCGRP ANZACCGRP	File use Files used at the same time Open Data Path Buffer size Formats (size and number) I/O counts Duplicates PAG size[1] Active programs	Reduce program size Reduce number of open files Reduce process access group (PAG) I/O Determine group job candidates

[1] The Licensed Internal Code no longer uses process access groups for caching data. Because of this implementation, this field will always be 0 for current releases.

Chapter 4. Advisor

The advisor provides an easy-to-use way to improve many of the performance characteristics of your system.

The advisor fits into the set of Performance Tools between automatic system tuning and the more specialized tools provided in Performance Tools and the reports (such as a Print System Report). Appendix C. Comparison of Performance Tools, provides more information about the functions provided in Performance Tools.

Automatic system tuning is a useful method for maintaining the basic conditions for good performance. If it is set to work at each system restart, it resets the basic tuning values to the recommended settings for the system configuration and controlling subsystem. Dynamic automatic system tuning adjusts only pool sizes and activity levels of shared pools based on system activity as measured at user-specified intervals. To adjust the system, the tuner uses a guideline that is calculated based on the number of jobs.

The advisor can help you to define specific tuning values and other parts of a processing environment to provide better performance for specific processing conditions on your system.

The advisor analyzes performance data and then produces recommendations and conclusions to help improve performance. The advisor might recommend changes to basic system tuning values, and might list conclusions about conditions that could cause performance problems.

You can choose to have the advisor change system tuning values as it recommends, or you can decide to make only the changes you select. You can use the advisor’s conclusions to make changes to your system, to guide further performance data collection, or to help you request performance reports containing more information and explanations.

The advisor can help you to improve system performance, but it will not identify or correct all performance problems. The performance information analyzed includes:

- Storage pool sizes
- Activity levels
- Disk and CPU utilization
- Communications utilizations and error rates
- Input/output processor utilization
- Unusual job activities—exceptions or excessive use of system resources
- Interactive trace data (when available) (Manager feature)

The advisor does not:

- Make any recommendations for changing specific application programs to improve their performance
- Analyze noninteractive trace data

The advisor is a good first tool to use to improve system performance. In many instances, it will be the only tool required to make the improvements you need. This chapter takes you through the process for using the advisor. In general, this process consists of the following steps:

1. Identify when the performance problems occur.
2. Use Collection Services to collect data.
3. Request the advisor to analyze the data.
4. Use the advisor's output to change system tuning values, to guide further data collection, or to request other more detailed performance reports.
5. Observe the effects of any tuning changes, and decide if another cycle through this process is required to further improve performance or to eliminate unwanted side effects.

Notes:

1. The examples in this chapter show how to use the advisor, but they do not contain specific solutions for any performance problems that might exist on a particular system.
2. Sometimes an analysis of data collected during normal system operation can help in selecting the advisor recommendations to implement to solve performance problems occurring at other times.
3. At times the advisor will suggest additional analysis using tools available only in the Manager feature.
4. When the advisor makes no significant recommendations or conclusions and the system's performance remains unacceptable, analysis at the application level is required. In this case, the advisor has ruled out many tuning, communications, and disk problems.
5. When making recommendations, the advisor takes into consideration some guidelines and threshold values from the BEST/1 hardware table.

Collecting the Right Performance Data

Before collecting performance data, you should clearly describe the problem to be investigated. From system users' comments or your own experience, you can begin to formulate a description of the problem. The problem description does not need to be overly detailed or technical, just try to simply describe one problem. For example:

- Interactive (or batch) processing seems too slow.
- File updating should go faster.
- At times the entire system seems to be sluggish.

Next, determine when the problem is most likely to occur. Maybe interactive work is slow first thing in the morning. Perhaps batch processing seems slow late in the afternoon.

When you can clearly describe the problem and have determined when it seems to occur, you are ready to collect performance data to be analyzed by the advisor.

If possible, focus on collecting data for one problem at a time. When you use Collection Services, you can collect data continuously. You can decide later how much of the data you want the advisor to analyze. For more information about when to collect performance data and how much to collect, see the Performance overview topic in the iSeries Information Center.

Requesting an Analysis

After you collect your data, you request the advisor to analyze all or part of that data.

To start the advisor, you can select the `Advisor` option on the IBM Performance Tools menu, or type the Analyze Performance Data (ANZPFRDTA) command on any command line.

Note: To analyze performance data from a library other than QPFRDATA when using the ANZPFRDTA command, type the command and press F4 (Prompt) to change the library name.

```
PERFORM                IBM Performance Tools for AS/400
                                                            System:   ABSYSTEM
Select one of the following:

     1. Select type of status
     2. Collect performance data
     3. Print performance report
     4. Capacity planning/modeling
     5. Performance utilities
     6. Configure and manage tools
     7. Display performance data
     8. System activity
     9. Performance graphics
    10. Advisor

    70. Related commands


Selection or command
===> 10

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F16=System main menu
(C) COPYRIGHT IBM CORP.
```

The next two steps in requesting a performance data analysis are:
- Select the member containing the performance data to analyze.
- Select the time intervals of data to analyze.

Selecting a Member

When the `Advisor` option is selected, or the ANZPFRDTA command is run, the Select Member for Analysis display appears.

```
                        Select Member for Analysis

Library  . . . .   QMPGDATA

Type option, press Enter.
  1=Select   5=Display

Option  Member      Text                             Date      Time
        Q338000036                                    12/03/00  00:00:39




                                                                  BOTTOM
F3=Exit   F12=Cancel   F15=Sort by name   F16=Sort by text
F19=Sort by date/time
```

To request an analysis, select only one member that contains performance data collected during a time when the problem occurred. When you select a member and press the Enter key, a Select Time Intervals to Analyze display appears.

Notes:

1. When you return to the Select Member for Analysis display, the 1 typed for the member remains. This is a reminder that you may want to display this member.
2. If Collection Services is running and you select one of the members shown in the Select Member for Analysis display, this member may appear with blank Date and Time fields until the first interval is collected.

Selecting Time Intervals

```
                     Select Time Intervals to Analyze

Member . . . . . . . :   Q338000036      Library  . . . . . . :   QMPGDATA

Type options, press Enter.
  1=Select

                   -Transaction-  -CPU Util--  --High--  Pool Fault    Excp
Opt  Date   Time     Count   Rsp  Tot Int Bch  Dsk Unit  Mch Usr ID    Util
     12/03  00:05        0   .00   81  69 +++   23 0004    2  17 02       0
     12/03  00:10        0   .00   85   0  72   36 0004    1  17 02       0
     12/03  00:15        0   .00   92   0  83   24 0004    0  29 02       0
     12/03  00:20        0   .00   98   0  91   12 0002    0   9 02       0
     12/03  00:25        0   .00   96   0  97   14 0004    0   5 02       0
     12/03  00:30        0   .00   94   0  85   16 0002    0   8 02       0
     12/03  00:35        0   .00   87   0  91   17 0002    0  13 02       0
     12/03  00:40        0   .00   84   0  76   16 0003    0  14 02       0
     12/03  00:45        0   .00   76   0  69   10 0004    0  19 02       0
     12/03  00:50        0   .00   79   0  73    7 0002    0   4 02       0
     12/03  00:55        0   .00   53   0  50    2 0001    0   0 02       0
                                                                      More...
F3=Exit   F5=Refresh   F11=Display histogram   F12=Cancel   F13=Select all
F14=Deselect all
```

The Select Time Intervals to Analyze display lists all the time intervals of performance data collected in the library member selected on the Select Member for Analysis display. To analyze a different member, press F12 (Cancel) to return to the Select Member for Analysis display.

The columns on the Select Time Intervals to Analyze display can help you focus the analysis on time intervals when the suspected performance problem seems to have occurred. If there are no obvious reasons to select only some of the displayed time intervals, you can select them all for analysis by pressing F13 (Select all).

When one or more time intervals are selected for analysis, press the Enter key to request the analysis by the advisor.

Note: The Transaction Count field does not include the number of DDM I/Os that were generated. Use the Display Performance Data (DSPPFRDTA) command to display the value for the logical database I/O for DDM jobs.

Using a Histogram

Sometimes a graph of the data for one of the performance values in the data makes it easier to select specific time intervals of data for analysis. To define and display a graph (called a **histogram**), press F11 (Display histogram) on the Select Time Intervals to Analyze display. The display then changes to include the Select Histogram window.

```
                       Select Time Intervals to Analyze
 ............................................
 :             Select Histogram             : ary  . . . . . . :   QMPGDATA
 :                                          :
 :  Type option, press Enter.               :
 :    1=Select                              :
 :                                          :
 :  Opt     View                            :   --High--  Pool Fault    Excp
 :          Transaction count               :   Dsk Unit  Mch Usr ID    Util
 :          Transaction response time       :    23 0004    2  17 02       0
 :          Total CPU utilization           :    36 0004    1  17 02       0
 :          Interactive CPU utilization     :    24 0004    0  29 02       0
 :          Batch CPU utilization           :    12 0002    0   9 02       0
 :          High disk utilization           :    14 0004    0   5 02       0
 :                              More...     :    16 0002    0   8 02       0
 :  F3=Exit   F12=Cancel                    :    17 0002    0  13 02       0
 :                                          :    16 0003    0  14 02       0
 :..........................................:    10 0004    0  19 02       0
      12/03  00:50        0   .00   79   0  73    7 0002    0   4 02       0
      12/03  00:55        0   .00   53   0  50    2 0001    0   0 02       0
                                                                        More...
 F3=Exit   F5=Refresh   F11=Display histogram   F12=Cancel   F13=Select all
 F14=Deselect all
```

The *View* column lists the performance values that can be selected to define the Y (vertical) histogram axis. The X (horizontal) histogram axis always shows the time intervals contained in the member.

As an example, to make it easier to see the time intervals where CPU utilization is the highest, you could select one of the CPU utilization views. A sample histogram for Total CPU Utilization follows:

```
                      Select Time Intervals from Histogram

Type a '1' under each interval to select, press Enter.

Total CPU utilization
     108 :
      99 :
      90 :  ****
      81 :********
      72 :**********
      63 :**********  *           *                              *    *
      54 :**********  *  *************** **********************************
      45 :*****************************************************************
      36 :*****************************************************************
      27 :*****************************************************************
      18 :*****************************************************************
       9 :*****************************************************************
       0 :*****************************************************************

          +-------+-------+-------+-------+-------+-------+-------+-------+
        00:05   00:45   01:25   02:05   02:45   03:25   04:05   04:45   05:25
F3=Exit   F5=Refresh   F11=Display histogram   F12=Cancel   F13=Select all
F14=Deselect all       F20=Scroll right
```

On this example, it is easy to see and select the time intervals of greatest interactive processing unit use. The number 1 is entered to select each time interval to be analyzed. All of the intervals can be quickly selected by pressing F13 (Select all), as shown in the example.

After you press Enter on the Select Time Intervals to Analyze display or on the Select Time Intervals from Histogram display, the advisor analyzes the performance data for the selected time intervals.

Notes:

1. An analysis of large amounts of performance data can take a long time and could affect system performance for other users.
2. The analysis performed by the advisor includes all of the types of performance data for the selected time intervals, and is not limited to the type of data selected to create the histogram.

Analyzing Trace Data

The advisor can analyze interactive transactions when the performance monitor is run with the option TRACE *ALL for the selected member (for data collected prior to V5R1) or when you issue the STRPFRTRC SIZE(*CALC) command (for data collected at V5R1). The file QTRTSUM, produced from the *FILE option of the Transaction report, is analyzed. If the file does not already exist, the advisor creates QTRTSUM using the default options. Otherwise, the existing QTRTSUM file is processed.

The command CHGJOBTYP can be run to change the job type of noninteractive jobs to interactive. After the job types have been changed, the *FILE option of the Transaction report can be run so that the advisor analyzes the jobs listed as interactive.

The performance information analyzed from trace data includes:

- Exceptions by job
- Transactions with long seize/lock wait times
- Unusual transaction activities—excessive wait times

The default is to analyze trace data when it is available. To avoid analyzing trace data, use the ANZPFRDTA command, press F4 (Prompt), and press F10 (Additional parameters) to change the value of the DATATYPE parameter to *SAMPLE.

Note: Caution should be used when analyzing an existing QTRTSUM file. The file may not include time intervals that match the intervals that were picked for the advisor to analyze.

Using the Advisor's Results

Depending on the content of the selected performance data, the advisor can produce recommendations, conclusions, and interval conclusions. What these are and how you can use them are explained as you look at the following examples.

When a performance data analysis has completed, the Display Recommendations display shows the results.

```
                         Display Recommendations
                                                          System:   ABSYSTEM
Member . . . . . . :   Q338000036       Library  . . . . . :   QMPGDATA
System . . . . . . :   ABSYSTEM         Version/Release  . :   5/ 1.0
Start date . . . . :   12/03/00         Model  . . . . . . :   510
Start time . . . . :   00:00:39         Serial number  . . :   10-18B6D
Partition ID . . . :   00               Feature Code . . . :   2144-2144
QPFRADJ  . . . . . :   2                QDYNPTYSCD . . . . :   1
QDYNPTYADJ . . . . :   1

Type options, press Enter.
  5=Display details

Option     Recommendations and conclusions
                            Recommendations
           Decrease pool size for listed pools.
  5        Increase pool size for listed pools.
           Decrease activity level in listed pools.
           Add more main storage.
           ASP space capacity exceeded guideline of 80.0%.
                              Conclusions
           High priority job CPU usage listed.
                                                                     More...
F3=Exit   F6=Print   F9=Tune system   F12=Cancel   F21=Command line
```

Understanding Recommendations

The *Recommendations* section of this display deals with conditions that significantly affect system performance. The recommendations result from comparing the system values and conditions in the analyzed performance data to the basic OS/400 performance guidelines.

The recommendations suggest changes to the basic system tuning values that can improve performance. They also list problems that can be solved by other actions. In this example, the recommendations about changing pool sizes can be carried out by changing system tuning values. But, the recommendation about ASP (auxiliary storage pool) space capacity might require redefining the use of system disk space or adding to system disk capacity. You might need technical assistance to complete this type of recommendation. **Auxiliary storage pool** can be one or more storage units defined from the disk units or disk unit subsystems that make up auxiliary storage. ASPs provide a means of isolating certain objects on specific disk units to prevent the loss of data due to disk media failures on other disk units.

To see more details about a recommendation, type 5 in the *Option* column. As an example, the following displays show the details for the example recommendation *Increase pool size for listed pools*.

```
                       Display Detailed Recommendation

Recommendation:

Increase pool size for listed pools.

Detailed recommendation:
PFR2567
Technical description . . . . . . . . :   The following table shows the
pool identifier, the current pool size, and the suggested pool size.

       Pool        From        To       Pool       From         To

          1       10238     12193




Increasing the pool size will reduce the page fault rate which will
                                                                    More...
Press Enter to continue.

F3=Exit   F12=Cancel
```

In this example only pool 1 should be increased in size. The text beginning at the bottom of this display and continuing on the following displays discusses the effects of changing a pool's size.

```
                       Display Detailed Recommendation

Recommendation:

Increase pool size for listed pools.

Detailed recommendation:
improve the response time and throughput of jobs in this pool.

Decreasing the pool size will free storage that may in turn be given
to pools with high fault rates.

Removing a pool will free storage that may in turn be given to pools with
high fault rates.

A pool will be increased by at least ten percent of its current size.
Pools that are decreased will all be decreased by the same percentage,
with ten percent of the current size as the maximum amount of decrease.
For example, if a 1500K pool needs storage, and a 2000K and 1000K pool can

                                                                     More...
Press Enter to continue.

F3=Exit   F12=Cancel
```

Many recommendations include this type of information to help you choose the right changes to make to your system.

Changing System Tuning Values

To see and select the tuning changes related to the recommendations, press F9 (Tune system) on the Display Recommendations display. A display similar to the following appears:

```
                         Select Tuning Recommendations

                                              Advisor         Current        Data
                       Name/              Recommended         System     Collection
Value To Be Changed    Number                 Value            Value         Value
POOLSIZE (K)           *MACHINE               12193             9420         11085
ACTIVITY LEVEL         *BASE                      6                7             6
POOLSIZE (K)           *INTERACT              70755            39683         70755
ACTIVITY LEVEL         *INTERACT                 27               21            31
POOLSIZE (K)           *SPOOL                    80               49            80
ACTIVITY LEVEL         *SPOOL                     3                2             3



                                                                            Bottom
Select one of the following:

     1. Tune to advisor's recommendations
     2. Restore system to data collection values
Selection


F3=Exit   F12=Cancel
```

On this Select Tuning Recommendations display you have several choices:

- Select menu option 1 (Tune to advisor's recommendations) to have the advisor make all the changes shown in the *Advisor Recommended Value* column. Usually this is a good choice to make when starting to solve a performance problem.
- Leave the values as they are listed in the *Current System Value* column.
- Select menu option 2 (Restore system to data collection values) to have the advisor set the values as they were when the analyzed performance data was collected (shown in the *Data Collection Value* column).
- Write down the tuning values that fit your needs, and use the appropriate system commands to change the values individually.

Notes:

1. The analysis and recommendations are based on the *Data Collection Values*. The *Current System Value* column is there for your reference and in case you want to reset your configuration to what it was at the time of data collection. If the *Advisor Recommended Value* equals the *Data Collection Value*, then the advisor is saying that this is an adequate setting for the workload analyzed. If the *Advisor Recommended Value* does not equal the *Data Collection Value*, then you will see recommendations and conclusions as to what should be changed.
2. When the dynamic tuning support is active (the system value is 2 or 3), the storage pool sizes and activity levels are automatically changed. Because of this automatic change, the advisor is unable to process the tuning request.

Understanding Conclusions

The *Conclusions* section of the Display Recommendations display lists conditions that could have affected performance when the analyzed data was collected. These conditions can include thresholds reached, save and restore activities, transmission line errors, and so on.

```
                             Display Recommendations
                                                              System:   ABSYSTEM
Member . . . . . . :   Q338000036       Library  . . . . . :   QMPGDATA
System . . . . . . :   ABSYSTEM         Version/Release  . :   5/ 1.0
Start date . . . . :   12/03/00         Model  . . . . . . :   510
Start time . . . . :   00:00:39         Serial number  . . :   10-18B6D
Partition ID . . . :   00               Feature Code . . . :   2144-2144
QPFRADJ  . . . . . :   2                QDYNPTYSCD . . . . :   1
QDYNPTYADJ . . . . :   1

Type options, press Enter.
  5=Display details

Option     Recommendations and conclusions
                            Recommendations
           Decrease pool size for listed pools.
           Increase pool size for listed pools.
           Decrease activity level in listed pools.
           Add more main storage.
           ASP space capacity exceeded guideline of 80.0%.
                              Conclusions
   5       Pool fault rates exceeded guideline.
           Pool fault rates below guideline.
           SDLC utlizations exceeded 50% guideline.

                                                                         More...
F3=Exit   F6=Print   F9=Tune system   F12=Cancel   F21=Command line
```

Some conclusions describe conditions that caused the advisor to make particular recommendations. Other conclusions not related to recommendations can be used as guides for collecting more performance data, or for adjusting the system.

To see more details about a conclusion, type 5 in the *Option* column. The following example is the display showing details for the conclusion *Pool fault rates exceeded guideline* that supports the recommendation to increase the size of pool 1.

```
                           Display Detailed Conclusion

Conclusion:

Pool fault rates exceeded guideline.

Detailed conclusion:
PFR2513
Technical description . . . . . . . . :   The following table shows the
pool identifier, the maximum fault rate over all the intervals, the fault
rate guideline, the number of intervals the guideline was exceeded, out of
1 intervals, and the date and time the maximum fault rate occurred. For
pool 2 (*BASE) the guideline is based on the fact that there are no user
jobs running in *BASE.

         ID       Rate      Guide  Intervals       Date       Time

          1        3.6        3.0          3   12/03/00    12:31:04



                                                                         More...
Press Enter to continue.

F3=Exit   F12=Cancel
```

In this example, the guideline of 3 faults was exceeded for pool 1 in three of the analyzed time intervals. The maximum fault rate was 3.6.

Understanding Interval Conclusions

The *Interval Conclusions* section of the Display Recommendations display contains the detailed data to support the conclusions for the analyzed time intervals.

```
                             Display Recommendations
                                                                 System:   ABSYSTEM
Member . . . . . . :   Q338000036       Library  . . . . . :   QMPGDATA
System . . . . . . :   ABSYSTEM         Version/Release  . :   5/ 1.0
Start date . . . . :   12/03/00         Model  . . . . . . :   510
Start time . . . . :   00:00:39         Serial number  . . :   10-18B6D
Partition ID . . . :   00               Feature Code . . . :   2144-2144
QPFRADJ  . . . . . :   2                QDYNPTYSCD . . . . :   1
QDYNPTYADJ . . . . :   1

Type options, press Enter.
  5=Display details

Option     Recommendations and conclusions
                          Interval Conclusions
  5        Pool fault rates above guideline.
           Total disk I/O was 17001.  (8396 Reads and 8605 Writes)
           No performance problems found on listed TRLAN lines.
           No performance problems found in system data file.
           No performance problems found with DIOP(s).
           No performance problems found with LIOP(s).
                                                                       More...
F3=Exit   F6=Print   F9=Tune system   F12=Cancel   F21=Command line
```

To see more details about an interval conclusion, type 5 in the *Option* column. The following example is the display showing details for the sample interval conclusion, *Pool fault rates above guideline*, which supports the conclusion that pool fault rates exceeded the guideline.

```
                     Display Detailed Interval Conclusion

Interval conclusion:

Pool fault rates above guideline.

Detailed interval conclusion:
PFR2553
Technical description . . . . . . . . :   The following table shows the
pool identifier, the fault rate, and the time the fault rate exceeded the
guideline.

         Id      Rate       Guide       Date       Time

          1       3.0         3.0   12/03/00    11:21:13
          1       3.0         3.0   12/03/00    12:11:06
          1       3.0         3.0   12/03/00    12:31:04





                                                                        Bottom
Press Enter to continue.

F3=Exit   F12=Cancel
```

In this example we see exactly when, and by how much, the fault rate guideline was exceeded for pool 1 in the analyzed time intervals.

An interval conclusion like this one provides information but does not support a conclusion or recommendation. It does not report a problem but provides information that can be helpful in understanding how your system is performing.

Tune System by Advisor's Recommendations

After you request a performance analysis, and look over the results, often the next step is to have the advisor tune the system as it recommends. Do this by selecting menu option 1 (Tune to advisor's recommendations) on the Select Tuning Recommendations display.

Next, observe the effects of the changes. Collect more performance data during the next time period when you expect the problem to occur. Also, observe the system and watch for the usual symptoms of the problem. Ask users who experienced the problem if they still notice it. Watch for any possible unwanted side effects from the tuning changes. These can occur if the changes are not fully compatible with some of your processing requirements, or if several problems are being worked on.

The first attempt to solve a basic performance problem can be successful. But sometimes the steps described in this chapter must be repeated until the best possible performance is achieved for your system and your processing requirements.

The original problem may continue or new problems may occur. The advisor might have no further recommendations or conclusions that you can use. At this time you could use other performance reports and commands to work on the problem. These are described in the Performance Tuning chapter of the *Work Management* book.

Sometimes tuning alone will not solve performance problems. To handle the intended work load, a system might need additional main storage, disk storage, or processing speed. BEST/1 can be used to determine if system processing capacities should be increased. For more information about BEST/1 and capacity planning, see the *BEST/1 Capacity Planning Tool* book.

Chapter 5. Displaying Performance Data

This chapter describes how to interactively view performance data.

Note: The data collection does not need to contain the trace data to use this display function. Trace data may be required, however, to further analyze performance problems isolated by this function.

Display Performance Data

To interactively display sample performance data, you can do one of the following:

- Type the Display Performance Data (DSPPFRDTA) command on any command line using the default value of *SELECT for the member parameter.
- Type the DSPPFRDTA command on any command line specifying a member for the MBR parameter.

  Note: If you specify a member on the DSPPFRDTA command, you do not see the Select Performance Member display or the Select Time Intervals to Display display. The Display Performance Data function starts to read the performance database files.
- If you are using the Manager feature, select the `Display performance data` option on the IBM Performance Tools menu.
- If you are using the Agent feature, select the `Advisor` option on the IBM Performance Tools menu. Then select option 5 from the next menu.

```
                            Select Performance Member

Library  . . . .   QPFRDATA

Type option, press Enter.
  1=Select

Option  Member      Text                                      Date      Time
  _     Q983221324                                            11/17/98  13:24:06
  _     Q983101458                                            11/05/98  14:58:20
  _     Q983081009                                            11/03/98  10:09:13
  _     Q983070759                                            11/02/98  07:59:25









                                                                          Bottom
F3=Exit   F12=Cancel   F15=Sort by name   F16=Sort by text
F19=Sort by date/time
(C) COPYRIGHT IBM CORP. 1981, 2001.
```

The member name, a text description, and the date and time you collected each set of performance data appear on this display. If you cannot find the data you want to display, use the Roll keys to page through the list of members or use the appropriate function key to sort the sets of performance data. You can sort the data by member name, text description, or by the date and time the member was created. When you find the performance data you want to display, for the Manager feature type a 1, or for the Agent feature type a 5, in the corresponding *Option* field.

Note: If Collection Services is running and is using one of the members shown in the Select Performance Member display, this member may appear with blank Date and Time fields until the first interval is collected.

If you are searching for a member located in a library that is different from the one currently listed in the *Library* field at the top of the display, type a new library name in the field and press Enter. A list of the performance members available in the library you specified appears. You can then select to display one of them.

After you select a performance member to display, the Select Time Intervals to Display display appears.

```
                       Select Time Intervals to Display

Member . . . . . . . :   Q983221324      Library  . . . . . . :   QPFRDATA

Type options, press Enter.
  1=Select

                   Transaction  --CPU Util---  --High---  -Pool Fault-    Excp
Opt  Date   Time   Count   Rsp  Tot  Int  Bch  Dsk  Unit  Mch  Usr  ID    Util
     11/17  13:39    427   2.2   10    4    4    4  0001    0    6  02       1
     11/17  13:54    441    .9   12    7    3    6  0005    0    6  02       0
     11/17  14:09    160    .6    6    3    2    4  0005    0    6  02       0
     11/17  14:24    189    .5    5    2    1    4  0005    0    6  02       0
     11/17  14:39    328    .5    8    3    3    6  0005    1    8  02       0
     11/17  14:54    167    .5    5    1    3    4  0005    0    5  02       0
     11/17  15:09    282    .6    8    3    3    4  0010    0    5  02       0
     11/17  15:19    167    .3    7    3    2    5  0005    0    6  02       0

                                                                        Bottom
F3=Exit   F5=Refresh   F11=Display histogram   F12=Cancel   F13=Select all
F14=Deselect all
```

Select the time interval for which you want to display performance data.

The Display Performance Data function then starts to read the performance database files. All the performance information required by this function is processed now, so there is reasonable response time when moving between displays later.

Note: The initial processing may cause a noticeable delay in presenting the first display.

After all the data is processed, the main display for the Display Performance Data function appears.

```
                         Display Performance Data

Member . . . . . . . .   Q344000033           F4 for list
  Library  . . . . . .     QMPGDATA

Elapsed time . . . :   00:04:14         Version  . . . . . :   5
System . . . . . . :   ABSYSTEM         Release  . . . . . :   1.0
Start date . . . . :   12/09/00         Model  . . . . . . :   510
Start time . . . . :   00:00:36         Serial number  . . :   10-18B6D
Partition ID . . . :   00               Feature Code . . . :   2144-2144
QPFRADJ  . . . . . :   2                QDYNPTYSCD . . . . :   1
QDYNPTYADJ . . . . :   1

CPU utilization (priority) . . . . . . . . . . . :           .00
CPU utilization (other)  . . . . . . . . . . . . :         91.64
Job count  . . . . . . . . . . . . . . . . . . . :            32
Transaction count  . . . . . . . . . . . . . . . :             0
Transactions per hour  . . . . . . . . . . . . . :             0
Average response (seconds) . . . . . . . . . . . :           .00
Disk utilization (percent) . . . . . . . . . . . :          6.66
                                                                    More...
F13=Display by subsystem   F14=Display by job type   F15=Display by interval
F24=More keys
```

On this display you can change both the *Member* and *Library* fields. If you type a new member name in the *Member* field and press Enter, the data in that member appears on the display. If you type a new library name in the *Library* field and press Enter, the program tries to locate the member in the specified library. If you press F4 (Prompt) after you enter the library name, the Select Performance Member display uses the specified library to present a list of data collections.

The Display Performance Data function helps you analyze the performance data. It highlights the values on this display that exceed the threshold values.

Therefore, if the interactive CPU utilization or the disk utilization exceeds the threshold, the field is highlighted on the display.

To access a command line after you start the Display Performance Data function, press F10 (Command entry). This allows you to work from a command entry display without exiting the display function. Once you exit the command entry, you are immediately returned to the Display Performance Data display without having to experience the initial processing delay.

To better understand system performance, you might want to view the data sorted by category. The second set of function keys on this display allows you to group the performance data by subsystem, job type, or interval.

```
                                   .
                                   .
                                   .

F13=Display by subsystem   F14=Display by job type   F15=Display by interval
F24=More keys
```

By categorizing the data, you might be able to isolate a group of jobs that require further analysis. If you do, you can then display the performance statistics for individual jobs.

The next sections describe the displays that show the performance data separated into the subsystem, job type, and interval categories.

Display Performance Data by Subsystem

If you press F13 on the Display Performance Data display, the Display by Subsystem display appears.

```
                             Display by Subsystem

Member . . . . . . . . :   Q344000033      Elapsed time . . . . :   00:04:14
  Library  . . . . . . :     QMPGDATA

Type options, press Enter.  Press F6 to display all jobs.
  5=Display jobs

                             CPU        Job         Tns      Average      Disk
Option    Subsystem         Util       Count       Count    Response       I/O
          *MACHINE         10.44          50           0         .00      8441
          BLDTESTSS          .08           1           0         .00         1
          QBATCH           24.77          10           0         .00        18
          QCMN               .00           0           0         .00         0
          QSERVER            .00           0           0         .00         0
          QSYSWRK          51.72          16           0         .00     12901
          QUSRWRK            .00           0           0         .00         0



                                                                          Bottom
F3=Exit   F6=Display all jobs   F12=Cancel   F14=Display by job type
F15=Display by interval
```

This display categorizes the performance data according to the subsystem in which the activity occurred.

From this display you may be able to isolate a single subsystem or group of subsystems that are of particular interest. To view the performance data for the jobs in particular subsystems, type a 5 in the appropriate *Option* fields and press Enter. If you do not want to select a particular subsystem, but would rather view the data for all the jobs in the measurement, press F6 (Display all jobs).

Display Performance Data by Job Type

If you press F14 on the Display Performance Data display, the Display by Job Type display appears.

```
                             Display by Job Type

Member . . . . . . . :   Q344000033      Elapsed time . . . . :   00:04:14
  Library  . . . . . :     QMPGDATA

Type options, press Enter.  Press F6 to display all jobs.
  5=Display jobs

                              CPU       Job        Tns     Average     Disk
Option   Job Type            Util      Count      Count   Response      I/O
         Autostart            .03          1          0        .00       60
         Batch              76.53         25          0        .00    12854
         LIC                10.07         45          0        .00     7998
         Sbs Monitor          .00          1          0        .00        6
         System               .37          5          0        .00      443






                                                                       Bottom
F3=Exit   F6=Display all jobs   F12=Cancel   F13=Display by subsystem
F15=Display by interval
```

This display categorizes the performance data according to the job types of the jobs running on your system.

From this display you may be able to isolate a single job type or group of job types that are of particular interest. To view the performance data for the jobs of particular job types, type a 5 in the appropriate *Option* fields and press Enter. If you do not want to select a particular job type, but would rather view the data for all the jobs in the measurement, press F6 (Display all jobs).

Display Performance Data by Interval

If you press F15 on the Display Performance Data display, the Display by Interval display appears.

```
                             Display by Interval

Member . . . . . . . :   Q344000033      Elapsed time . . . . :   00:04:14
  Library  . . . . . :     QMPGDATA

Type options, press Enter.  Press F6 to display all jobs.
  5=Display jobs

                               CPU      Job       Tns    Average    Disk
Option  Date      Time        Util     Count     Count  Response     I/O
        12/09/00  00:05:00   91.64        32         0       .00   21922










                                                                       Bottom
F3=Exit   F6=Display all jobs   F12=Cancel   F13=Display by subsystem
F14=Display by job type
```

This display categorizes the performance data according to the collection intervals that occurred during the measurement.

From this display, you may be able to isolate a single interval or group of intervals that are of particular interest. To view the performance data for the jobs in particular intervals, type a 5 in the appropriate *Option* fields and press Enter. If you do not want to select a particular interval, but would rather view the data for all the jobs in the measurement, press F6 (Display all jobs).

Display Jobs

If you selected a subsystem on the Display by Subsystem display, selected a job type on the Display by Job Type display, selected an interval on the Display by Interval display, or pressed F6 (Display all jobs) on any of these or the Display Performance Data display, the Display Jobs display appears.

```
                                 Display Jobs

Subsystem . . . . :   *ALL              Member  . . . . . :   Q344000033
Elapsed time  . . :   00:04:14            Library . . . . :     QMPGDATA

Type options, press Enter.
  5=Display job detail

                                        Job      CPU      Tns     Avg    Disk
Option  Job         User        Number  Type    Util     Count    Rsp     I/O
        Q1PDR       QPM400      030341  BCH    16.01         0     .0    3780
        QYMEARCPMA  QSYS        030343  BCH    15.49         0     .0    3713
        QYMEPFRCVT  QSYS        030344  BCH    10.80         0     .0    3289
        CFINT01                         LIC     5.42         0     .0       0
        QYPSJSVR    QYPSJSVR    030186  BCH     4.27         0     .0     188
        BUSYJOBS1   KPS         030336  BCH     3.77         0     .0       4
        BUSYJOBS1   KPS         030331  BCH     3.13         0     .0       0
        BUSYJOBS2   KPS         030335  BCH     2.53         0     .0       1
        BUSYJOBS2   KPS         030340  BCH     2.44         0     .0       3
        BUSYJOBS1   KPS         030334  BCH     2.37         0     .0       1
                                                                       More...
F3=Exit           F12=Cancel   F15=Sort by job   F16=Sort by job type
F19=Sort by CPU   F24=More keys
```

This display appears when you request to view the jobs in a particular subsystem. If you request a job type or interval, the *Subsystem* indicator at the top of the display is replaced by a *Job Type* or a *Interval* indicator. Also, if you selected a particular job type, the *Job Type* column does not appear because all the jobs have the same type as indicated by the *Job Type* field at the top of the display. If you request to see all the jobs (by pressing F6 on the Display by Subsystem, the Display by Job Type, or the Display by Interval displays) the appropriate indicator (*Subsystem*, *Job Type*, or *Interval*) appears at the top of the display showing a value of '*ALL' and the *Job Type* column is present. If you press F6 from the Display Performance Data display, there is no indicator, such as subsystem, job type, or interval, at the top of the display. Also, in this case, the *Job Type* column would be present.

Display Job Detail

If you type a 5 in the *Option* field next to a job on either the Display Jobs display or the Display Remote Jobs display (see page 39), and press Enter, the Display Job Detail display appears.

```
                              Display Job Detail

Job  . . . . . . . . :   Q1PDR           Job type . . . . . . :   BCH
  User . . . . . . . :     QPM400        Subsystem  . . . . . :   QSYSWRK
  Number . . . . . . :     030341        Pool . . . . . . . . :   02
Member . . . . . . . :   Q344000033      Priority . . . . . . :   50
  Library  . . . . . :     QMPGDATA      Elapsed time . . . . :   00:04:14


             CPU        Tns    Average      Disk   Act->  Wait->   Act->
Interval  Seconds     Count  Response       I/O    Wait   Inel     Inel
00:05:00   40.682         0        .0      3780     9.6      .0      .0







                                                                        Bottom
Press Enter to continue.

F3=Exit   F11=View 2   F12=Cancel   F15=Sort by interval   F24=More keys
```

The Display Job Detail display provides you with the performance data for a particular job, broken down by collection intervals. This display presents the performance information using three different views, which can be accessed by function keys. F11 shows you the next view in the series.

Display Performance Data for System Resources

When you are on the Display Performance Data display, you may want to view the performance data specifically related to storage pools, disk units, or communications lines, instead of the job-related information previously discussed. The third set of function keys, as shown below, allows you to do this.

```
                                     .
                                     .
                                     .

F19=Display pool detail   F20=Display disk detail
F21=Display communications detail   F24=More keys
```

Display Pool Detail

If you press F19 on the Display Performance Data display, the Display Pool Detail display appears.

```
                              Display Pool Detail

Member . . . . . . . :   Q344000033      Elapsed time . . . . :   00:04:14
  Library  . . . . . :     QMPGDATA

Type options, press Enter.
  5=Display pool intervals

                Size    Act     Tns     Avg  Expert
Opt  Pool       (KB)    Lvl    Count    Rsp  Cache
      01      152044      0        0     .0    0
      02      547884    334        0     .0    0
      03        7864      6        0     .0    0
      04       78640     52        0     .0    0









                                                                       Bottom
F3=Exit   F11=Display faults and pages   F12=Cancel   F15=Sort by pool
F24=More keys
```

The Display Pool Detail display presents performance information for each pool in the measurement. More than one view is used to present all the pool information.

Although the Display Pool Detail display presents the pool information as totals for the entire measurement, you may want to examine the data for a particular pool over time. Using the Display pool intervals option allows you to view the same pool information broken down into the time intervals in which it occurred.

Display Pool Interval

By typing a 5 in the *Option* field next to a pool and by pressing Enter, the Display Pool Interval display appears with performance information for that pool.

```
                             Display Pool Interval

Pool . . . . . . . . :   01              Member . . . . . . . :   Q344000033
Elapsed time . . . . :   00:04:14          Library  . . . . . :     QMPGDATA

               Size    Act    Tns     Avg    DB       DB   Non-DB  Non-DB
Interval       (KB)    Lvl   Count    Rsp  Faults   Pages  Faults   Pages
00:05:00     152044      0       0     .0      .0      .0     1.2     1.6












                                                                       Bottom
Press Enter to continue.

F3=Exit   F11=Display transitions   F12=Cancel   F15=Sort by interval
F24=More keys
```

The Display Pool Interval display presents the same columns of information as the Display Pool Detail display, except that the data is broken down by time intervals.

A second view (not shown here) also exists for the Display Pool Interval display, which presents the data for the state transitions.

Display Disk Detail

If you press F20 on the Display Performance Data display, the Display Disk Detail display appears.

```
                             Display Disk Detail

Member . . . . . . . :   Q344000033      Elapsed time . . . . :   00:04:14
  Library  . . . . . :     QMPGDATA

Type options, press Enter.
  5=Display disk intervals

                                      ---Activity Per Second----
             Unit          Size  ASP   Read    Read  Write  Write
Opt  Unit    Name           (M)  ID     Rqs     (K)   Rqs    (K)
      0001   DD004         8589  01     8.2  123.1    7.5  152.6
      0002   DD001         8589  01     9.5  129.5   10.1  167.1
      0003   DD002         8589  01     8.5  125.1    9.1  177.1
      0004   DD003         8589  01     7.8  112.7    8.6  163.2
      0005   DD005          728  01      .2    1.7     .8    5.3
      0006   DD006          970  01      .4    3.7    1.1    9.7
      0007   DD007          728  01      .3    1.8     .8    4.7
      0008   DD008          970  01      .5    3.8    1.1    8.8
      0009   DD009          728  01      .2    1.5     .7    4.8
                                                                  More...
F3=Exit   F11=View 2   F12=Cancel   F15=Sort by unit   F22=Sort by % used
F23=Sort by % busy
```

The Display Disk Detail display presents performance information for each disk unit attached to the system on which the data collection was performed. More than one view is used to present all the disk information.

Although the Display Disk Detail display presents the disk information as totals for the entire measurement, you may want to examine the data for a particular disk unit over time. Using the Display disk intervals option allows you to view the same disk information broken down into the time intervals in which it occurred.

Display Disk Interval

By typing a 5 in the *Option* field next to a disk unit and by pressing Enter, the Display Disk Interval display appears with performance information for that disk unit.

```
                            Display Disk Interval

Unit . . . . . . . . . :   0001            Member . . . . . . . :   Q344000033
Size (M) . . . . . . . :   8589              Library  . . . . . :     QMPGDATA
Unit name  . . . . . . :   DD004           Elapsed time . . . . :   00:04:14

                                       --------Activity Per Second---------
            ASP       %        %        Read       Read      Write      Write
Interval    ID      Used     Busy        Rqs        (K)       Rqs        (K)
00:05:00    01      68.2     17.6        8.2      123.6        7.5      153.2










                                                                          Bottom
Press Enter to continue.

F3=Exit   F12=Cancel   F15=Sort by interval   F22=Sort by % used
F23=Sort by % busy
```

The Display Disk Interval display presents the same columns of information as the Display Disk Detail display, except that the data is broken down by time intervals.

Note: The *Size (M)* field is at the top of the display because the size of the disk unit cannot change from one interval to the next.

Display Communications Line Detail

If you press F21 on the Display Performance Data display, the Display Communications Line Detail display appears.

```
                      Display Communications Line Detail

Member . . . . . . . :   Q344000033      Elapsed time . . . . :   00:04:14
  Library  . . . . . :     QMPGDATA

Type options, press Enter.
  5=Display remote jobs   7=Display communications interval data

         Line         Line         Line       Tns     Average     Job       %
Option   ID           Type        Speed      Count   Response    Count    Busy
                      TRLAN          .0          0        .00       77      .0
         TRNLINE      TRLAN     16000.0          0        .00        0      .1










                                                                          Bottom
F3=Exit   F12=Cancel   F15=Sort by line ID   F20=Sort by transactions
F24=More keys
```

Figure 1. Display Communications Line Detail

The Display Communications Line Detail display presents performance information for each communications line attached to the system.

The Display Communications Line Detail display presents the totals for each line in the measurement. One of the options on this display lets you view performance data for the jobs using a communications line. The other option displays the time interval performance data for a communications line.

Display Remote Jobs

If you type a 5 (Display remote jobs) on the Display Communications Line Detail display in the *Option* field next to a communications line and press Enter, the Display Remote Jobs display appears with the performance information for that line listed by job.

```
                             Display Remote Jobs

Line . . . . . . . . :                   Member . . . . . . . :   Q344000033
Line type  . . . . . :   TRLAN             Library  . . . . . :     QMPGDATA
Line speed . . . . . :   .0              Elapsed time . . . . :   00:04:14

Type options, press Enter.
  5=Display job detail

                                        Job      CPU      Tns     Avg    Disk
Option  Job         User        Number  Type    Util     Count    Rsp     I/O
        Q1PDR       QPM400      030341  BCH    16.01         0     .0    3780
        QYMEARCPMA  QSYS        030343  BCH    15.49         0     .0    3713
        QYMEPFRCVT  QSYS        030344  BCH    10.80         0     .0    3289
        CFINT01                         LIC     5.42         0     .0       0
        QYPSJSVR    QYPSJSVR    030186  BCH     4.27         0     .0     188
        BUSYJOBS1   KPS         030336  BCH     3.77         0     .0       4
        BUSYJOBS1   KPS         030331  BCH     3.13         0     .0       0
        BUSYJOBS2   KPS         030335  BCH     2.53         0     .0       1
        BUSYJOBS2   KPS         030340  BCH     2.44         0     .0       3
                                                                      More...
F3=Exit          F12=Cancel   F15=Sort by job   F16=Sort by job type
F19=Sort by CPU   F24=More keys
```

Figure 2. Display Remote Jobs

If you type a 5 in the *Option* column, you can display more detailed information for the remote job. This option calls the Display Job Detail display, just as option 5 did from the Display Jobs display. Refer to “Display Job Detail” on page 34 for information on the performance data that will be shown.

Display Communications Interval Data

To see a display of performance data for a communications line by time interval, type a 7 (Display communications interval data) in the *Option* field next to the communications line on the Display Communications Line Detail display, and press Enter. The resulting Display Communications Interval Data display lists the performance averages and totals for that communications line for the time intervals in the current performance data member.

From the Display Communications Interval Data display you can request data about the jobs using the communications line during any of the listed time intervals. To do this, type a 5 in the *Option* column by the selected time interval.

Each communications protocol has its own type of Display Communications Interval Data display, but all are quite similar. An example and description for token-ring LAN area network (TRLAN) is shown in Figure 3. Other communications protocols are:

- X.25
- Synchronous data link control (SDLC)
- Ethernet local area network (ELAN)
- Distributed data interface (DDI)
- Frame relay (FRLY)
- Binary synchronous communications (BSC)
- Asynchronous data link control (ASYNC)

Note: Option 7 (Display communications interval data) is not valid for IDLC lines. To view ISDN and IDLC line information, press F13 (Display network interface data).

```
                       Display Communications Interval Data

Line ID  . . . . . . :   TRNLINE         Member . . . . . . . :   Q344000033
Line type  . . . . . :   TRLAN             Library  . . . . . :     QMPGDATA
Line speed . . . . . :   16000.0         Elapsed time . . . . :   00:04:14
IOP name . . . . . . :   CC02

Type options, press Enter.
  5=Display remote jobs

                                                  ---------Congestion---------
                             I Frames  I Frames  Local  Local  Remote  Remote
        Itv        Line  Trnsmitd    Recd      Not    Seq     Not     Seq
Option  End        Util   Per Sec   Per Sec  Ready  Error   Ready   Error
        00:05:00     .1        0         0      0      0       0       0






                                                                        Bottom
F3=Exit   F11=View2     F12=Cancel   F15=Sort by itv end
F20=Sort by line util   F24=More keys
```

Figure 3. Display Communications Interval Data for TRLAN

Display Remote Interval Jobs

This display lists information about the jobs using a communications line during a time interval. To request it, type a 5 (Display remote jobs) in the *Option* column by a time interval on a Display Communications Interval Data display, and press Enter.

```
                        Display Interval Remote Jobs

Interval . . . . . . . . :     13:08     Member . . . . . . . . . . : MONDAY
Line ID  . . . . . . . . :   MPLSCHI       Library  . . . . . . . . :   QPFRDATA
Line type  . . . . . . . :      SDLC     Elapsed time . . . . . . . : 00:24:50
Line speed . . . . . . . :      19.2
Line utilization . . . . :       78%

                                    Job     CPU    Tns    Avg   Disk
Job          User          Number   Type   Util   Count   Rsp    I/O
DSP15        X07733        030191    DDM    .16      19    .0    230
DSP40        SMITH         030275    INT    .24     240   3.5   1598
DSP43        U5531         030212    DDM    .00       0    .0     76








                                                                        Bottom
F3=Exit            F12=Cancel    F15=Sort by job    F16=Sort by job type
F19=Sort by CPU    F24=More keys
```

The end time for the selected time interval, the line name, line type, line speed, and average use during the time interval are shown in the fields *Interval*, *Line ID*, *Line type*, *Line speed* and *Line utilization* at the top of the display. The column descriptions are the same as for Figure 2 on page 39.

Display Network Interface Data

To see a display of performance data for Integrated Services Digital Network (ISDN) network interfaces, press F13 (Display network interface data) on the Display Communications Line Detail display.

Note: F13 is shown only if your data collection contains ISDN data.

This display shows performance information for each ISDN network interface and channel pair configured on the system that data was collected for. From this display, you can view the data on a per-interval basis by typing a 7 by the network interface and channel you want to see.

| You can find the ISDN information under the Networking topic in the iSeries
| Information Center.

```
                       Display Network Interface Data

Member . . . . . . . :   ISDN1           Elapsed time . . . . :   01:54:39
  Library  . . . . . :     V4R2CT

Type options, press Enter.
  7=Display channel interval data

                             Transmit/              Percent              Percent
                             Receive/     Total     Frames     Total     Frames
        Network               Average     Frames    Trnsmitd   Frames    Received
Option  Interface   Channel  Line Util  Trnsmitd    Again    Received  in Error
        ISDNSS_A    B1       01/01/01      8778         0       8802         0
        ISDNSS_B    B1       13/17/15      8506         7       9859         9
        ISDNSS_A    B2       00/00/00      3758         0       3779         0
        ISDNSS_B    B2       00/00/00      3779         0       3736         0
        ISDNSS_A    D        11/15/13      1318        40       1430        38
        ISDNSS_B    D        00/00/00       994         0        993         0



                                                                          Bottom
F3=Exit   F12=Cancel    F15=Sort by network interface   F16=Sort by channel
F20=Sort by line util   F24=More keys
```

Figure 4. Display Network Interface Data

Display Channel Interval Data

To see a display of performance data for a specific ISDN network interface and channel by time interval, type a 7 (Display channel interval data) in the *Option* field next to the network interface on the Display Network Interface Data display and press the Enter key. The resulting Display Channel Interval Data display lists the performance averages and totals for that network interface and channel for the time intervals in the current performance data member.

Each channel type has its own type of Display Channel Interval Data display. An example and description of this display for each channel type follow.

```
                        Display Channel Interval Data

Network Interface  . :   ISDNSS_B        Member . . . . . . . :   ISDN1
Channel  . . . . . . :   B1                Library  . . . . . :     QPFRDATA
Line speed . . . . . :   64.0            Elapsed time . . . . :   01:54:39
IOP name . . . . . . :   CMB01

Type options, press Enter.
  5=Display remote jobs

                           Transmit/             Percent             Percent
                           Receive/     Total    Frames     Total    Frames
     Itv       Line         Average    Frames   Trnsmitd   Frames    Received
Opt  End       ID          Line Util  Trnsmitd    Again    Received   in Error
     14:33:11  ISDNSS_B1   99/99/99       347        33       130        39
     14:36:22  ISDNSS_B1   99/99/99        35       100        75       100
     14:44:54  ISDNSS_B1   27/99/70       376        52       578        34
     14:50:55  ISDNSS_B2   00/01/00       256         0       255         0
     14:56:19  ISDNSS_B2   24/39/31       238        15       286        25
                                                                      More...
F3=Exit   F11=View2     F12=Cancel   F15=Sort by itv end   F19=Sort by line ID
F20=Sort by line util   F24=More keys
```

Figure 5. Display Channel Interval Data for B-channel

From this display you can request data about the jobs using the communications line listed during any of the time intervals. To do this, type a 5 in the *Option* column by the selected time interval.

```
                        Display Channel Interval Data

Network Interface  . :   ISDNSS_A        Member . . . . . . . :   ISDN1
Channel  . . . . . . :   D                 Library  . . . . . :     QPFRDATA
Line speed . . . . . :   16.5            Elapsed time . . . . :   01:54:39
IOP name . . . . . . :   CMB01

          Transmit/                                         Loss
          Receive/   -Outgoing Calls-  -Incoming Calls-      of
Itv        Average    Total   Percent   Total   Percent    Frame
End       Line Util   Calls  Rejected   Calls  Rejected   Alignment
14:46:20  12/21/16       42        28      15        26        452
15:01:19  20/06/13       74        74      33       100        135
15:16:17  00/00/00        0         0       5         0          0
15:21:17  00/00/00        0         0       2         0          0
15:31:16  00/00/00        0         0       2         0          0
15:46:14  07/10/09       21       100      34       100        348
                                                                      More...
Press Enter to continue.

F3=Exit   F11=View 2  F12=Cancel   F13=Display maintenance channel
F24=More keys
```

Figure 6. Display Channel Interval Data for D-channel

Display Maintenance Channel Data

This display shows performance data for the ISDN maintenance channel. To request it, press F13 (Display maintenance channel) on the Display Channel Interval Data for D-channels display.

Note: F13 is shown only if the system you collected data for had its ISDN maintenance channel active.

```
                       Display Maintenance Channel Data

 Network Interface  . :   ISDNSS_A       Member . . . . . . . :   ISDN1
 Line speed . . . . . :   16.5             Library  . . . . . :     QPFRDATA
 IOP name . . . . . . :   CMB01          Elapsed time . . . . :   01:54:39

                             Percent
              Percent     Severely                                  Far
 Itv          Errored      Errored       DTSE       DTSE      End Code
 End          Seconds      Seconds        In         Out      Violation
 14:46:20          50           36        734         83           32
 15:01:19           6           24         32         14           52
 15:16:17           0            0          0          0            0
 15:21:17           0            0          0          0            0
 15:31:16           0            0          0          0            0
 15:46:14          99           99         36         45           66
 16:01:13          95           80         11          9            1
                                                                         More...
 Press Enter to continue.

 F3=Exit   F12=Cancel   F15=Sort by itv end   F20=Sort by DTSE in
 F21=Sort by DTSE out   F22=Sort by percent severely errored seconds
```

Figure 7. Display Maintenance Channel Data

Chapter 6. System Activity

This chapter describes the functions that allow you to work with performance data for the jobs and Licensed Internal Code tasks currently running on the system. These functions provide the ability to interactively view and collect the data in a QAITMON database file by using the Work with System Activity (WRKSYSACT) command and to print reports based on the collected data (print activity report). These functions are available as OS/400 commands or through option 8 (System activity) on the IBM Performance Tools menu. If you select option 8, the System Activity menu appears.

```
                              System Activity

Select one of the following:

     1. Work with system activity
     2. Print activity report
                                   •
                                   •
                                   •
```

Refer to "Work with System Activity" and "Print Activity Report" on page 52 for a description of both selections shown on the System Activity menu.

Note: Management Central has a system monitoring capability that also provides viewing performance metrics real time. See the Performance overview topic in the iSeries Information Center for more information about this capability..

Work with System Activity

The Work with System Activity (WRKSYSACT) command allows you to view and collect performance data in a real-time fashion. This data, which consists of CPU utilizations, synchronous and asynchronous I/O counts, storage amounts, and more, is reported for any job or task that is currently active on the system.

Note: To be considered active, a job or task must use at least one-tenth of 1% (.1%) of the processing unit or perform one I/O operation.

Only one call of the Work with System Activity function can be active at one time. If this function is currently active when the WRKSYSACT command is run, you receive a message indicating that:

- The function is already active
- The name of the user profile who is running the command.

The performance statistics reported by this function represent activity that has occurred during the elapsed time since a previous collection. Notice that this may contrast with other system functions that generally provide cumulative values until specifically reset. In most cases the time interval between data collections ranges from 1 second to several minutes, depending on how often you want to view or collect new data. On systems with very little activity, a subsecond refresh interval may be possible.

Depending on the value specified for the OUTPUT parameter of the Work with System Activity command, the data gathered by this function is processed in one of the following methods:

- Shown on the display station only
- Written to a database file only
- Shown on the display station and written to a database file

When the data is written to a database file only, this function submits a batch job under the name WRKSYSACT. When the data is written to a file and shown on the display, the statistics are put in the file each time the display is refreshed. This does not include the data presented on the initial display of the Work with System Activity display. See the file descriptions in Table 7 on page 51.

When the data is being directed to the display station (either the first or third method), the first display that appears resembles the following:

```
                          Work with System Activity                   ABSYSTEM
                                                              12/09/00  19:20:10
Automatic refresh in seconds  . . . . . . . . . . . . . . . . .     5
Elapsed time . . . . :   00:00:02        Overall CPU util . . :   99.4
Overall DB CPU util  :   .0


Type options, press Enter.
  1=Monitor job   5=Work with job
                                                            Total  Total   DB
     Job or                                            CPU   Sync  Async   CPU
Opt  Task        User        Number  Thread    Pty  Util   I/O    I/O   Util
     BUSYJOBS2   KPS         030529  00000029   50  32.3      0      0     .0
     BUSYJOBS1   KPS         030524  0000001E   50  32.3      0      0     .0
     CRTPFRDTA   QSYS        030519  0000000A   50  31.5     29      5     .0
     CFINT01                                     0   1.5      0      0     .0
     QPADEV000B  AAAA        030508  0000001D    1   1.5      0      0     .0
     IDELANDEV-                                  0    .1      0      0     .0


                                                                          Bottom
F3=Exit   F10=Update list   F11=View 2   F12=Cancel   F19=Automatic refresh
F24=More keys
```

Figure 8. System with Single Processor

The input-capable field *Automatic refresh in seconds* at the top of the display controls the amount of time between display refreshes when the automatic refresh feature is active. Refer to "Automatic Refresh Mode" on page 48 for more information on this field. The second field at the top of the display, *Elapsed time*, reflects the length of time in which the currently shown performance statistics occurred. Described in a different way, this value represents the time between the last display refresh and the next-to-last display refresh.

Note: The Work with System Activity display automatically gathers the data twice before displaying the first display. Therefore, the initial *Elapsed time* should be approximately 2 seconds, which means that the statistics shown occurred in the 2 seconds previous to the current display.

Single-Processor System

The *Overall CPU util* represents the CPU utilization for the entire system during the elapsed time. This value does not always equal the sum of the individual CPU utilizations shown in the list, since a job or task could use an extremely small amount of processing unit time, thus affecting the overall utilization, but not use enough CPU resource to be included in the list of active jobs. (Refer to the requirements for being considered active at the beginning of this chapter.) The discrepancy in CPU utilizations, however, is small and should have little effect on the usability of this function.

The *Overall CPU util* could exceed 100% on extremely busy systems, because the data collection process does not occur instantaneously. However, you should be aware that overall CPU utilizations slightly over 100% are an acceptable possibility.

The *Overall DB CPU util* is the percentage of the overall CPU that is used to perform database processing. This utilization provides a better understanding of the amount of server resources that are being used for database processing. If you fully use the available database CPU, that does not mean that all compute cycles on a server have been consumed. You could add workloads to the server to take advantage of the remaining CPU cycles.

Multiple-Processor System

For a multiple-processor system, *Overall CPU* field is replaced by these fields:

- *Minimum CPU util*
- *Maximum CPU util*
- *Average CPU util*
- *Number of CPUs*

For each of the CPU utilization fields, the value shown is the total CPU utilization divided by the number of processors shown in the *Number of CPUs* field. Figure 9 shows the Work with System Activity display for a system with more than one processor:

```
                          Work with System Activity                  ABSYSTEM
                                                           02/08/96  10:45:19
Automatic refresh in seconds  . . . . . . . . . . . . . . . . . .     5
Elapsed time . . . . . . :   00:01:02     Average CPU util . . : 97.0
Minimun CPU util . . . . :       94.1     Maximum CPU util . . : 99.9
Number of CPUs . . . . . :          4

Type options, press Enter.
  1=Monitor job   5=Work with job
                                                            Total  Total
     Job or                                            CPU   Sync  Async   PAG
Opt  Task        User        Number  Thread    Pty  Util   I/O    I/O   Fault
     QPADEV0007  SUSTAITA    029844              1  25.2      0      0      0
     QPADEV0012  PATO        029845              1  24.0      0      0      0
     QPADEV0015  SOFIACN     029846              1  25.5      0      0      0
     QPADEV0060  BRLEON      029849              1  24.8      4    212      0

                                                                       Bottom
F3=Exit   F10=Update list   F11=View 2   F12=Cancel   F19=Automatic refresh
F24=More keys
```

Figure 9. System with Multiple Processors

The two options shown on the Work with System Activity allow you to analyze specific jobs and tasks that appear in the list. Refer to "Monitoring Specific Jobs" and "Working with Jobs" on page 49 for more information on these options.

The jobs and tasks are presented on this display in decreasing order of a number of different methods. This order is initially controlled by the Sequence (SEQ) parameter on the Work with System Activity command. The default is to sort the jobs and tasks by CPU utilization. Once the function has been started, however, F16 (Resequence) serves as a switch between the sorting methods.

The Work with System Activity function uses different views to present all the performance statistics. Pressing F11 shows you the next view in the series and pressing F10 refreshes the current view. F11 shows you these various views:

- View 1, CPU utilization, database utilization, and the number of asynchronous and synchronous I/O operations.
- View 2, Synchronous database and nondatabase read and write operations.
- View 3 Asynchronous database and nondatabase read and write operations.
- View 4, Storage allocations.

Note: As mentioned above, the *Job or Task* column is shown only when INFTYPE(*ALL) is specified. This value for the *Information type* parameter instructs the function to display both jobs and tasks. Specifying INFTYPE(*JOBS) causes the *Job or Task* column, to be replaced by the *Job* column because only jobs are to be displayed. Similarly, specifying INFTYPE(*TASKS) causes the *Job or Task* column to be replaced by the *Task* column since only tasks are to be displayed. Later sections of this chapter describe how to switch between these information types through the use of function keys.

Automatic Refresh Mode

Automatic Refresh mode represents an important feature of the Work with System Activity function. Once started, this mode continually updates the display without requiring further user intervention.

To start the Automatic Refresh mode, first enter the desired number of seconds between refreshes in the *Automatic refresh in seconds* field. This value, which has an initial default of 5 seconds, can range from a minimum of 1 second to a maximum of 900 seconds (15 minutes).

Note: Setting the *Automatic refresh seconds* at 5 or greater generally results in the Work with System Activity function using reasonably small amounts of the processing unit, depending on the size of the system being monitored. Setting this value lower than 5 seconds causes this function to use larger amounts of the processing unit, and therefore, is not recommended.

The Automatic Refresh function attempts to maintain even refresh intervals by compensating for the time required to process, display, and, possibly, write the performance data. Therefore, you may occasionally notice that the elapsed time does not exactly match the value specified for the *Automatic refresh in seconds* field. Press F19 to end the automatic refresh function.

Monitoring Specific Jobs

While using the Work with System Activity function, you may want to view the performance statistics for a set of jobs and tasks on the system. By typing a 1 in the *Opt* column before a list entry, that job or task is selected for monitoring. You may monitor as many as 20 jobs and tasks at a single time.

Once you have selected jobs and tasks for monitoring, the Work with System Activity function is placed in a subset mode. While in this mode, you see performance data for only the selected jobs and tasks whenever the display is refreshed. Also in this mode, you can use option 5 (Work with job) on a job and the job remains in the selected group. To remove a single job or task from the selected group (as long as it is not the last or only selected entry), blank out the option field and press the Enter key. This causes a new group to be built from those entries that still have a 1 in the *Opt* field.

To return to normal operating mode, press either F13 (Jobs and tasks), F14 (Jobs only), or F15 (Tasks only). These function keys are the only way to end the monitoring feature without exiting the Work with System Activity function.

Working with Jobs

By typing a 5 in the option field next to a job and pressing Enter, the Work with Job (WRKJOB) command is started for that job. If you select more than one job before you press Enter, you cause the WRKJOB command to be started multiple times.

Note: Option 5 (Work with job) is valid only with jobs. This function cannot be started for tasks.

Refer to the iSeries Information Center for further information on the Work with Job command.

Displaying Different Information Types

As previously mentioned, you can control the type of information being shown on the display. This control comes through the use of the INFTYPE (Information type) parameter or through the use of F13 (Display jobs and tasks), F14 (Display jobs only), or F15 (Display tasks only).

If you specify INFTYPE(*ALL) on the Work with System Activity command or press F13, statistics for both jobs and tasks are shown. Column headings and function keys similar to the following appear on the Work with System Activity display:

```
                                                     Total  Total   DB
     Job or                                    CPU    Sync  Async   CPU
Opt  Task         User        Number  Thread    Pty  Util   I/O    I/O  Util
     BUSYJOBS2    KPS         030522  00000015   50  48.2     0      0    .0
     BUSYJOBS2    KPS         030529  00000029   50   3.5     0      0    .0
     QPADEV000B   AAAA        030508  0000001D    1   1.5     0      0    .0
     QYPSPFRCOL   QSYS        028990  0000000D    1   1.1     4      1    .0
     IOSTATSTAS                                   0    .9     0      0    .0
     CFINT01                                      0    .7     0      0    .0
     QYPSPFRCOL   QSYS        028990  0000010F    1    .3     0      0    .0
     QYPSPFRCOL   QSYS        028990  00000008    1    .1     0      1    .0
                                                                       More...
F3=Exit   F10=Update list   F11=View 2   F12=Cancel   F19=Automatic refresh
F24=More keys
```

If you specify INFTYPE(*JOBS) or press F14, statistics for jobs only are shown. Column headings and function keys similar to the following appear on the Work with System Activity display:

```
                                                          Total  Total   DB
                                                     CPU   Sync  Async   CPU
Opt  Job         User        Number  Thread    Pty  Util   I/O    I/O   Util
     QPADEV000B  AAAA        030508  0000001D    1   1.7      0      0     .0

                                        .
                                        .
                                        .
F13=Display jobs and tasks   F15=Display tasks only   F16=Sequence by I/O
F24=More keys
```

And finally, if you specify INFTYPE(*TASKS) or press F15, statistics for tasks only are shown. Column headings and function keys similar to the following appear on the Work with System Activity display:

```
                                                          Total  Total   DB
                                                     CPU   Sync  Async   CPU
Opt  Task                            Thread    Pty  Util   I/O    I/O   Util
     CFINT01                                     0    .1      0      0     .0
     IDELANDEV-  000000                          0    .1      0      0     .0

                                        .
                                        .
                                        .
F13=Display jobs and tasks   F14=Display jobs only   F16=Sequence by I/O
F24=More keys
```

Accessing Work Management Functions

To assist you in analyzing the performance of the system, function keys F20 through F23 have been set up to provide access to several Work Management functions. The third set of function keys appears on the Work with System Activity display as follows:

```
F20=Work with active jobs   F21=Work with system status
F22=Work with subsystems    F23=Work with disk status   F24=More keys
```

F20 starts the Work with Active Jobs (WRKACTJOB) command. F21 starts the Work with System Status (WRKSYSSTS) command. F22 starts the Work with Subsystems (WRKSBS) command, and F23 starts the Work with Disk Status (WRKDSKSTS) command. Refer to the Work Management topic in the iSeries Information Center for further information on these commands and how to access this function from Operations Navigator. In addition, the following table shows you what character-based interface function is available from Operations Navigator:

Table 6. Comparison between OS/400 CL commands and Operations Navigator function

CL command	Operations Navigator function
WRKSYSSTS	Some, but not all, of the statistical information that is provided on the top half of the display is available with the Management Central's system monitors.
WRKSBS	All of the function is available in Work Management except for option 5 (Display subsystem description).

Table 6. Comparison between OS/400 CL commands and Operations Navigator function (continued)

CL command	Operations Navigator function
WRKDSKSTS	All of the function is available from Configuration and Service—>Hardware.

Content of Database File QAITMON

The collected performance data is stored in the file QAITMON located in the library specified by the LIB parameter on the Work with System Activity command. Each performance collection, which is stored in a member determined by the MBR parameter, contains one record for each active job or task in an interval.

Table 7 describes the content of a single record in QAITMON.

Table 7. File QAITMON

Field Name	Attributes	Description
LVLID	CHAR(7)	The level of the module that collected this data and the level of this file in the form VVRRRFF, where VV = version number, RRR = release number, and FF = file level.
DTETIM	CHAR(13)	The date (CMMDDYY) and time (HHMMSS) that the data was collected.
ITVTIM	PACKED(11,0)	The time between data collections, where one unit equals 4096 microseconds.
CPUTOT	PACKED(11,0)	The total processing unit time used by all tasks and jobs during the interval, where one unit equals 4096 microseconds. For multiple-processor systems, this is the average use by all processors.
NAME	CHAR(10)	The job or task name for this entry.
JOBUSR	CHAR(10)	The user profile associated with a job.
JOBNBR	CHAR(6)	The number assigned to the job.
PTY	CHAR(3)	The priority of the job or task when the data was collected.
CPUDLT	PACKED(11,0)	The processing unit time used by this task or job during the interval, where one unit equals 4096 microseconds. For multiple-processor systems, this is the average use by all processors.
IOTOT	PACKED(11,0)	The total physical I/O operations (synchronous and asynchronous) performed by this job or task.
SDBR	PACKED(11,0)	The number of synchronous database reads.
SNDBR	PACKED(11,0)	The number of synchronous nondatabase reads.
SDBW	PACKED(11,0)	The number of synchronous database writes.
SNDBW	PACKED(11,0)	The number of synchronous nondatabase writes.
ADBR	PACKED(11,0)	The number of asynchronous database reads.
ANDBR	PACKED(11,0)	The number of asynchronous nondatabase reads.
ADBW	PACKED(11,0)	The number of asynchronous database writes.
ANDBW	PACKED(11,0)	The number of asynchronous nondatabase writes.
PAGFLT	PACKED(11,0)	The number of process access group faults.
RSRV2	PACKED(11,0)	Reserved.
JTFLAG	CHAR(1)	A flag indicating whether this record represents a job or task where ‘00’X = job and ‘80’X = task.
RSRV1	CHAR(4)	Reserved.
PERMW	PACKED(11,0)	The number of writes that were for permanent objects.
IOPND	PACKED(11,0)	The number of I/O-pending page faults.
SMSYNC	PACKED(11,0)	The number of waits for asynchronous I/O operations to complete.

Table 7. File QAITMON (continued)

Field Name	Attributes	Description
OVRTOT	PACKED(11,0)	The total number of binary, decimal, and floating point overflow exceptions.
CPU1[1]	PACKED(11,0)	For multiple-processor systems, the time used in processor one by jobs and tasks during the interval. One unit of time equals 4096 microseconds.
CPU2[1]	PACKED(11,0)	For multiple-processor systems, the time used in processor two by jobs and tasks during the interval. One unit of time equals 4096 microseconds.
CPUCNT	PACKED(3,0)	The number of active processors in the system during data collection.
CPU3[1]	PACKED(11,0)	For multiple-processor systems, the time used in processor three by jobs and tasks during the interval. One unit of time equals 4096 microseconds.
CPU4[1]	PACKED(11,0)	For multiple-processor systems, the time used in processor four by jobs and tasks during the interval. One unit of time equals 4096 microseconds.
CPU5–CPU32	PACKED(11,0)	For multiple-processor systems, the time used in processor *n* by jobs and tasks during the interval. One unit of time equals 4096 microseconds.
THDID	CHAR(8)	The thread identifier assigned to a job. When a task is running, this field is blank.
STGALC	PACKED(11,0)	Storage allocated.
STGDLC	PACKED(11,0)	Storage deallocated.
DBCDLT	PACKED(11,0)	Database CPU time for the job or task.
DBCTOT	PACKED(11,0)	Overall CPU time for database activity.

Notes:

1 Even though these fields are no longer shown on the Work with System Activity display, you can query the QAITMON file after running `WRKSYSACT OUTPUT(*FILE)` or `WRKSYSACT OUTPUT(*BOTH)`.

Print Activity Report

The Print Activity Report (PRTACTRPT) command creates a report using the performance data collected by the Work with System Activity (WRKSYSACT) command. This report is produced in the spooled file QPITACTR.

Depending on the value specified for the Report Type (RPTTYPE) option on the Print Activity Report command, one of two report types, or both, are created. The summary report provides the top 10 listings showing the most CPU-intensive and the most I/O-intensive entries over the entire specified period. The detailed report shows a selected number of entries for each interval in the specified period. These entries are ordered according to a user selected field. Refer to the following sections for more detail on each of these report types.

Summary Activity Report

The Summary Activity Report consists of two sections. The first lists (in decreasing order) the top 10 entries according to CPU utilization during the specified period, and the second lists (also in decreasing order) the top 10 entries according to total I/O activity performed during the specified period. The value used for total I/O is actually the sum of the total synchronous I/O and the total asynchronous I/O. If 10 active jobs or tasks are not present in the specified period, these sections list as many entries as are available.

The following represents a sample Summary Activity Report:

```
                                                System Activity Report                                   7/07/01  11:06:26
                                                                                                                Page    1
Member  . . . . :  QAITMON      Report Type . . . . :  SUMMARY     Version . . . . :     5    Started . . . . :  07/07/01  10:56:22
Library . . . . :  QPFRDATA                                        Release . . . . :   1.0    Stopped . . . . :  07/07/01  10:57:09
Order by CPU Utilization:
                                            Total  Total         -------Synchronous I/O-----    ------Asynchronous I/O------
Job or                                 CPU   Sync  Async   PAG     DB     DB  Non-DB  Non-DB      DB     DB  Non-DB  Non-DB
 Task       User        Number  Pty   Util   I/O    I/O   Fault   Read  Write   Read   Write    Read  Write   Read   Write
----------  ----------  ------  ---   ----  -----  -----  -----  -----  -----  ------  ------   -----  -----  ------  ------
QCQSARTR    QSVCCS      093261   35   17.9    450     21      0     35      0     387      28       4      2       0      15
QCQRCVDS    QSVMSS      093254   20    2.7    156    128      0      0      0     152       4       0      0       0     128
QPADEV0003  PITA        093215   20    2.3    291     43      0      0      0     186     105       0      1       0      42
QPADEV0004  ALDO        093219   20    1.8    157     29      0      0      0     127      30       0      0       0      29
CFINT1                            0    1.2      0      0      0      0      0       0       0       0      0       0       0
WRKSYSACT   RAMON       093253    1     .7     45     20      0      0     30       1      14       0     20       0       0
SMP00002                          0     .2     24      0      0      0      0       0      24       0      0       0       0
QSYSWRK     QSYS        093130    0     .1     24      0      0      0      0       4      20       0      0       0       0
QTGTELNETS  QTCP        093172   20     .1      0      0      0      0      0       0       0       0      0       0       0
QPADEV0005  MUTH        093205   20     .0      9      0      0      2      0       7       0       0      0       0       0
Order by Total I/O:
                                            Total  Total         -------Synchronous I/O-----    ------Asynchronous I/O------
Job or                                 CPU   Sync  Async   PAG     DB     DB  Non-DB  Non-DB      DB     DB  Non-DB  Non-DB
 Task       User        Number  Pty   Util   I/O    I/O   Fault   Read  Write   Read   Write    Read  Write   Read   Write
----------  ----------  ------  ---   ----  -----  -----  -----  -----  -----  ------  ------   -----  -----  ------  ------
QDCPOBJ2    QSYS        093115   60     .0      0      0      0      0      0       0       0       0      0       0       0
QDCPOBJ1    QSYS        093114   60     .0      0      0      0      0      0       0       0       0      0       0       0
SCPF        QSYS        000000   40     .0     17      5      0      2      6       7       2       0      1       0       4
LCTRS                             0     .0      0      0      0      0      0       0       0       0      0       0       0
SMASPTASK                         0     .0      0      0      0      0      0       0       0       0      0       0       0
SMP00003                          0     .0     73      0      0      0      1       0      72       0      0       0       0
SMP00002                          0     .2     24      0      0      0      0       0      24       0      0       0       0
SMP00001                          0     .0     49      0      0      0      1       0      48       0      0       0       0
QPADEV0015  RAMON       093231   20     .0      0      0      0      0      0       0       0       0      0       0       0
QTGTELNETS  QTCP        093172   20     .1      0      0      0      0      0       0       0       0      0       0       0
```

Figure 10. Sample Summary Activity Report

The header portion of this report contains the following information:

Report title
The title of the report.

Current date and time
The date and time when this report was printed.

Report page number
The page number currently being printed.

User-selected report title
The title specified by the user on the TITLE parameter of the Print Activity Report command.

Member
The name of the member in QAITMON that contained the performance data.

Library
The library where QAITMON was located.

Report type
The type of report, either summary or detail, being printed.

Version
The version of the Performance Tools licensed program that collected the data.

Release
The release level of the Performance Tools licensed program that collected the data.

Period start date and time
The start date and time of the period during which the performance statistics being printed were collected.

Period end date and time
The end date and time of the period during which the performance statistics being printed were collected.

The columns in the summary activity report are:

Job or Task
The name of the job or task for which the performance statistics are being printed.

User The user profile associated with the job.

Number
The number assigned to the job.

Pty The priority at which the job or task was running when the performance statistics were first collected.

CPU Util
The percentage of the specified period during which the processing unit was used by the job or task. For a multiple-processor system, this is the total utilization divided by the number of processors.

Total Sync I/O
The total number of synchronous physical disk I/O operations performed by the job or task during the specified period. This value is the sum of the synchronous database/nondatabase reads and writes.

Total Async I/O
The total number of asynchronous physical disk I/O operations started by the job or task during the specified period. This value is the sum of the asynchronous database/nondatabase reads and writes.

PAG Fault
The number of process access group (PAG) faults caused by the job or task during the specified period.

Synchronous I/O DB Read
The number of synchronous database read operations performed by the job or task during the specified period.

Synchronous I/O DB Write
The number of synchronous database write operations performed by the job or task during the specified period.

Synchronous I/O Non-DB Read
The number of synchronous nondatabase read operations performed by the job or task during the specified period.

Synchronous I/O Non-DB Write
The number of synchronous nondatabase write operations performed by the job or task during the specified period.

Asynchronous I/O DB Read
The number of asynchronous database read operations started by the job or task during the specified period.

Asynchronous I/O DB Write
: The number of asynchronous database write operations started by the job or task during the specified period.

Asynchronous I/O Non-DB Read
: The number of asynchronous nondatabase read operations started by the job or task during the specified period.

Asynchronous I/O Non-DB Write
: The number of asynchronous nondatabase write operations started by the job or task during the specified period.

Note: The asynchronous I/O operations are performed by system asynchronous I/O tasks.

Detail Activity Report

For each interval available in the specified period, the Detail Activity Report lists the performance statistics for the number of entries specified by the Number of Jobs (NBRJOBS) parameter. The entries are ordered according to the Sequence (SEQ) parameter.

The following represents a sample Detail Activity Report.

```
                                                  System Activity Report                                      7/07/01  11:06:38
                                                                                                                         Page    1
Member  . . . . :  QAITMON      Report Type . . . . :  DETAIL      Version . . . . :    5    Started . . . . :  07/07/01  10:56:22
Library . . . . :  QPFRDATA     Sequence  . . . . . :  CPU         Release . . . . :  1.0    Stopped . . . . :  07/07/01  10:57:09
Time . . . . :   10:56:22                        Total CPU Utilization . . . . . . . . . . . . :     .0
                                            Total  Total        -------Synchronous I/O-----    ------Asynchronous I/O------
Job or                                   CPU   Sync  Async    PAG     DB     DB  Non-DB  Non-DB      DB     DB  Non-DB  Non-DB
 Task       User        Number  Pty     Util    I/O    I/O  Fault   Read  Write    Read   Write    Read  Write    Read   Write
----------  ----------  ------  ---     ----  -----  -----  -----  -----  -----  ------  ------   -----  -----  ------  ------
WRKSYSACT   RAMON       093253    1       .2      0      0      0      0      0       0       0       0      0       0       0
RMSRVCTKLO                        0       .0      0      0      0      0      0       0       0       0      0       0       0
LIDMGR-TAS  K--AHT                0       .0      0      0      0      0      0       0       0       0      0       0       0
SMASPTASK                         0       .0      0      0      0      0      0       0       0       0      0       0       0
SMASPAGENT  TASK                  0       .0      0      0      0      0      0       0       0       0      0       0       0
SMCFGVALID  ATER                  0       .0      0      0      0      0      0       0       0       0      0       0       0
SMCFGUPDAT  ER                    0       .0      0      0      0      0      0       0       0       0      0       0       0
SMSLSSERVI  CETASK                0       .0      0      0      0      0      0       0       0       0      0       0       0
IOPI-HRI-P  ERS-IO                0       .0      0      0      0      0      0       0       0       0      0       0       0
XMERRLOGER                        0       .0      0      0      0      0      0       0       0       0      0       0       0
Time . . . . :   10:56:27                        Total CPU Utilization . . . . . . . . . . . . :     .0
                                            Total  Total        -------Synchronous I/O-----    ------Asynchronous I/O------
Job or                                   CPU   Sync  Async    PAG     DB     DB  Non-DB  Non-DB      DB     DB  Non-DB  Non-DB
 Task       User        Number  Pty     Util    I/O    I/O  Fault   Read  Write    Read   Write    Read  Write    Read   Write
----------  ----------  ------  ---     ----  -----  -----  -----  -----  -----  ------  ------   -----  -----  ------  ------
WRKSYSACT   RAMON       093253    1       .7      8      2      0      0      3       1       4       0      2       0       0
QPADEV0005  MUTH        093205   20       .5      9      0      0      2      0       7       0       0      0       0       0
QLZPSERV    QUSER       093239   20       .0      0      0      0      0      0       0       0       0      0       0       0
RMSRVCTKLO                        0       .0      0      0      0      0      0       0       0       0      0       0       0
LIDMGR-TAS  K--AHT                0       .0      0      0      0      0      0       0       0       0      0       0       0
SMASPTASK                         0       .0      0      0      0      0      0       0       0       0      0       0       0
SMASPAGENT  TASK                  0       .0      0      0      0      0      0       0       0       0      0       0       0
SMCFGVALID  ATER                  0       .0      0      0      0      0      0       0       0       0      0       0       0
SMCFGUPDAT  ER                    0       .0      0      0      0      0      0       0       0       0      0       0       0
SMSLSSERVI  CETASK                0       .0      0      0      0      0      0       0       0       0      0       0       0
```

Figure 11. Sample Detail Activity Report

The header portion of this report contains the same information as found on the summary report, except for the *Sequence* field, which defines the order of the entries listed for each interval. The value found in this field corresponds to the value specified for the sequence (SEQ) parameter on the Print Activity Report command.

The body of the Detail Activity Report contains the same columns of information found on the summary report. There are, however, two additional fields associated with the statistics for each interval:

Time The end time for the collection interval.

Total CPU Utilization
The processing unit use for the entire system during the collection interval.

For a multiple-processor system, this is the total utilization divided by the number of processors.

Chapter 7. Performance Reports—Manager Feature

Performance reports provide a way for you to effectively research areas of the system that are causing performance problems. After you have collected performance data over time, different reports offer you ways to see how and where system resources are used. Performance reports can direct you to specific application programs, users, or inefficient workloads that are causing lower overall response times.

Several types of performance reports show data focusing on different aspects of the system. For example, one report identifies CPU use and another identifies communications use. These reports help identify various performance problems. If you get complaints that the user sign-ons are taking longer than they should, you could use a *Transaction Report* to find out how many CPU seconds are used by the sign-on. You could then use a *Transition Report* to more closely identify how those CPU seconds are used.

A Performance Report

```
                                                          System Report                                        12/11/00 16:38:36
                                                         Disk Utilization                                             Page 0006
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM           Version/Release  :   5/ 1.0   Stopped  . . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
       Unit               Size   IOP   IOP           Dsk CPU  ASP   --Percent--    Op Per    K Per     - Average Time Per I/O --
 Unit  Name        Type  (M)     Util  Name          Util     ID    Full   Util    Second     I/O      Service   Wait   Response
 ----  ---------- ---- -------  ----  ------------  -------  ---   ----   ----  ---------  ---------  -------  ------  --------
 0001  DD001      6713   7,516    .2  CMB01              2.3   01   60.6    5.0       2.58        9.7    .0193   .0085      .0278
 0002  DD009      6717   6,442    .2  CMB01              2.3   01   66.7     .6        .30        4.5    .0193   .0000      .0193
 0003  DD018      6717   8,589    .2  CMB01              2.3   01   60.7     .6        .33       10.4    .0180   .0150      .0330
 0004  DD017      6717   7,516    .2  CMB01              2.3   01   62.7     .3        .14        4.8    .0200   .0000      .0200
 0005  DD004      6714  13,161    .2  CMB01              2.3   01   60.6    5.1       1.20       21.0    .0422   .0679      .1101
 0006  DD006      6714  13,161    .2  CMB01              2.3   01   60.6    8.9       2.64       14.0    .0336   .0370      .0706
 0007  DD008      6717   6,442    .2  CMB01              2.3   01   63.4     .7        .38        4.7    .0182   .0026      .0208
 0008  DD003      6714  13,161    .2  CMB01              2.3   01   60.6    8.1       2.25       15.3    .0358   .0403      .0761
 0009  DD007      6717   6,442    .2  CMB01              2.3   01   63.4     .2        .14        4.9    .0138   .0000      .0138
 0010  DD005      6714  13,161    .2  CMB01              2.3   01   60.6    8.1       2.27       15.4    .0356   .0382      .0738
 0011  DD013      6717   7,516    .2  CMB01              2.3   01   60.6     .8        .34       17.2    .0229   .0229      .0458
 0012  DD010      6717   7,516    .2  CMB01              2.3   01   62.5     .3        .17        5.7    .0172   .0058      .0230
 0013  DD002      6713   7,516    .2  CMB01              2.3   01   60.7    1.7        .63       21.4    .0268   .0237      .0505
 0014  DD012      6717   7,516    .2  CMB01              2.3   01   63.0     .5        .28        4.3    .0177   .0000      .0177
 0015  DD015      6717   7,516    .2  CMB01              2.3   01   62.6     .3        .14        5.0    .0201   .0000      .0201
 0016  DD014      6717   7,516    .2  CMB01              2.3   01   62.9     .7        .39        6.9    .0177   .0000      .0177
 0017  DD011      6717   8,589    .2  CMB01              2.3   01   60.7     .8        .44       14.4    .0180   .0113      .0293
 0018  DD016      6717   6,442    .2  CMB01              2.3   01   64.9     .5        .26        4.7    .0187   .0000      .0187
Total                  155,718
Average                                                         61.8    2.4        .83       13.2    .0288   .0276      .0564
Unit                     --  Disk arm identifier
Unit Name                --  Disk arm resource name
Type                     --  Type of disk
Size (M)                 --  Disk space capacity in millions of bytes
IOP Util                 --  Percentage of utilization for each Input/Output Processor
IOP Name                 --  Input/Output Processor resource name
Dsk CPU Util             --  Percentage of Disk Processor Utilization
ASP ID                   --  Auxiliary Storage Pool ID
Percent Full             --  Percentage of disk space capacity in use
Percent Util             --  Average disk operation utilization (busy)
Op per Second            --  Average number of disk operations per second
K Per I/O                --  Average number of kilobytes (1024) transferred per disk operation
Average Service Time     --  Average disk service time per I/O operation
Average Wait Time        --  Average disk wait time per I/O operation
Average Response Time    --  Average disk response time per I/O operation
```

Figure 12. A Performance Report

Note: This report is only provided as an example of the layout of a report. See each specific report example for current report details.

Performance Report Header

Each report, regardless of the type or section, contains information in the header of the report that identifies characteristics of the data:

Report title
: The first line identifies the type of performance report. The second line identifies the section of the report.

Current date and time
: Is the date and time the report was printed.

Report page number
: Identifies the page of the report.

User-selected report title
: Is the name assigned to the report by a user.

Data member name
: Is the performance data member used in the report. This name corresponds to the name used on the MBR parameter of the Create Performance data (CRTPFRDTA) command.

Library name
: Is the library where the performance data used in the report is located.

Model number
: `270` is the model number and `22A8-2252-1519` is the feature code of the server on which the performance data was collected for this report.

Partition ID
: The partition ID in which the collection was run. This change accommodates the logical partition implementation. Here are some of the values that you might see:

- If your system is not partitioned (which is the default) or you used Collection Services to collect and print the performance data for the primary partition of a logical partition system, this value is 00.
- If you collected data with the Start Performance Monitor (STRPFRMON) command in a previous release, the value for the partition ID is 00.
- If you used Collection Services to collect and print the performance data in any secondary partition of a logical partition system, this value is the same as the partition ID that is shown on the Work with System Partitions display under the Start Service Tools (STRSST) command.

Serial number
: `10-45WFM` is the serial number of the system unit in this example. The serial number can be 10 characters.

System name
: `ABSYSTEM` is the name of the server on which the performance data was collected for this report.

Feature Code
: The Interactive feature code values for 7xx servers. For 7xx servers, the report heading for the feature code will read: `Feature Code . : 208D-2064-1505`.

Main storage size
: Is the size of the main storage on the server on which the performance data was collected in this example.

OS/400 version and release level
`x/ x.0` indicates which version and release level that the server was running.

Data collection start date and time
Is the date and time Collection Services started collecting performance data in this example. Depending on whether or not you select specific intervals or a specific starting time, you could see the following:

- If you specify no intervals at which to run the report, the start date and time is the date and time at which the data was collected.
- If you specify specific intervals at which to run the report, the start date and time is the date and time at which the data was collected.

Note: For the system report only, you should consult the Report Selection Criteria section to find out which intervals were selected.

Data collection stop date and time
Is the date and time Collection Services stopped collecting performance data in this example. Depending on whether or not you select specific intervals or a specific ending time, you could see the following:

- If you specify no intervals at which to run the report, the stop date and time is the date and time at which the data was collected.
- If you specify specific intervals at which to run the report, the stop date and time is the date and time at which the data was collected.

Note: For the system report only, you should consult the Report Selection Criteria section to find out which intervals were selected.

Column headings
Each report also has several columns that make up the information of the report. Some are specific to a particular report and others are consistent between reports. In this example, **IOP Util** is one of the column headings. For short descriptions of these columns, see “Performance Report Columns” on page 157.

Available Performance Reports

System Report
This report has the following sections:

- Workload
- Resource Utilization
- Resource Utilization Expansion
- Storage Pool Utilization
- Disk Utilization
- Communications Summary
- TCP/IP Summary
- Report Selection Criteria

Component Report
This report has the following sections:

- Component Interval Activity
- Job Workload Activity
- Storage Pool Activity
- Disk Activity

- IOP Utilizations
- Local Work Stations–Response Time Buckets
- Remote Work Station–Response Time Buckets
- Exception Occurrence Summary and Interval Counts
- Database Journaling Summary
- TCP/IP Activity
- Report Selection Criteria

Transaction Report

This report has the following sections:

- Job Summary Report
  - Job Summary
  - System Summary Data
  - Distribution of Transactions by CPU/Transaction
  - Transaction Significance
  - Interactive Transactions by 5-Minute Intervals
  - Interactive Throughput by 5-Minute Intervals
  - Interactive CPU
  - Interactive Response Time by 5-Minute Intervals
  - Scatter diagram
  - Interactive Program Transaction Statistics
  - Summary of Seize/Lock Conflict by Object
  - Report Selection Criteria

  The default for the OPTION parameter on the PRTTNSRPT command is *SS (special system information). If you leave this default, the following special summary sections print:
  - Priority-Jobtype-Pool Statistics
  - Job Statistics
  - Interactive Program Statistics
  - Individual Transaction Statistics
  - Longest Seize/Lock Conflicts
  - Longest Holders of Seize/Lock Conflicts
  - Batch Job Analysis
  - Concurrent Batch Job Statistics
- Transaction Report
- Transition Report

Lock Report

Job Interval Report

This report has the following sections:

- Interactive Job Summary
- Noninteractive Job Summary
- Interactive Job Detail
- Noninteractive Job Detail
- Report Selection Criteria

Pool Interval Report

This report has the following sections:

- Subsystem Activity
- Pool Activity
- Report Selection Criteria

Resource Interval Report

This report has the following sections:

- Disk Utilization Summary
- Disk Utilization Detail
- Communications Line Detail
  - SDLC Protocol
  - X.25 Protocol
  - TRLAN Protocol
  - ELAN Protocol
  - ASYNC Protocol
  - BSC Protocol
  - ISDN Network Interface
  - Network Interface Maintenance Channel for ISDN
  - IDLC Protocol
  - DDI Protocol
  - Frame Relay Protocol
- IOP Utilizations
- Local Work Station Response Times
- Remote Work Station Response Times

  Note: This section appears only if 5494 remote work station data is included in the data collection. Collection Services does not generate data for remote work stations (file QAPMRWS). This section applies only to performance data generated by the STRPFRMON command prior to V5R1 and converted in V5R1 with the Convert Performance Data (CVTPFRDTA) command.

Batch Job Trace Report

This report has the following sections:

- Job Summary

Which Report Do I Want?

The "System Report" on page 73 supplies you with an overview of how the system is operating. It contains summary information on the workload, resource use, storage pool utilization, disk utilization, and communications. This is a good report to run and print often, giving you a general idea of system use. You can print selected sections of this report.

The "Component Report" on page 82 supplies you with information about the same components of system performance as a System Report, but at a greater level of detail. This report helps you find which jobs are consuming high amounts of system resources, such as CPU, disk, and so on.

The “Job Interval Report” on page 124, “Pool Interval Report” on page 130, and “Resource Interval Report” on page 133 provide the same information as the System Report and Component Report do, but on an interval-by-interval basis.

The “Lock Report” on page 120 provides information about lock and seize conflicts during system operation.

The “Batch Job Trace Report” on page 146 shows the progression of different job types (for example, batch jobs) traced through time.

The “Transaction Report” on page 95 provides detailed information about the transactions that occurred during the performance data collection.

Printing Performance Reports

You can print reports using the performance data that you collected. Prior to V5R1, Option 3 (Print performance report) displayed a list of performance members that were located in the QAPMCONF file. This list included both sample data and trace data that was collected by the Start Performance Monitor (STRPFRMON) command. Collection Services does not collect trace data. However, you can use the STRPFRTRC and TRCINT commands to collect trace data. This data is located in the QAPMDMPT file. Therefore, in V5R1, you see two views of the Print Performance Report display, one for sample data and one for trace data.

Note: If your trace data and sample data are both in the current library, you can use F20 to toggle between the two Print Performance Report displays.

After you have collected your data, you must create a set of performance data files from the performance information stored in a management collection (*MGTCOL) object. Use the Create Performance Data (CRTPFRDTA) command. After you have created the data files, you can request to print your reports.

Use the following commands to print reports for sample data that you collected with Collection Services:

- Print System Report (PRTSYSRPT)
- Print Component Report (PRTCPTRPT)
- Print Job Interval Report (PRTJOBRPT)
- Print Pool Report (PRTPOLRPT)
- Print Resource Report (PRTRSCRPT)

Use the following commands to print reports for trace data that you collected with the Start Performance Trace (STRPFRTRC) and Trace Internal (TRCINT) commands:

- Print Transaction Report (PRTTNSRPT)
- Print Lock Report (PRTLCKRPT)
- Print Job Trace Report (PRTTRCRPT)

Note: You must use the End Performance Trace (ENDPFRTRC) command to stop the collection of performance trace data and then optionally write performance trace data to a database file before you can print the Transaction reports.

Using Menus to Print Performance Report – Sample Data

1. After you have collected your data, you must create a set of performance data files from the performance information stored in a management collection (*MGTCOL) object. Use the Create Performance Data (CRTPFRDTA) command. After you have created the data files, you can request to print your reports.
2. To start Performance Tools, use the Start Performance Tools (STRPFRT) command or type `go perform` on a command line.
3. To print selected information from the sample data that you collected with Collection Services, choose option 3 (Print performance report) on the IBM Performance Tools menu. The Print Performance Report display appears.

   The member name, a text description, and the date and time you collected each set of performance data appear on this display. If you cannot find the data you want to print in a report, use the appropriate function key to sort the sets of performance data. You can sort them by member name, text description, or by the date and time the member was created.
4. When you find the performance data, select the type of report you want by typing one of the following options that corresponds to the type of report:

Option	Description
1	System Report
2	Component Report
3	Job Report
4	Pool Report
5	Resource Report

```
                      Print Performance Report - Sample data

Library . . . . . .   QPFRDATA

Type option, press Enter.
  1=System report   2=Component report   3=Job report   4=Pool report
  5=Resource report

Option   Member       Text                                 Date       Time
  1      TUEDTA                                           03/17/01   12:20:29
  _      DLTTEST18                                        03/17/01   10:10:20
  _      DLTTEST17                                        03/17/01   10:10:02
  _      DLTTEST16                                        03/17/01   10:09:42
  _      DLTTEST15                                        03/17/01   10:09:32
  _      DLTTEST14                                        03/17/01   10:09:22
  _      DLTTEST13                                        03/17/01   10:09:04
  _      DLTTEST11                                        03/17/01   10:08:56
  _      DLTTEST10                                        03/17/01   10:08:49
  _      DLTTEST9                                         03/17/01   10:08:44
  _      DLTTEST8                                         03/17/01   10:08:35
                                                                      More...
F3=Exit   F5=Refresh   F11=Work with your spooled output files   F12=Cancel
F15=Sort by member     F16=Sort by text
```

Figure 13. Print Performance Report - Sample data display

Note: If Collection Services is running and is using one of the members shown in the Print Performance Report display, this member may appear with blank Date and Time fields until the first interval is collected.

5. The Select Sections for Report display appears when you select to print any of the reports for the sample data. For example, if you selected to print a System Report, you would see the following display:

```
                          Select Sections for Report

Member . . . . . . . . . . . :   Q961030917

Type options, press Enter.  Press F6 to print entire report.
  1=Select

Option     Section
           Workload
           Resource Utilization
           Resource Utilization Expansion
           Storage Pool Utilization
           Disk Utilization
           Communication Summary
           TCP/IP Summary




                                                                        Bottom
F3=Exit   F6=Print entire report   F12=Cancel
```

The Select Categories for Report display appears when you select to print one of the following reports:

- System Report
- Component Report
- Job Report
- Pool Report
- Resource Report

Note: The Select Sections for Report display is shown first, followed by the Select Categories for Report display.

```
                         Select Categories for Report

Member . . . . . . . . . . . :   TUEDTA

Type options, press Enter.  Press F6 to print entire report.
  1=Select

Option     Category
  _        Time interval
  _        Job
  _        User ID
  _        Subsystem
  _        Pool
  _        Communications line
  _        Control unit
  _        Functional area




                                                                      Bottom
F3=Exit   F6=Print entire report   F12=Cancel
```

The name of the performance data member you chose on the Print Performance Report display appears at the top of the Select Categories for Report display.

6. To include all categories of information in your report, Press F6. To limit the amount of information in the report, type a 1 in the *Option* column next to those categories of information for which you want performance data. Press Enter.

   For example, if you choose the Time interval option, the Select Time Intervals display appears. This display shows an interactive view of some of the key performance parameters of the data collected. The member name you typed on the Print Performance Reports display appears in the *Performance data* field. The intervals you defined to collect the performance data appear.

```
                            Select Time Intervals

Library . . . . . :   QPFRDATA      Performance data . . . . . :   TUEDTA

Type options, press Enter.
  1=Select
                                         CPU        High       Pool
                   Transaction  -Utilization-  --Util--  -Fault/Sec-
Opt  Date   Time   Count  Resp  Tot Inter Bch  Dsk Unit  Mch User ID    Excp
 _   03/17  12:39     33   1.5    3     2   0    2 0017    0    1 03      77
 _   03/17  12:44     26    .9    1     1   0    1 0002    0    0 03       7
 _   03/17  12:49     20    .2    1     0   0    1 0009    0    0 03       7








 F3=Exit                   F5=Refresh                  F12=Cancel
 F13=Sort (date/time)      F14=Sort (count)            F24=More keys
```

7. Use the Select Time Intervals display to choose specific time intervals from the performance data to produce a report. You should select specific time intervals

to help you manage the volume of data associated with the performance measurement. The Select Time Intervals display allows you to interactively select the time intervals of interest. This selection reduces the amount of processing required to produce the requested report, and also reduces the size of the resulting report.

To select time intervals to print on your report, type a 1 in the *Opt* column next to the appropriate intervals. When you select multiple intervals, they are combined to create a single report.

If it is difficult to find the time interval you need, you can sort the intervals differently before making your selection. You can choose to sort the time intervals in any of the following ways:

- Date/time
- Transaction count
- Response time
- Total processing unit time
- Interactive processing unit time
- Batch processing unit time
- Disk utilization
- Machine pool faults
- User pool faults
- Exceptions

If you choose to print the report with only certain categories of information, a display appears for each category. For example, if you choose Pool, the Select or Omit Pools display appears.

8. Use the Select or Omit Pools display to select pools to include or omit from your report. To use this display, type the number for the pools you want to select or omit. If you do not know the pool numbers to select, press F4 (Prompt) to see a list of pools that were active during the collection of performance data.

```
                              Select or Omit Pools

Member . . . . . . . . . . . :   TUEDTA

Type options, press Enter.
  1=Select   2=Omit

Option     Pool     Text
  _         01      Machine pool
  _         02      Base pool
  _         03
  _         04
                                                                    Bottom








F12=Cancel
```

Type a 1 in the *Option* column next to the items you want to include in your report. Or type a 2 if you want certain items omitted from your report.

Note: You cannot use both the Select and Omit options at the same time. You must indicate either the items to select or the items to omit.

To include all the items in the report, leave the *Option* column blank, and press the Enter key.

For each category you choose on the Select Categories for Report display, you must complete one of the following corresponding displays:

- Select Time Intervals
- Select or Omit Pools
- Select or Omit Jobs
- Select or Omit User IDs
- Select or Omit Subsystems
- Select or Omit Communications Lines
- Select or Omit Control Units
- Select or Omit Functional Areas

When you choose the information you want to appear on your report from the options shown on these displays, the Select Report Options display appears. Following is an example of the display that appears if you did not use the Select Time Intervals display to choose any time intervals for the Job Report:

```
                             Specify Report Options

 Type choices, press Enter.

 Report title . . . .   New data entry in production

 Start:
   Day  . . . . . . .   *FIRST                  *FIRST, MM/DD/YY
   Time . . . . . . .   *FIRST                  *FIRST, HH:MM:SS

 Stop:
   Day  . . . . . . .   *LAST                   *LAST, MM/DD/YY
   Time . . . . . . .   *LAST                   *LAST, HH:MM:SS

 Omit system tasks      *YES                    *YES, *NO

 Report detail  . . .   *JOB                    *JOB, *THREAD

 Job description  . .   QPFRJOBD                Name, *NONE
   Library  . . . . .     *LIBL                 Name, *LIBL, *CURLIB


 F3=Exit   F12=Cancel
```

9. Specify the start and stop date and time. If you do not specify the start and stop date and time, the report includes data from the first (or only) date that data was collected, to the last (or only) date that data was collected. You may also type a report title in the *Report title* field and specify whether or not you want your report to include the system tasks. Press Enter to process and print your report.

   Note: The *Omit system tasks* field appears only if you requested printing of a Job Report. The *Report detail* field appears only if you requested printing of a Job Report or a Component Report.

If you made use of the Select Time Intervals display, the following version of the Select Report Options display appears instead:

```
                             Specify Report Options

 Type choices, press Enter.

 Report title . . . .   New data entry in production

 Omit system tasks      *YES                  *YES, *NO

 Report detail  . . .   *JOB                  *JOB, *THREAD

 Job description  . .   QPFRJOBD              Name, *NONE
   Library  . . . . .     *LIBL               Name, *LIBL, *CURLIB











 F3=Exit   F12=Cancel
```

If you so choose, type a report title in the *Report title* field. You can specify whether or not to include the system tasks in your Job Report. Also, you can specify whether to provide detailed job information at the thread level or job level for the Component Report and the Job Report. Press the Enter key to process and print your report.

10. Press Enter to submit a batch request to print a System Report for the entire data collection period.

    Note: If you want to generate the report interactively (instead of in batch), you can specify *NONE in the Job Description field of the Specify Report Options display.

11. Press F3 (Exit) to go to the IBM Performance Tools menu.

    The batch request you submit takes a period of time to complete, depending on the amount of data collected. Use the Work with Submitted Job (WRKSBMJOB) command to check the status of the request.

    After the System Report has been produced, you can view it online and direct it to an active writer by following steps 12 through 15.

```
PERFORM                 IBM Performance Tools for AS/400
                                                          System:   ABSYSTEM
Select one of the following:

     1. Select type of status
     2. Collect performance data
     3. Print performance report
     4. Capacity planning/modeling
     5. Performance utilities
     6. Configure and manage tools
     7. Display performance data
     8. System activity
     9. Performance graphics
    10. Advisor

    70. Related commands


Selection or command
===> WRKSPLF____________________________________________________________
________________________________________________________________________
F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F16=System main menu
```

12. Type WRKSPLF on the command entry line, and press the Enter key.

    The Work with All Spooled Files display appears.

```
                         Work with All Spooled Files

Type options, press Enter.
  2=Change   3=Hold   4=Delete   5=Display   6=Release   8=Attributes

                             Device or                     Total    Cur
Opt  File        User        Queue       User Data   Sts   Pages    Page  Copy
 2   QPPTSYSR    USERID      QSYSPRT                 RDY       7             1













Parameters for option 2 or command
===> OUTQ(outqname)_____________________________________________________
F3=Exit   F10=View 3   F11=View 2   F12=Cancel   F24=More keys
```

On this display you could choose option 5, for example, to view the System Report online.

13. For this example, type a 2 under the *Opt* column to change the output queue for the System Report (the QPPTSYSR file). In this example, you might want to move the report to an output queue that has an active writer, so the report prints on the device the writer is associated with.
14. Type the new output queue name. To do this, type OUTQ(outqname) on the command entry line.
15. Press Enter. The System Report prints when a device is available.

Using Menus to Print Performance Report – Trace Data

1. To start Performance Tools, use the Start Performance Tools (STRPFRT) command or type `go perform` on a command line.
2. To collect the trace data, use either the Start Performance Trace (STRPFRTRC) command or the Trace Internal (TRCINT) command. These commands start the data collection. You must also end the data collection with either the End Performance Trace (ENDPFRTRC) command or the Dump Trace (DMPTRC) command.
3. To print selected information from the trace data that you collected, choose option 3 (Print performance report) on the IBM Performance Tools menu. The Print Performance Report display appears.

   The member name, a text description, and the date and time you collected each set of performance data appear on this display. If you cannot find the data you want to print in a report, use the appropriate function key to sort the sets of performance data. You can sort them by member name, text description, or by the date and time the member was created.
4. When you find the performance data, select the type of report you want by typing one of the following options that corresponds to the type of report:

Option	Description
1	Transaction Report
2	Lock Report
3	Batch job trace Report

```
                    Print Performance Report - Trace data

Library . . . . . .   QPFRDATA

 Type option, press Enter.
  1=Transaction report   2=Lock report   3=Batch job trace report


Option   Member       Text                                  Date       Time
  1      TUEDTA                                            03/17/01   12:20:29
  _      DLTTEST18                                         03/17/01   10:10:20
  _      DLTTEST17                                         03/17/01   10:10:02
  _      DLTTEST16                                         03/17/01   10:09:42
  _      DLTTEST15                                         03/17/01   10:09:32
  _      DLTTEST14                                         03/17/01   10:09:22
  _      DLTTEST13                                         03/17/01   10:09:04
  _      DLTTEST11                                         03/17/01   10:08:56
  _      DLTTEST10                                         03/17/01   10:08:49
  _      DLTTEST9                                          03/17/01   10:08:44
  _      DLTTEST8                                          03/17/01   10:08:35
                                                                      More...
F3=Exit   F5=Refresh   F11=Work with your spooled output files   F12=Cancel
F15=Sort by member     F16=Sort by text
```

Figure 14. Print Performance Report - Trace data display

5. To print a Transaction Report, Lock Report, or Batch Job Trace Report, press Enter, and the parameters for the corresponding print command appear. Complete the parameters and press Enter.

Why Performance Reports May Seem Inconsistent

Performance Tools pulls data from the various database files to create the performance reports. As a result, some values in the report's columns are inconsistent between reports where it seems like they should match.

For example, the Communications Summary report (System Report) uses the QAPMJOBS file. QAPMJOBS file records batch use for jobs that are not related to communications. As a result, batch use of a line or TCP use does not show up in the QAPMJOBS file. Because the QAPMJOBS file only shows transactions for jobs, and the communications line connected to the job is classified as interactive, no batch use for communications is recorded by the QAPMJOBS file.

Note: The Communications Summary (System Report) only shows interactive results. Besides this section only takes information from the records which have data in the line description, communications line name, or in the secondary line description, pass-through and emulation (only ″virtual″ type connection).

Another example is the IOP Utilizations Component report section, which uses the QAPMCIOP file. This file has field values for the idle loop count and the idle loop time. These values make up the data that is used to calculate the IOP utilization value that shows up in this report. The IOP utilization result is just the percentage of CPU used in the IOP. When the communication IOP utilization shows a value different than 0, it does not necessarily mean that the IOP is doing any data transfers, it may just be overhead of an active line.

Another confusing example is how Client Access transactions show up on the System report. Client Access jobs show up in the interactive category, but some Client Access functions show up in batch or evoke categories. In addition, lots of Client Access activity never become a real job. This can have some effect on transaction counting. For example, the Interactive Workload System report section shows the different job types (Interactive, Client Access, DDM Server, Passthrough, and so on). Each of these job types has a column with the corresponding total of transactions for each one. This report pulls data from the QAPMSYS file, where Collection Services assigns different classifications of data for the different job types. Collection Services checks for certain attributes and flags on the system to determine which types they are. For example, Client Access jobs are identified by a flag. The flag is turned on when a Client Access application sets a Client Access bit in the work control block (WCB). Collection Services then recognizes this job as Client Access and classifies it as such.

As a result, the number of transactions that show up on the Interactive Workload section differs from the number of transactions that show up on the Communications Summary System report section. The Communications Summary System report section only shows the number of interactive transactions on the communication line over a period of time (which includes Client Access transactions). The transactions that are unrelated to the communications line do not show up in this section of the report.

Performance Tools reports show the data based on the contents of the database files. In some cases, this causes slight inconsistencies between reports.

Table 8 on page 72 identifies the type of workload that is running on the system and shows how the System Report (SYS), the Component Report (CPT), and the Transaction Report (TNS) report the job type for the QAPMJOBS database file.

The abbreviations for the field value headings include the following:

- JBTYPE - job type
- JBSTYP - job subtype
- JBPTTF - target pass-through flag
- JBPTSF - source pass-through flag
- JBEAF - emulation active flag
- JBPCSF - Client Access flag
- JBDDMF - target DDM job flag

The *Desc* column identifies the type of workload that is running on the system. This column contains a number that is associated with the following descriptions:

- 1 - 5250 twinaxial data link control, remote workstation support, or 3270 remote attach
- 2 - APPC 5250 emulation (Client Access)
- 3 - Target APPC display station pass-through
- 4 - Target Telnet 5250
- 5 - Source pass-through
- 6 - Target distributed data management (DDM)
- 7 - APPC router
- 8 - Host server ("Client Access"), pre-started job
- 9 - APPC, batch evoke
- 10 - Normal batch job
- 11 - Auto start job
- 12 - Subsystem monitor
- 13 - Spool writer
- 14 - Spool print driver
- 15 - Other system jobs
- 16 - typical secondary thread

You can find the descriptions for the one-character and two-character abbreviations used in the table under the *Typ* column description at the end of this chapter.

Table 8. Job Types

Desc	Jobtype Listed in Reports			QAPMJOBOS and QAPMJOBMI Field Values[1] If you use performance data generated by the STRPFRMON command and ENDPFRMON command (pre-V5R1), the field values are from the QAPMJOBS file.						
	SYS	**CPT**	**TNS**	**JBTYPE**	**JBSTYP**	**JBPTTF**	**JBPTSF**	**JBEAF**	**JBPCSF**	**JBDDMF**
1	I[2]	I	I	I	b	0	0	0	0	0
2	CA[2,3]	C	I	I	b	1	0	0	1	0
3	PT[2,4]	P	I	I	b	1	0	0	0	0
4	PT[2,4]	P	I	I	b	1	0	0	0	0
5	NA	NA	NA	NA	b	0	1	0	0	0
6	DDM server[5]	D	BE	B	E	1	1	0	0	1
7	Batch[5]	E	BE	B	E	0	0	0	1	0
8	Batch[5]	C	BJ	B	J	0	0	0	1	0
9	Batch[5]	C	B	B	b	0	0	0	0	0

Table 8. Job Types (continued)

Desc	Jobtype Listed in Reports			QAPMJOBOS and QAPMJOBMI Field Values[1] If you use performance data generated by the STRPFRMON command and ENDPFRMON command (pre-V5R1), the field values are from the QAPMJOBS file.						
	SYS	**CPT**	**TNS**	**JBTYPE**	**JBSTYP**	**JBPTTF**	**JBPTSF**	**JBEAF**	**JBPCSF**	**JBDDMF**
10	Batch[5]	B	B	B	b	0	0	0	0	0
11	Auto start[5]	A	A	A	b	1	1	0	0	0
12	System[5]	M	M	M	b	0	0	0	0	0
13	Spool[5]	W	W	W	b	0	0	0	0	0
14	Spool[5]	W	WP	W	P	0	0	0	0	0
15	Batch[5]	S	S	S	b	0	0	0	0	0
16	Batch[5]	B	BD	B	D	0	0	0	0	0

1 A lowercase *b* indicates the field is blank.

2 Interactive workload

3 CA represents Client Access

4 PT represents pass-through (SNA display station pass-through and Telnet jobs that are recorded as pass-through)

5 Non-interactive workload

System Report

Printing the System Report

Print the System Report using the Print System Report (PRTSYSRPT) command, or select option 1 (System report) on the Print Performance Reports - Sample data display.

What Is the System Report?

The System Report is an overview of system operation during the data collection period. Produce and save this report periodically so you have a record of the workload and resource utilization (for example, how your system meets the users' needs and at what cost). Use the reports to see what processing trends are developing, and to project when you might need to make application, system, or operational changes to accommodate changing workloads.

Every System Report includes the Workload, Resource Utilization, and Resource Utilization Expansion sections. However, the Storage Pool Utilization, Disk Utilization, and Communications Summary sections are omitted when certain report categories are selected on the Select Categories for Report display. Table 9 shows the categories that cause these sections to be omitted.

Table 9. Report Categories that Cause System Report Sections to be Omitted

Report Category	Report Section Omitted
Time Interval	None

Table 9. Report Categories that Cause System Report Sections to be Omitted (continued)

Report Category	Report Section Omitted
Job	Storage Pool Utilization Disk Utilization Communications Summary
User ID	Storage Pool Utilization Disk Utilization Communications Summary
Subsystem	Storage Pool Utilization Disk Utilization Communications Summary
Pool	Disk Utilization Communications Summary
Communications line	Storage Pool Utilization Disk Utilization
Control unit	Storage Pool Utilization Disk Utilization
Functional area	Storage Pool Utilization Disk Utilization Communications Summary

For samples of each section of the System Report, see “Sample System Reports” on page 76.

For definitions of specific columns in the reports, see “Performance Report Columns” on page 157.

Workload

Interactive Workload

The first part of the Workload section shows the interactive workload of the system.

See the sample report shown in Figure 15 on page 77.

Noninteractive Workload

The second part of the Workload section shows the noninteractive workload of the system.

See the sample report shown in Figure 16 on page 77.

Resource Utilization

The Resource Utilization section shows the average resource utilization per interactive transaction. Use it to note changes in resource utilization from one measurement period to another and to determine resource utilization trends.

Resource Utilization (First Part)

See the sample report shown in Figure 17 on page 77.

Resource Utilization (Second Part)

See the sample report shown in Figure 18 on page 77.

Resource Utilization Expansion

The Resource Utilization Expansion section gives the average resource use per transaction by job type.

Resource Utilization Expansion (First Part)

See the sample report shown in Figure 20 on page 78.

Resource Utilization Expansion (Second Part)

The second part of the Resource Utilization Expansion section contains CPU and I/O utilization information.

See the sample report shown in Figure 21 on page 78.

Storage Pool Utilization

Use the Storage Pool Utilization section of the System Report to help you set the storage pool size and activity level.

See the sample report shown in Figure 22 on page 79.

Disk Utilization

The Disk Utilization section of the System Report shows the utilization for each disk.

See the sample report shown in Figure 23 on page 80.

Communications Summary

The Communications Summary section of the System Report shows the use of the communications lines and processors.

See the sample report in Figure 24 on page 80.

Note: The line utilization in the system report shown in Figure 24 on page 80 does not correspond with the “Component Report: IOP Utilizations” for an IOP running SDLC remote work stations. A low SDLC line utilization value results in a high IOP utilization value due to polling. However, because the SDLC line transfers a larger percentage of user data, an IOP polls less frequently. Usually this results in an overall increase in IOP utilization. In some cases, though, especially when the SDLC lines have a low utilization, this results in an overall decrease in IOP utilization. Thus, a high IOP utilization value is significant only if at least one of the attached SDLC lines is active.

TCP/IP Summary

The TCP/IP Summary section of the System Report includes summary data at the TCP/IP interface level (line type and line description name). The summary includes information such as packets sent and received. This information is useful when investigating the reason for transmission errors. The values in the unicast and non-unicast columns provide an indication as to where the problem resides. The problem can be related to transmissions sent to specific users (unicast) or in transmissions sent to many users (broadcast or multicast, which are instances of non-unicast transmissions).

See the sample report shown in “TCP/IP Summary–Sample” on page 81.

Report Selection Criteria

The System Report shows you several selection criteria. In addition to the selection criteria that are described in the following sections, the System Report also shows you these criteria:

- Which sections were printed
- Which sections were not printed or were partially printed due to errors
- Which sections were not printed or were partially printed due to missing data.

Report Selection Criteria (Selected Start/End Time/Date)

The Selected Start/End Time/Date Criteria section gives the range of of time the report must generate. If you use no SELECT Start/End Time/Date, the message `No Select Time/Date were chosen` appears.

A sample report is shown in Figure 28 on page 82.

Report Selection Criteria (Date/Time Intervals)

The Selected Date/Time Intervals Criteria section gives the interval number Date and time of the intervals selected to generate the report. If you use no SELECT Date/Time Intervals, the message `All Intervals were chosen` appears.

A sample report is shown in Figure 29 on page 82.

Report Selection Criteria (Select Parameters)

The Report Selection Criteria section gives the selection values you chose to produce the report. If you use no SELECT parameters, the message `No Select parameters were chosen` appears.

A sample report is shown in Figure 26 on page 81.

Report Selection Criteria (Omit Parameters)

If you did not use OMIT parameters, the message `No Omit parameters were chosen` appears.

See the sample report showing the OMIT parameters on the Report Selection Criteria section of the System Report in Figure 27 on page 82.

Sample System Reports

See "Performance Report Columns" on page 157 for an alphabetized list containing definitions for each column in the reports.

Workload Section: Interactive Workload–Sample

```
12/11/00 16:38:36
                                                             Workload                                                  Page 0001
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM           Version/Release  :   5/ 1.0   Stopped  . . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
QPFRADJ . . . : 2          QDYNPTYSCD  . . : 1                  QDYNPTYADJ . . . : 1
Interactive Workload
    Job               Number          Average      Logical DB      -------- Printer ----------       Communications        MRT
    Type            Transactions      Response      I/O Count         Lines          Pages            I/O Count          Max Time
-------------     ----------------    --------  -----------------  -------------  -----------      ---------------      --------
Client Access                    1        .00                   0              0            0                    0
PassThru                       801       2.19               2,011         28,018          508                    0
Total                          802                          2,011         28,018          508                    0
Average                                  2.18
-----------------------------------------------------------------------------------------------------------------------------------
```

Figure 15. Workload Section: Interactive Workload

Workload Section: Noninteractive Workload–Sample

```
Non-Interactive Workload
    Job         Number          Logical DB        --------- Printer ---------      Communications          CPU Per          Logical
    Type        Of Jobs          I/O Count           Lines            Pages          I/O Count           Logical I/O      I/O /Second
----------     ---------      ----------------    -------------    -----------     --------------        -----------      -----------
Batch                383                17,401            4,215            103                  0              .0077               .4
Spool                  3                   102                0              0                  0              .0026               .0
AutoStart              6                     0                0              0                  0              .0000               .0
Total                392                17,503            4,215            103                  0
Average                                                                                                        .0078               .4
Total CPU Utilization . . . . . . . . . . . . . .:    .7
Total CPU Utilization (Interactive Feature) . .:    .1
Total CPU Utilization (Database Capability) . .:    .0
```

Figure 16. Workload Section: Noninteractive Workload

Resource Utilization (First Part)–Sample

```
                                                          System Report                                               12/11/00 16:38:36
                                                       Resource Utilization                                                   Page 0002
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM           Version/Release  :   5/ 1.0   Stopped  . . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
                    -------------------- Average Per Transaction --------------------
                                                 Sync         Async
      Job           Response        CPU          Disk         Disk              DB
     Type           Seconds       Seconds         I/O          I/O              I/O           Faults
--------------      --------     ---------   -------------  -----------      ---------     ---------------
Client Access           .00          1.68         1,356.0        186.0             .0                   0
PassThru               2.19           .04            36.8          4.9            2.5                   0
Average                2.18           .04            38.4          5.1            2.5                   0
-----------------------------------------------------------------------------------------------------------------------------------
```

Figure 17. Resource Utilization

Resource Utilization (Second Part)–Sample

```
                               Tns          Active       -------------------------- Disk I/O Per Second ---------------------------
      Job          CPU        /Hour        Jobs Per       Total     --------- Synchronous --------    -------- Asynchronous --------
     Type          Util        Rate        Interval        I/O       DBR     DBW     NDBR    NDBW      DBR     DBW     NDBR    NDBW
--------------     ----   --------------   --------      -------    -----   -----   -----   -----     -----   -----   -----   -----
Client Access        .0              0          22           .0       .0      .0      .0      .0        .0      .0      .0      .0
PassThru             .0             69           5           .8       .0      .0      .1      .5        .0      .0      .0      .0
Batch                .3              0           8          3.2       .0      .0      .5     1.6        .0      .0      .0      .9
Spool                .0              0           0           .0       .0      .0      .0      .0        .0      .0      .0      .0
AutoStart            .0              0           0           .2       .0      .0      .0      .1        .0      .0      .0      .0
Average              .4             69          36          4.3       .0      .0      .7     2.3        .0      .0      .0     1.0
```

Figure 18. Resource Utilization

Resource Utilization Expansion (Interactive)–Sample

```
                                                          System Report                                            12/11/00 16:38:36
                                                 Resource Utilization Expansion                                          Page 0003
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM           Version/Release  :   5/ 1.0   Stopped  . . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
Interactive Resource Utilization Expansion
                ---------------------------------------------  Average Per Transaction --------------------------------------------
                --------------------- Physical Disk I/O ------------------------  -------- Logical ---------  -- Communications --
     Job        --------- Synchronous ---------  -------- Asynchronous ---------  ----- Data Base I/O ------         I/O
     Type         DBR     DBW     NDBR    NDBW      DBR     DBW     NDBR    NDBW     Read     Write     Other    Get          Put
--------------  ------- ------- ------- -------   ------- ------- ------- -------   -------   -------   -------  -----        -----
Client Access    100.00    4.00  540.00  712.00       .00   23.00    5.00  158.00       .00       .00       .00     .0           .0
PassThru            .13     .43    8.01   28.21       .01     .38     .01    4.48      2.50       .00       .00     .0           .0
Average             .26     .43    8.68   29.06       .01     .41     .02    4.67      2.50       .00       .00     .0           .0
-----------------------------------------------------------------------------------------------------------------------------------
```

Figure 19. Resource Utilization Expansion – Interactive

Resource Utilization Expansion (non-interactive)–Sample

```
Non-Interactive Resource Utilization Expansion
                ------------------------------------------------  Average Per Second ---------------------------------------------
                --------------------- Physical Disk I/O ------------------------  -------- Logical ---------  -- Communications --
     Job        --------- Synchronous ---------  -------- Asynchronous ---------  ----- Data Base I/O ------         I/O
     Type         DBR     DBW     NDBR    NDBW      DBR     DBW     NDBR    NDBW     Read     Write     Other    Get          Put
--------------  ------- ------- ------- -------   ------- ------- ------- -------   -------   -------   -------  -----        -----
Batch               .01     .05     .58    1.62       .00     .05     .01     .93       .17       .24       .00     .0           .0
Spool               .00     .00     .00     .00       .00     .00     .00     .00       .00       .00       .00     .0           .0
AutoStart           .00     .00     .00     .18       .00     .00     .00     .01       .00       .00       .00     .0           .0
Average             .01     .06     .59    1.81       .00     .05     .01     .95       .17       .24       .00     .0           .0
----------------------------------------------------------------------------------------------------------------------------------
```

Figure 20. Resource Utilization Expansion – non-interactive

Resource Utilization Expansion (Second Part)–Sample

```
                   Job          CPU    Cum                        -------- Disk I/O -------    ---- CPU Per I/O -----  --- DIO /Sec ---
Priority           Type         Util   Util     Faults               Sync         Async          Sync        Async     Sync     Async
--------       --------------   ----   ----- --------------     -----------   -----------    ----------  ----------  -------  -------
  000          System             .2     .2               0         296,334        95,377         .0004       .0012      7.1      2.3
  001          Batch              .0     .3               7           1,755         1,848         .0014       .0013       .0       .0
  005          Batch              .0     .3             801          36,603        15,609         .0007       .0018       .8       .3
  009          System             .0     .3              42             114            12         .0000       .0006       .0       .0
  010          Batch              .0     .3               0          10,842         1,058         .0008       .0087       .2       .0
  015          AutoStart          .0     .3               0               7             0         .0217       .0000       .0       .0
  016          System             .0     .3               0               5             0         .0004       .0000       .0       .0
  020          Client Access      .0     .3               0           1,356           186         .0012       .0090       .0       .0
               PassThru           .0     .4             200          28,230         3,835         .0012       .0091       .6       .0
               Batch              .0     .5               0           2,293         1,013         .0086       .0196       .0       .0
               System             .0     .5               0          18,206         2,825         .0000       .0004       .4       .0
```

Figure 21. Resource Utilization Expansion (Second Part)

Storage Pool Utilization–Sample

```
                                                             System Report                                            12/11/00 16:38:36
                                                       Storage Pool Utilization                                               Page 0005
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM           Version/Release  :   5/ 1.0   Stopped  . . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
                                                                ---------- Avg Per Second ---------  ---- Avg Per Minute -----
Pool  Expert      Size      Act   CPU         Number    Average   ------ DB ------   ---- Non-DB ----   Act-     Wait-   Act-
 ID   Cache       (KB)      Lvl   Util          Tns     Response    Fault  Pages      Fault   Pages     Wait     Inel    Inel
----  ------- -----------  -----  -----    -----------  --------   ------- -------   ------- -------  --------  ------- -------
*01    0        134,608      0     .3                0       .00        .0      .0        .4      .7        4        0       0
*02    3      1,790,172     93     .3                0       .00        .0      .1        .4      .6      639        0       0
 03    0         20,968      5     .0                0       .00        .0      .0        .0      .0        0        0       0
*04    3        151,404     40     .0              801      2.19        .0      .0        .0      .2        1        0       0
Total         2,097,152            .7              801                  .0      .1       1.0     1.5      645        0       0
Average                                                     2.18
*  The pool did not exist for all of run, or the size or activity level
   changed during run.
Pool ID                 --  Pool identifier
Expert Cache            --  Method used by the system to tune the storage pool
Size (KB)               --  Size of the pool in kilobytes at the time of the first sample interval
Act Lvl                 --  Activity level at the time of the first sample interval
CPU Util                --  Percentage of available CPU time used.  This is the average of all processors
Number Tns              --  Number of transactions processed by jobs in this pool
Average Response        --  Average transaction response time
DB Fault                --  Average number of data base faults per second
DB Pages                --  Average number of data base pages per second
Non-DB Fault            --  Average number of non-data base faults per second
Non-DB Pages            --  Average number of non-data base pages per second
Act-Wait                --  Average number of active to wait job state transitions per minute
Wait-Inel               --  Average number of wait to ineligible job state transitions per minute
Act-Inel                --  Average number of active to ineligible job state transitions per minute
```

Figure 22. Storage Pool Utilization

Disk Utilization–Sample

```
                                                 System Report                                          12/11/00 16:38:36
                                                Disk Utilization                                              Page 0006
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM           Version/Release  :   5/ 1.0   Stopped  . . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
        Unit               Size   IOP    IOP           Dsk CPU  ASP   --Percent--   Op Per     K Per     - Average Time Per I/O --
 Unit   Name       Type   (M)    Util   Name          Util     ID    Full  Util    Second      I/O       Service   Wait   Response
 ----   ---------- ---- -------  ----   ------------  -------  ---   ----  ----  ---------  ---------   -------  ------  --------
 0001   DD001      6713   7,516    .2   CMB01             2.3   01   60.6   5.0       2.58        9.7    .0193   .0085     .0278
 0002   DD009      6717   6,442    .2   CMB01             2.3   01   66.7    .6        .30        4.5    .0193   .0000     .0193
 0003   DD018      6717   8,589    .2   CMB01             2.3   01   60.7    .6        .33       10.4    .0180   .0150     .0330
 0004   DD017      6717   7,516    .2   CMB01             2.3   01   62.7    .3        .14        4.8    .0200   .0000     .0200
 0005   DD004      6714  13,161    .2   CMB01             2.3   01   60.6   5.1       1.20       21.0    .0422   .0679     .1101
 0006   DD006      6714  13,161    .2   CMB01             2.3   01   60.6   8.9       2.64       14.0    .0336   .0370     .0706
 0007   DD008      6717   6,442    .2   CMB01             2.3   01   63.4    .7        .38        4.7    .0182   .0026     .0208
 0008   DD003      6714  13,161    .2   CMB01             2.3   01   60.6   8.1       2.25       15.3    .0358   .0403     .0761
 0009   DD007      6717   6,442    .2   CMB01             2.3   01   63.4    .2        .14        4.9    .0138   .0000     .0138
 0010   DD005      6714  13,161    .2   CMB01             2.3   01   60.6   8.1       2.27       15.4    .0356   .0382     .0738
 0011   DD013      6717   7,516    .2   CMB01             2.3   01   60.6    .8        .34       17.2    .0229   .0229     .0458
 0012   DD010      6717   7,516    .2   CMB01             2.3   01   62.5    .3        .17        5.7    .0172   .0058     .0230
 0013   DD002      6713   7,516    .2   CMB01             2.3   01   60.7   1.7        .63       21.4    .0268   .0237     .0505
 0014   DD012      6717   7,516    .2   CMB01             2.3   01   63.0    .5        .28        4.3    .0177   .0000     .0177
 0015   DD015      6717   7,516    .2   CMB01             2.3   01   62.6    .3        .14        5.0    .0201   .0000     .0201
 0016   DD014      6717   7,516    .2   CMB01             2.3   01   62.9    .7        .39        6.9    .0177   .0000     .0177
 0017   DD011      6717   8,589    .2   CMB01             2.3   01   60.7    .8        .44       14.4    .0180   .0113     .0293
 0018   DD016      6717   6,442    .2   CMB01             2.3   01   64.9    .5        .26        4.7    .0187   .0000     .0187
Total                   155,718
Average                                                             61.8   2.4        .83       13.2    .0288   .0276     .0564
Unit                    --  Disk arm identifier
Unit Name               --  Disk arm resource name
Type                    --  Type of disk
Size (M)                --  Disk space capacity in millions of bytes
IOP Util                --  Percentage of utilization for each Input/Output Processor
IOP Name                --  Input/Output Processor resource name
Dsk CPU Util            --  Percentage of Disk Processor Utilization
ASP ID                  --  Auxiliary Storage Pool ID
Percent Full            --  Percentage of disk space capacity in use
Percent Util            --  Average disk operation utilization (busy)
Op per Second           --  Average number of disk operations per second
K Per I/O               --  Average number of kilobytes (1024) transferred per disk operation
Average Service Time    --  Average disk service time per I/O operation
Average Wait Time       --  Average disk wait time per I/O operation
Average Response Time   --  Average disk response time per I/O operation
```

Figure 23. Disk Utilization

Communications Summary–Sample

```
                                                 System Report                                          12/11/00 16:38:36
                                             Communications Summary                                           Page 0007
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM           Version/Release  :   5/ 1.0   Stopped  . . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
     IOP Name/                          Line     Avg     Max     Active       Number       Average     ------ Bytes Per Second ----
       Line             Protocol       Speed    Util    Util    Devices    Transactions   Response     Received         Transmitted
--------------------    --------    ---------   ----    ----    -------    ------------   --------    ----------        -----------
CMB01         (284E)
  NTRN935A               TRLAN/H     16000.0     0       0        0                0          .00        2148.8              103.6
IOP Name/Line           --  IOP Resource name and model number, Line ID
Protocol                --  Line protocol (SDLC, ASYNC, BSC, X25, TRLAN, ELAN, IDLC, DDI, FRLY)
                            If /H the protocol is half duplex, if /F it is full duplex
Line Speed              --  Line speed (1000 bits per second)
                            (For IDLC this is the maximum over the measurement)
Avg Util                --  Average line utilization
Max Util                --  Maximum line utilization in all measurement intervals
Active Devices          --  Average number of active devices on the line
Number Transactions     --  Number of transactions
Average Response        --  Average system response (service) time (seconds)
Bytes /Sec Received     --  Average number of bytes received per second
Bytes /Sec Transmitted  --  Average number of bytes transmitted per second
```

Figure 24. Communications Summary

TCP/IP Summary–Sample

```
                                                             System Report                                          121100   16:38:36
                                                            TCP/IP Summary                                                 Page 0008
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM        Main storage . . : 2048.0 MB  Started  . . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
               MTU        KB      ------------- Packets Received --------------     KB      ----------- Packets Sent ------------
Line Type/     Size      Received                                 Number   Pct  Transmitted                                    Pct
  Line Name   (bytes)    /Second        Unicast       Non-Unicast   Error  Error   /Second       Unicast       Non-Unicast   Error
------------ --------- ------------ --------------- --------------- ------- ----- ----------- --------------- --------------- -----
                1,900
  *LOOPBACK                      0           2,197               0       0   .00           0           2,197               0   .00
TOKEN RING      4,100
  NTRN935A                       0          11,076          25,088       0   .00           0          11,528              57   .00
TOKEN RING     16,388
  XINSW2K00                      0             599             627       0   .00           0             728              47   .00
Line Type/Line Name     --  The type and name of the line description used by the interface.
MTU Size (bytes)        --  Maximum Transmission Unit (MTU) size in bytes for interface
KB Received/Second      --  Number of kilobytes (1024 bytes) received on interface per second
Unicast Packets Rcvd    --  Number of unicast packets received
Non-Unicast Packet Rcvd --  Number of non-unicast packets received
Num Packets Received Er --  Number of packets received that contained errors
Pct Packets Received Er --  Percentage of inbound packets that contained errors
KB Transmitted/Second   --  Number of kilobytes (1024 bytes) transmitted out of interface per second
Unicast Packets Sent    --  Number of unicast packets sent
Non-unicast Packet Sent --  Number of non-unicast packets sent
Pct Packets Sent Error  --  Percentage of outbound packets that could not be sent because of errors
```

Figure 25. TCP/IP Summary

System Report Selection Criteria: Select Parameters–Sample

```
2/22/01 11:00:59
                                                       Report Selection Criteria                                           Page 0004
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM        Main storage . . : 2048.0 MB  Started  . . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
Selected Start/End Time/Date:
                     - No Select Time/Date were chosen.
Selected Date/Time Intervals:
                     - All Intervals were chosen.
Select Parameters:
Pools                - 01 02 03 04
Jobs                 -       /          /Q*
User IDs             - QSYS
Subsystems           - QINTER      QBATCH
Communications Lines - ETH1        ETH2        ETH3        ETH4
                       TRLAN1      TRLAN2      TRLAN3      TRLAN4
Control Units        - CTRL1       CTRL2       CTRL3       CTRL4
Omit Parameters:
                     - No Omit parameters were chosen.
Sections Printed:
                     - Workload
                     - Resource Utilization
                     - Resource Utilization Expansion
                     - Storage Pool Utilization
                     - Disk Utilization
                     - Communications Summary
                     - TCP/IP Summary
Sections not printed or partially printed due to Errors:
Sections not printed or partially printed due to Missing data:
```

Figure 26. Report Selection Criteria: Select Parameters

System Report Selection Criteria: Omit Parameters–Sample

```
                                                         System Report                                                 2/22/01 10:49:04
                                                   Report Selection Criteria                                                  Page 0004
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM           Version/Release  :   5/ 1.0   Stopped  . . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
Selected Start/End Time/Date:
                     - No Select Time/Date were chosen.
Selected Date/Time Intervals:
                     - All Intervals were chosen.
Select Parameters:
                     - No Select parameters were chosen.
Omit Parameters:
Pools                - 01 02 03 04
Jobs                 -      /         /Q*
User IDs             - QSYS
Subsystems           - QINTER      QBATCH
Communications Lines - ETH1        ETH2        ETH3        ETH4
                       TRLAN1      TRLAN2      TRLAN3      TRLAN4
Control Units        - CTRL1       CTRL2       CTRL3       CTRL4
Sections Printed:
                     - Workload
                     - Resource Utilization
                     - Resource Utilization Expansion
                     - Storage Pool Utilization
                     - Disk Utilization
                     - Communications Summary
                     - TCP/IP Summary
Sections not printed or partially printed due to Errors:
Sections not printed or partially printed due to Missing data:
```

Figure 27. Report Selection Criteria: Omit Parameters

Report Selection Criteria: Selected Start/End Time/Date–Sample

```
Selected Start/End Time/Date:
                     Start Date/Time: 12/27/95 15:13:42
                     End   Date/Time: 12/27/95 17:38:42
Selected Date/Time Intervals:
```

Figure 28. Report Selection Criteria: Start/End Time/Date

Report Selection Criteria: Date/Time Intervals–Sample

```
Selected Start/End Time/Date:
                       - No Select Time/Date were chosen.
Selected Date/Time Intervals:
                         Interval
                         Number     Date    Time
                           2        12/27   16:13
                           3        12/27   17:13
                           4        12/27   17:38
```

Figure 29. Report Selection Criteria: Date/Time Intervals

Component Report

Printing the Component Report

Use the Print Component Report (PRTCPTRPT) command, or select option 2 (Component report) on the Print Performance Reports - Sample data display.

What Is the Component Report?

This series of reports, like the System Report, is produced from the sample data that you collected. It expands on the detail for each component of system performance shown on the System Report. Data is shown for each sample interval, or in some cases, for each job. Because the report can be lengthy, you may want to use the Select Time Intervals display when requesting this report to select only those measurement intervals of interest to you.

Note: The Component Report does not show information for Client Access devices for the Job Workload Activity, IOP Utilizations, and the Remote Work Stations – Response Time Buckets sections.

For samples of each section of the Component Report, see “Sample Component Reports” on page 86.

For definitions of specific columns in the reports, see “Performance Report Columns” on page 157.

Component Interval Activity

The Component Interval Activity section of the Component Report gives the use of the processing unit, disks, and pools at various time intervals.

See the sample report shown in Figure 30 on page 87.

Job Workload Activity

The Job Workload Activity section of the Component Report gives the total number of transactions, the transactions per hour, the average response time, the number of disk operations, the number of communications operations, the number of PAG faults, the number of arithmetic overflows, and the number of permanent writes for each job.

See the sample report shown in Figure 31 on page 88.

Storage Pool Activity

The Storage Pool Activity section of the Component Report gives detailed information for each storage pool. This information includes the storage pool activity level, as well as the number of transactions processed in each pool.

The Pool Identifier, shown at the top of the Storage Pool Activity section, specifies the storage pool identifier (the value can be from 01 through 16). A separate Storage Pool Activity section exists for each pool that was in use during the measurement period and was selected on the PRTCPTRPT command.

See the sample report shown in Figure 32 on page 89.

Disk Activity

The Disk Activity section of the Component Report gives the average disk activity per hour and the disk capacity for each disk.

See the sample report shown in Figure 33 on page 90.

Input/Output Processor (IOP) Utilizations

The IOP Utilizations section of the Component Report gives the input/output processor (IOP) utilization for communications, direct access storage devices (DASDs), multifunction (DASD, communication, and local work stations).

Consistent utilization, at or above the threshold value of the DASD IOP and multifunction IOP, will affect system performance and cause longer response times or less throughput.

See the utilization guidelines and thresholds in *BEST/1 Capacity Planning Tool* book for a list of threshold values.

See the sample report shown in Figure 34 on page 91.

Note: The total for the I/O processor utilization oftentimes does not match the sum of the three columns (IOP Processor Util Comm, IOP Processor Util LWSC, and IOP Processor Util DASD). This mismatch is caused by the utilization of other small components, such as system time.

Local Work Stations

The Local Work Stations section of the Component Report gives the utilization of each controller, the range of response times for each device, and the average response time for each device. The values for the response times may vary depending on the values you use.

See the sample report shown in Figure 35 on page 91.

Remote Work Stations

The Remote Work Stations section of the Component Report gives the range of response times for each device on the displayed controllers and the average response time for each device. The values for the response times may vary depending on the values you use.

Note: This section appears only if 5494 remote work station data is included in the data collection. Collection Services does not generate data for remote work stations (file QAPMRWS). This section applies only to performance data generated by the STRPFRMON command prior to V5R1 and converted in V5R1 with the Convert Performance Data (CVTPFRDTA) command.

See the sample report shown in Figure 36 on page 92.

Exception Occurrence Summary and Interval Counts

The Exception Occurrence Summary and Interval Counts section of the Component Report gives the number of exceptions that occurred and the frequency of these exceptions.

In some cases these exception counts can be high even under normal system operation.

See the sample report shown in Figure 37 on page 92.

Database Journaling Summary

The Database Journaling section of the Component Report provides information about the journal activity on the system. This information is helpful in understanding the trade-offs between the following:

- The affects of extensive journaling.
- The time required to rebuild access paths during an IPL following an abnormal system end.

For more information on journaling, see the *Backup and Recovery* book.

The Database Journaling section summarizes the journaling activity resulting from user-initiated activities and from system-managed access-path protection (SMAPP) support. This includes the following information:

- The number of start and stop journaling operations performed.
- The number of journal entry deposits made on behalf of objects for which a user started journaling.
- The number of journal entry deposits made on behalf of objects for which the system started journaling.

The report contains the following fields for the number of journal deposits resulting from system-initiated journaling:

- The total number of deposits.
- A subset of the total number of deposits made to journals created by a user.

  The remaining journal entries were deposited to internal system journals. Internal system journals are created and maintained by the system.

As journal entries are deposited to the journals, the system attempts to group these entries into larger bundles to provide more efficient I/O. The number of bundles written to user-created journals can be compared to the number of bundles written to system-created journals. This proportion indicates how efficiently the system performs I/O to the journal receivers.

When SMAPP is active on the system, the following information is also available:

- The number of exposed access paths.
- An estimate of the time in minutes required to rebuild the exposed access paths following an abnormal system end.
- The number of adjustments made by the system to internal journal tuning tables.

  Note: The estimated rebuild time is rounded to the nearest full minute. The estimate is available only on a system-wide basis, not by auxiliary storage pool (ASP), even though access path recovery times may be specified on an ASP basis.

The number of exposed access paths and their estimated rebuild exposure does not include the following:

- Access paths that are being journaled by a user
- Access paths that were created with the *REBLD maintenance option

See the *Backup and Recovery* book for more SMAPP considerations.

The estimated rebuild exposure is calculated two ways:

- Current estimated system exposure
- Estimated exposure if the system was not journaling any of the exposed access paths

These calculated values will be the same if the system access path recovery time is set to *NONE. These values will also be the same if the system access path recovery time is set to a time greater than the current estimated exposure.

See the sample report shown in Figure 38 on page 93.

TCP/IP Activity

The TCP/IP Activity section of the Component Report includes detailed TCP/IP data at both the system-wide level and the interface (line type and line name) level.

See the sample report shown in Figure 39 on page 94.

Report Selection Criteria

The Report Selection Criteria section of the Component Report gives the selection values you chose to produce the report.

If you did not use the SELECT parameters, the message `No Select parameters were chosen` appears. If you did not use OMIT parameters, the message `No Omit parameters were chosen` appears. In addition to these selection criteria, you also see the following:

- Which sections were printed
- Which sections were not printed or were partially printed due to errors
- Which sections were not printed or were partially printed due to missing data.

See the sample report shown in Figure 40 on page 95.

Sample Component Reports

See “Performance Report Columns” on page 157 for an alphabetized list containing definitions for each column in the reports.

Component Interval Activity–Sample

```
                                                        Component Report                                            12/11/00 16:41:22
                                                  Component Interval Activity                                                  Page    1
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0  MB Started . . . . :  12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . :ABSYSTEM            Version/Release  :    5/ 1.0  Stopped . . . . :  12/07/00 23:45:00
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                                                            Int   DB     --- Disk I/O ----      High            Pool          Excp
 Itv      Tns       Rsp      DDM     -CPU Utilization-   Feat  Cpb    --- Per Second --  -Utilization- --- Faults/Sec --     per
 End     /Hour     /Tns      I/O     Total Inter Batch   Util  Util   Sync      Async    Disk      Unit Mch    User    ID   Second
----- ----------- ----- ---------- ----- ----- -----   ----- -----  -------- --------  ----      ---- ---     ----    -- ---------
12:30          44   .18          0    .3    .0    .1      .0    .0        .5       .1     3      0008  0        0    02        3.1
12:45         132   .09          0    .3    .0    .2      .3    .0        .5       .1     1      0006  0        0    04        2.7
13:00          19   .00          0    .3    .0    .1      .0    .0        .5       .1     1      0006  0        0    02         .4
13:15           0   .00          0    .3    .0    .2      .0    .0        .5       .1     1      0006  0        0    02         .2
13:30           0   .00          0    .2    .0    .1      .0    .0        .3       .0     1      0010  0        0    02         .1
13:45          20   .20          0    .3    .0    .1      .0    .0        .5       .1     1      0010  0        0    02         .2
14:00          15 17.50          0   1.1    .0    .1      .0    .0       2.3       .2    12      0006  2        0    04         .1
14:15           0   .00          0    .9    .0    .2      .0    .0        .7       .1    31      0008  0        0    02         .2
14:30           8   .00          0   1.2    .0    .2      .0    .0        .7       .3     6      0006  0        0    02         .2
14:45          48   .08          0   1.9    .0    .6      .1    .1       1.9       .6    22      0006  0        0    02        2.2
15:00         408   .13          0    .7    .0    .4      .5    .1       2.8       .6     8      0010  0        0    02         .7
15:15          71   .16          0    .6    .0    .2      .1    .0       1.0       .2     9      0006  0        0    04         .4
15:30         580   .29          0    .8    .2    .2      .7    .0       4.7       .6    16      0010  1        0    04        2.2
15:45       1,644   .27          0   1.3    .3    .4     1.0    .0       4.3      1.7    13      0006  1        0    04        1.8
16:00          80   .15          0    .9    .0    .1      .2    .0        .8       .3    43      0006  0        0    04         .2
16:15          63   .00          0   1.0    .0    .3      .0    .0        .9       .1    29      0006  0        0    02         .4
16:30           0   .00          0    .7    .0    .4      .0    .0       1.1       .4     5      0006  0        0    02         .8
16:45          40   .00          0    .3    .0    .1      .1    .0        .4       .1     4      0008  0        0    02         .2
17:00           0   .00          0    .3    .0    .1      .0    .0        .3       .1     3      0008  0        0    02         .1
17:15           0   .00          0   4.1    .0   3.5      .0    .3      48.2     22.5    27      0010  4        2    02        2.3
17:30           0   .00          0   1.7    .0   1.3      .0    .0      18.7      9.0    14      0010  1        0    02        1.0
17:45           0   .00          0    .3    .0    .1      .0    .0        .3       .1     3      0008  0        0    02         .1
18:00           0   .00          0    .3    .0    .1      .0    .0        .3       .1     2      0008  0        0    02         .1
18:15           0   .00          0    .4    .0    .2      .0    .0        .6       .1     3      0008  0        0    02         .1
18:30           0   .00          0    .3    .0    .1      .0    .0        .4       .1     2      0008  0        0    02         .2
Itv End                 --  Interval end time (hour and minute)
Tns /Hour               --  Number of interactive transactions per hour
Rsp /Tns                --  Average interactive transaction response time in seconds
DDM I/O                 --  Number of logical DB I/O operations for DDM server jobs
Total CPU Utilization   --  Percentage of available CPU time used by interactive and batch jobs. This is the average
                            of all processors
Inter CPU Utilization   --  Percentage of available CPU time used by interactive jobs.  This is the average of all processors
Batch CPU Utilization   --  Percentage of available CPU time used by batch jobs. This is the average of all processors
Int Feat Util           --  Percentage of interactive feature used by all jobs
DB Cpb Util             --  Percentage of database capability used to perform database processing
Sync Disk I/O Per Sec   --  Average synchronous disk I/O operations per second
Async Disk I/O Per Sec  --  Average asynchronous disk I/O operations per second
High Disk Utilization   --  Percent of utilization of the most utilized disk arm during this interval
High Utilization Unit   --  Disk arm which had the most utilization during this interval
Mch Pool Faults/Sec     --  Average number of machine pool faults per second
User Pool Faults/Sec    --  Average number of user pool page faults per second,
                            for the user pool with highest fault rate during this interval
Pool ID                 --  User pool that had the highest page fault rate
Excp per second         --  Number of program exceptions that occurred per second
```

Figure 30. Component Interval Activity

Job Workload Activity–Sample

```
                                                              Component Report                                                12/11/00 16:41:22
                                                           Job Workload Activity                                                     Page    3
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM        Main storage . . : 2048.0  MB Started . . . . :  12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . :ABSYSTEM             Version/Release  :    5/ 1.0  Stopped . . . . :  12/07/00 23:45:00
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                            T     P        DB
   Job     User Name/ Job   y     t   CPU  Cpb            Tns             -------- Disk I/O ---------  Cmn    PAG  Arith  Perm
   Name    Thread     Number p  Pl y  Util  Util    Tns    /Hour    Rsp    Sync    Async   Logical    I/O   Fault Ovrflw Write
---------- ---------- ------ -- -- -- ----- -----  ------ --------- ------- -------- -------- -------- -------- ----- ------ ------
ADMIN      QTMHHTTP   008647 B  02 25   .02    .0       0         0   .000      117       10        0        0     0      0     17
ADMIN      QTMHHTTP   008649 B  02 25   .08    .0       0         0   .000     1359      426     1836        0     0      0   1247
ADMIN      QTMHHTTP   008650 B  02 25   .03    .0       0         0   .000      153       29      114        0     0      0    163
ADMIN      QTMHHTTP   008651 B  02 25   .01    .0       0         0   .000       39       10       32        0     0      0     45
ADMIN      QTMHHTTP   008716 B  02 25  5.80    .0       0         0   .000       55       10        0        0     0      0     33
CsteTask                     L  01 00   .01    .0       0         0   .000       20        0        0        0     0      0      0
CFINT01                      L  01 00   .13    .0       0         0   .000        0        0        0        0     0      0      0
CLGCLT                       L  01 00   .00    .0       0         0   .000        0        0        0        0     0      0      0
CR-MGR                       L  01 00   .00    .0       0         0   .000       72        0        0        0     0      0     35
CRTPFRDTA  QSYS       008684 B  02 50   .13    .0       0         0   .000       34       10        0        0     0      0     34
CSTCCLUSTE                   L  01 00   .00    .0       0         0   .000        1        0        0        0     0      0      0
DBL3Base00                   L  02 36   .00    .0       0         0   .000        0        0        0        0     0      0      0
DICRG      QSYS       008799 B  02 20  1.73    .0       0         0   .000      115       87        0        0     0      0    126
DIROU001                     L  01 20   .00    .0       0         0   .000       65       41        0        0     0      0     92
EL-ERRLOG                    L  01 00   .00    .0       0         0   .000      622      385        0        0     0      0    705
FPHA-XINSW                   L  01 00   .06    .0       0         0   .000      100        0        0        0     0      0      0
FPHI-XINSW                   L  01 00   .32    .0       0         0   .000       63        0        0        0     0      0      0
GETERRLOG  WLERRLOG   008961 B  02 50   .48   2.5       0         0   .000      344       97      191        0     0      0    294
IODDTIMERT                   L  01 00   .00    .0       0         0   .000        0        0        0        0     0      0      0
IOELADDENT                   L  01 00   .00    .0       0         0   .000       41        0        0        0     0      0      0
IOPI-HRI-P                   L  01 00   .00    .0       0         0   .000       34       37        0        0     0      0     15
IOPTDASDSU                   L  01 00   .00    .0       0         0   .000        0        0        0        0     0      0      0
IOP2689001                   L  01 00   .00    .0       0         0   .000       46        0        0        0     0      0      0
IOP284E000                   L  01 00   .00    .0       0         0   .000       14        0        0        0     0      0      0
IOP2890000                   L  01 00   .00    .0       0         0   .000        2        0        0        0     0      0      0
Job Name                --  Job name
User Name/Thread        --  User name or secondary thread identifier
Job Number              --  Job number
Typ                     --  Job type
Pl                      --  Pool that the job ran in
Pty                     --  Priority of the job
CPU Util                --  Percentage of available CPU time used by the job.  This is the average of all processors
DB Cpb Util             --  Percentage of database capability used by the job to perform database processing
Tns                     --  Total number of transactions for the job
Tns /Hour               --  Transactions per hour
Rsp                     --  Average interactive transaction response time in seconds
Sync Disk I/O           --  Number of synchronous disk operations (reads and writes)
Async Disk I/O          --  Number of asynchronous disk operations (reads and writes)
Logical Disk I/O        --  Number of logical disk operations (Get, Put, Upd, Other)
Cmn I/O                 --  Number of communications operations (Get, Put)
PAG Fault               --  Number of faults involving the Process Access Group
Arith Ovrflw            --  Number of arithmetic overflow exceptions
Perm Write              --  Number of permanent writes
```

Figure 31. Job Workload Activity

Storage Pool Activity–Sample

Component Report 12/11/00 16:41:22
Storage Pool Activity Page 16
Member . . . : PT51MBR15 Model/Serial . : 270/10-45WFM Main storage . . : 2048.0 MB Started . . . . : 12/07/00 12:10:39
Library . . : PTNOELIB System name . . :ABSYSTEM Version/Release : 5/ 1.0 Stopped . . . . : 12/07/00 23:45:00
Partition ID : 00 Feature Code . :22A8-2252-1519
Pool identifier . . . : 01 Expert Cache . . . : 0

	Pool			Avg		Avg Per Second				Avg Per Minute		
						DB		Non-DB				
Itv End	Size (KB)	Act Level	Total Tns	Rsp Time	CPU Util	Faults	Pages	Faults	Pages	Act-Wait	Wait-Inel	Act-Inel
12:30	134,608	0	0	.00	.1	.0	0	.1	0	4	0	0
12:45	138,020	0	0	.00	.1	.0	0	.0	0	4	0	0
13:00	140,348	0	0	.00	.1	.0	0	.1	0	4	0	0
13:15	141,524	0	0	.00	.1	.0	0	.0	0	4	0	0
13:30	142,708	0	0	.00	.1	.0	0	.0	0	3	0	0
13:45	143,400	0	0	.00	.1	.0	0	.0	0	5	0	0
14:00	155,684	0	0	.00	.9	.0	0	2.6	3	5	0	0
14:15	148,996	0	0	.00	.6	.0	0	.6	0	4	0	0
14:30	147,956	0	0	.00	.9	.0	0	.5	1	5	0	0
14:45	139,936	0	0	.00	1.2	.0	0	.4	0	6	0	0
15:00	145,908	0	0	.00	.2	.0	0	.5	0	5	0	0
15:15	139,640	0	0	.00	.3	.0	0	.1	0	5	0	0
15:30	145,592	0	0	.00	.3	.0	0	1.9	2	9	0	0
15:45	141,680	0	0	.00	.4	.0	0	1.3	2	12	0	0
16:00	149,496	0	0	.00	.6	.0	0	.1	0	4	0	0
16:15	147,216	0	0	.00	.6	.0	0	.1	0	5	0	0
16:30	146,700	0	0	.00	.2	.0	0	.1	0	7	0	0
16:45	147,412	0	0	.00	.2	.0	0	.1	0	4	0	0
17:00	145,676	0	0	.00	.1	.0	0	.0	0	4	0	0
17:15	141,768	0	0	.00	.5	.0	0	4.3	4	4	0	0
17:30	148,332	0	0	.00	.3	.0	0	1.1	1	4	0	0
17:45	147,812	0	0	.00	.1	.0	0	.0	0	3	0	0
18:00	146,068	0	0	.00	.1	.0	0	.0	0	4	0	0
18:15	147,292	0	0	.00	.1	.0	0	.1	0	4	0	0
18:30	148,528	0	0	.00	.1	.0	0	.0	0	4	0	0

Itv End -- Interval end time (hour and minute)
Pool Size (KB) -- Initial pool size in kilobytes (1024)
Act Level -- Initial pool activity level
Total Tns -- Number of transactions processed in this pool
Avg Resp Time -- Average transaction response time
CPU Util -- Percentage of available CPU time used by the job. This is the average of all processors
DB Faults -- Database faults per second
DB Pages -- Database pages per second
Non-DB Faults -- Nondatabase faults per second
Non-DB Pages -- Nondatabase pages per second
Act-Wait -- Number of active-to-wait transitions per minute
Wait-Inel -- Number of wait-to-ineligible transitions per minute
Act-Inel -- Number of active-to-ineligible transitions per minute

Figure 32. Storage Pool Activity

Disk Activity–Sample

```
                                                    Component Report                                       12/11/00 16:41:22
                                                      Disk Activity                                                Page  24
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0  MB Started . . . . :  12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . :ABSYSTEM            Version/Release  :    5/ 1.0  Stopped . . . . :  12/07/00 23:45:00
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                    ------------- Average Disk Activity Per Hour -------------  ------ Cache hit Statistics -------
              Srv   ----------------- Disk Arm Seek Distance -----------------  Device Controller Write  EACS  EACS  -Disk Capacity-
 Unit   Util  Time          0      1/12       1/6       1/3       2/3      >2/3   Read      Read   Effic  Read  Resp    MB    Percent
 ----   ---- ----- --------- --------- --------- --------- --------- ---------  ------ ---------- ----- ----- -----  ------- -------
 0001    5.0 .0194     9,107     3,316       433       309       722       172   38.9         .0  44.3    .0    .0    2,954   39.3
 0002     .6 .0194     1,935       596       120       103       729       188   48.7         .0  25.9    .0    .0    2,140   33.2
 0003     .6 .0181     1,209       378        40       101        60         0   41.1         .0  45.6    .0    .0    3,370   39.2
 0004     .3 .0200     2,112       417       115        45        63       198   30.6         .0    .0    .0    .0    2,797   37.2
 0005    5.1 .0424    12,475     3,371       459       219     3,216       897   12.9         .0  12.8    .0    .0    5,176   39.3
 0006    8.8 .0334    15,276     4,187       483       570     4,896       379   19.8         .0  13.1    .0    .0    5,182   39.3
 0007     .7 .0182     2,747       705       141       128       937       169   40.0         .0  20.7    .0    .0    2,351   36.4
 0008    8.1 .0360    15,667     4,056       446       433     4,976       510   17.3         .0   1.3    .0    .0    5,182   39.3
 0009     .2 .0139     1,862       494       105       119       328        60   45.3         .0    .0    .0    .0    2,351   36.4
 0010    8.0 .0353    15,320     4,033       470       487     4,469       646   18.7         .0   2.2    .0    .0    5,183   39.3
 0011     .8 .0229     3,114       713       118        26       212       351   34.6         .0  26.9    .0    .0    2,957   39.3
 0012     .3 .0173     2,381       728       100        25       196       355   35.5         .0    .0    .0    .0    2,814   37.4
 0013    1.7 .0269     4,834       916        52        95       380       283   12.3         .0  14.9    .0    .0    2,950   39.2
 0014     .5 .0178     2,689       600       128        78        99       692   34.2         .0  12.0    .0    .0    2,774   36.9
 0015     .3 .0202     6,096       785       158        22       187       324   35.8         .0    .0    .0    .0    2,810   37.3
 0016     .7 .0177     3,206       666        91        81        88       651   28.7         .0  23.0    .0    .0    2,785   37.0
 0017     .8 .0181     1,582       527        39       243        50        31   30.5         .0  46.5    .0    .0    3,375   39.2
 0018     .5 .0187     1,898       522       117        92       433       191   39.3         .0  19.9    .0    .0    2,258   35.0
           Column                         Total                 Average
        ---------------------------  ----------------    ----------------
        Util                                                         2.4
        Srv Time                                                   .0289
        Disk Arm Seek Distance
           0                                   103,519
           1/12                                 27,018
           1/6                                   3,624
           1/3                                   3,185
           2/3                                  22,049
           >2/3                                  6,104
        Cache hit Statistics
            Device Read                                             25.4
            Controller Read                                           .0
            Write Efficiency                                        37.9
            EACS Read                                                 .0
            EACS Resp                                                 .0
        Disk Capacity
            MB                                  59,409
            Percent                               38.1
Unit                    --  Disk arm identifier
Util                    --  Drive utilization
Srv Time                --  Average service time per request in seconds
Disk Arm Seek Distance  --  Average seek distance distributions per hour
    0                   --  Number of zero seeks
    1/12                --  Number of seeks between 0 and 1/12 of the disk
    1/6                 --  Number of seeks between 1/12 and 1/6 of the disk
    1/3                 --  Number of seeks between 1/6 and 1/3 of the disk
    2/3                 --  Number of seeks between 1/3 and 2/3 of the disk
    >2/3                --  Number of seeks greaterABSYSTEM3 of the disk
Cache hit Statistics    --
    Device Read         --  Percent of device read hits for each arm
    Controller Read     --  Percent of controller cache read hits for each arm
    Write Efficiency    --  Percent of efficiency of write cache
    EACS Read           --  Extended Adaptive Cache Simulator percent read hits
    EACS Resp           --  Extended Adaptive Cache Simulator estimated percent response time improvement
Disk Capacity           --  Average amount of disk space used or available
    MB                  --  Millions of bytes available on the disk
    Percent             --  Percent of space available on the disk
```

Figure 33. Disk Activity

IOP Utilizations–Sample

```
                                                    Component Report                                       12/11/00 16:41:22
                                                    IOP Utilizations                                           Page   26
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0  MB Started . . . . :  12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . :ABSYSTEM            Version/Release  :    5/ 1.0  Stopped . . . . :  12/07/00 23:45:00
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                        --- IOP Processor Util ---     DASD      -- KBytes Transmitted --    Available
IOP                     Total   Comm   LWSC   DASD    Ops/Sec       IOP          System      Storage     Util 2
--------------------    -----  -----  -----  -----  -----------  -----------  -----------  -----------   ------
CC02          (2890)       .9     .0     .0     .0                        46            0   65,086,832      .0
CC04          (2689)       .4     .0     .0     .0                 2,472,942      821,643   30,729,361      .0
CMB01         (284E)       .5     .1     .0     .1                    54,429        2,720   24,412,094      .0
IOP                          --  Resource name and model number for each communications, DASD,
                                 multifunction, and local work station IOP
IOP Processor Util Total     --  Total utilization for IOP
IOP Processor Util Comm      --  Utilization of IOP due to communications activity
IOP Processor Util LWSC      --  Utilization of IOP due to local work station activity
IOP Processor Util DASD      --  Utilization of IOP due to DASD activity
DASD Ops/Sec                 --  Disk operations per second
KBytes Transmitted IOP       --  Total Kbytes transmitted from an IOP to the system across the bus
KBytes Transmitted System    --  Total Kbytes transmitted to the IOP from the system across the bus
Available Storage            --  The average number of bytes of free local storage in the IOP
Util 2                       --  Utilization of co-processor
```

Figure 34. IOP Utilizations

Local Work Stations–Response Time Buckets–Sample

```
                                                    Component Report                                       12/11/00 16:41:22
                                      Local Work Stations - Response Time Buckets                              Page   27
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0  MB Started . . . . :  12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . :ABSYSTEM            Version/Release  :    5/ 1.0  Stopped . . . . :  12/07/00 23:45:00
Partition ID  : 00         Feature Code  . :22A8-2252-1519
   Ctl/Device      Util     IOP Name
---------------    ----     ------------
                     .0
                                       0- 1.0      1.0- 2.0     2.0- 4.0     4.0- 8.0     > 8.0     Rsp Time
                                       ------     ---------    ---------    ---------    ------     --------
Total Responses                             0             0            0            0         0          .00
Ctl                     --  Controller identifier
Device                  --  Device identifier
Util                    --  Controller utilization
IOP Name                --  Input/Output processor resource name
0- 1.0                  --  Number of response times in this range
 1.0- 2.0               --  Number of response times in this range
 2.0- 4.0               --  Number of response times in this range
 4.0- 8.0               --  Number of response times in this range
> 8.0                   --  Number of response times in this range
Rsp time                --  Average external response time (in seconds)
                            for this workstation(s)
```

Figure 35. Local Work Stations – Response Time Buckets

Remote Work Stations–Response Time Buckets–Sample

```
                                                 Component Report                                       9/24/98  7:38:05
                                    Remote Work Stations - Response Time Buckets                               Page   18
                                                Sample Component Report
Member  . . . : TEST20     Model/Serial  . : 500-2142/10-317CD   Main storage . . :  128.0  M  Started . . . . :  09/19/98 16:47:34
  Library . . : RWSDATA    System name . . :         ABSYSTEM   Version/Release  :    4/ 2.0  Stopped . . . . :  09/19/98 17:12:36
   Ctl/Device               IOP Name
---------------            ------------
ABSYSTEM                    CC02
                                          0- 1.0     1.0- 2.0    2.0- 4.0     4.0- 8.0     > 8.0     Rsp Time
                                          ------     ---------   ---------    ---------    ------    --------
     RCH5DSP07                              845            0           0            0         0         .02
Total Responses                             845            0           0            0         0         .02
Ctl                     --  Controller identifier
Device                  --  Device identifier
IOP Name                --  Input/Output processor resource name
0- 1.0                  --  Number of response times in this range
 1.0- 2.0               --  Number of response times in this range
 2.0- 4.0               --  Number of response times in this range
 4.0- 8.0               --  Number of response times in this range
> 8.0                   --  Number of response times in this range
Rsp time                --  Average external response time (in seconds)
                            for this workstation(s)
```

Figure 36. Remote Work Stations – Response Time Buckets

Exception Occurrence Summary and Interval Counts–Sample

```
                                                 Component Report                                      12/11/00 16:41:22
                                 Exception Occurrence Summary and Interval Counts                              Page   28
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM        Main storage . . : 2048.0  MB Started . . . . :  12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . :ABSYSTEM             Version/Release  :    5/ 1.0  Stopped . . . . :  12/07/00 23:45:00
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                            Exception Counts
             Exception
               Type                   Description                    Total
         ----------------    -----------------------------------    -----------
         Size                Size                                            16
         Binary Overflow     Binary overflow                                 16
         Decimal Overflow    Decimal overflow                                 0
         Flp Overflow        Floating point overflow                          0
         Decimal Data        Decimal data                                     0
         Aut Lookup          Authority lookup                            21,380
         PAG Fault           Process Access Group fault                       0
         Seize Conflict      Seize conflict                               2,535
         Lock Conflict       Lock conflict                                  829
         Verify              Verify                                       1,389
         Teraspace EAO       Teraspace Effective Address Overflow             0
          ------------------------------------------ Exceptions Per Second ------------------------------------------
 Itv               Binary   Decimal     Flp     Decimal      Aut       PAG      Seize      Lock                Teraspace
 End       Size   Overflow  Overflow  Overflow    Data      Lookup     Fault   Conflict   Conflict     Verify      EAO
-----    -------  --------  --------  --------  --------   --------  --------  --------   --------   --------  ---------
12:30        .0        .0        .0        .0        .0        3.1        .0        .0         .0         .0         .0
12:45        .0        .0        .0        .0        .0        2.5        .0        .0         .0         .2         .0
13:00        .0        .0        .0        .0        .0         .3        .0        .0         .0         .0         .0
13:15        .0        .0        .0        .0        .0         .2        .0        .0         .0         .0         .0
13:30        .0        .0        .0        .0        .0         .1        .0        .0         .0         .0         .0
13:45        .0        .0        .0        .0        .0         .2        .0        .0         .0         .0         .0
14:00        .0        .0        .0        .0        .0         .1        .0        .0         .0         .0         .0
14:15        .0        .0        .0        .0        .0         .2        .0        .0         .0         .0         .0
14:30        .0        .0        .0        .0        .0         .1        .0        .0         .0         .0         .0
14:45        .0        .0        .0        .0        .0        2.0        .0        .1         .0         .0         .0
15:00        .0        .0        .0        .0        .0         .6        .0        .0         .0         .0         .0
15:15        .0        .0        .0        .0        .0         .3        .0        .0         .0         .0         .0
15:30        .0        .0        .0        .0        .0        2.1        .0        .0         .0         .0         .0
15:45        .0        .0        .0        .0        .0        1.7        .0        .0         .0         .0         .0
16:00        .0        .0        .0        .0        .0         .1        .0        .0         .0         .0         .0
16:15        .0        .0        .0        .0        .0         .4        .0        .0         .0         .0         .0
16:30        .0        .0        .0        .0        .0         .7        .0        .0         .0         .0         .0
16:45        .0        .0        .0        .0        .0         .1        .0        .0         .0         .0         .0
17:00        .0        .0        .0        .0        .0         .1        .0        .0         .0         .0         .0
17:15        .0        .0        .0        .0        .0         .2        .0       1.4         .6         .0         .0
17:30        .0        .0        .0        .0        .0         .1        .0        .6         .2         .0         .0
17:45        .0        .0        .0        .0        .0         .1        .0        .0         .0         .0         .0
18:00        .0        .0        .0        .0        .0         .1        .0        .0         .0         .0         .0
18:15        .0        .0        .0        .0        .0         .1        .0        .0         .0         .0         .0
18:30        .0        .0        .0        .0        .0         .2        .0        .0         .0         .0         .0
```

Figure 37. Exception Occurrence Summary and Interval Counts

Database Journaling Summary–Sample

```
                                                     Component Report                                            12/11/00 16:41:22
                                               Database Journaling Summary                                                Page  30
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0  MB Started . . . . :  12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . :ABSYSTEM            Version/Release  :    5/ 1.0  Stopped . . . . :  12/07/00 23:45:00
Partition ID  : 00         Feature Code  . :22A8-2252-1519
       ------- Journal Operations ------   --- Journal Deposits ---   Bundle    Bundle   --Exposed AP --   --Est Exposr --
 Itv   User     User     System   System   User     System   System   Writes    Writes   System   Not      Curr     AP Not   SMAPP
 End   Starts   Stops    Starts   Stops    Total    Total    ToUser   User      System   Jrnld    Jrnld    System   Jrnld    ReTune
-----  ------   ------   ------   ------  -------- -------  -------  -------  --------  ------   ------   ------   ------   ------
12:30       0        0        0        0      100       0        0        6         1        0       17       13       13        0
12:45       0        0        0        0      993       0        0        9         0        0       17       13       13        0
13:00       0        0        0        0      155       0        0        4         0        0       17       13       13        0
13:15       0        0        0        0      112       0        0        5         0        0       17       13       13        0
13:30       0        0        0        0       74       0        0        5         0        0       17       13       13        0
13:45       0        0        0        0      128       0        0        5         0        0       17       13       13        0
14:00       0        0        0        0      158      35        0        6        22        0       17       13       13        0
14:15       0        0        0        0      129      18        0        4         6        0       17       13       13        0
14:30       0        0        0        0      160      47        0        6        28        0       17       13       13        0
14:45       0        0        0        0      833      50        0       10        28        0       17       13       13        0
15:00       0        0        0        0      586      36        0      315        14        0       17       13       13        0
15:15       0        0        0        0      224      30        0        7         8        0       17       13       13        0
15:30       0        0        0        0      425      29        0       24        10        0       17       13       13        0
15:45       0        0        0        0      907      41        0       28        12        0       17       13       13        0
16:00       0        0        0        0      123      16        0        6         6        0       17       13       13        0
16:15       0        0        0        0      216      20        0        7         6        0       17       13       13        0
16:30       0        0        0        0      388      19        0       29         6        0       17       13       13        0
16:45       0        0        0        0      109      20        0        4         6        0       17       13       13        0
17:00       0        0        0        0       96      16        0        4         6        0       17       13       13        0
Itv End                 --  Interval end time (hour and minute)
User Starts             --  Start journal operations initiated by user
User Stops              --  Stop journal operations initiated by user
System Starts           --  Start journal operations initiated by system
System Stops            --  Stop journal operations initiated by system
User Total              --  Journal deposits resulting from user journaled
                              objects
System Total            --  Journal deposits resulting from system journaled
                              objects (total)
System ToUser           --  Journal deposits resulting from system journaled
                              objects to user created journals
Bundle Writes User      --  Bundle writes to user created journals
Bundle Writes System    --  Bundle writes to internal system journals
Exposed AP System Jrnld --  Exposed access paths currently being journaled
                              by the system
Exposed AP Not Jrnld    --  Exposed access paths currently not being journaled
Est Exposr Curr System  --  System estimated access path recovery time
                              exposure in minutes
Est Exposr AP Not Jrnld --  System estimated access path recovery time
                              exposure in minutes if no access
                              paths were being journaled by the system
SMAPP ReTune            --  System Managed Access Path Protection tuning
                              adjustments
```

Figure 38. Database Journaling Summary

TCP/IP Activity–Sample

```
                                                       Component Report                                                   12/11/00 16:41:22
                                                       TCP/IP Activity                                                           Page   32
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM        Main storage . . : 2048.0 MB  Started . . . . :  12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . :ABSYSTEM             Version/Release  :    5/ 1.0  Stopped . . . . :  12/07/00 23:45:00
Partition ID  : 00         Feature Code  . :22A8-2252-1519
System TCP/IP
      ----- Datagrams -----  Datagrams Requested  --- TCP Segments ---- ------- UDP Datagrams ------- ------- ICMP Messages ------
 Itv                   Pct  - for Transmission -- - per Second --  Pct                              Pct                             Pct
 End     Received     Error      Total       Dscrd  Rcvd     Sent   Rtrns  Received      Sent      Error  Received     Sent      Error
----- --------------- ----- --------------- ----- ------- ------- ----- ----------- ----------- ----- ---------- ----------- -----
12:30             779   .00             129   .00       0       0  2.73          16          16   .00         32          32   .00
12:45           1,451   .00           1,100   .00       0       1   .95           4           4   .00         32          32   .00
13:00             861   .00             196   .00       0       0  5.47           4           4   .00         39          32   .00
13:15             759   .00             120   .00       0       0   .00           8           8   .00         32          32   .00
13:30             719   .00              86   .00       0       0   .00           4           4   .00         29          29   .00
13:45           1,202   .00             176   .00       0       0  3.92           8           8   .00         34          37  5.63
14:00             940   .00             190   .00       0       0  1.80         551          41   .00         25          25   .00
14:15             830   .00             145   .00       0       0   .00         683          16   .00         31          31   .00
14:30             970   .00             179   .00       0       0  9.64         823          13   .00         33          34   .00
14:45           1,588   .00             946   .00       0       0  9.33         928          18   .00         79          32   .00
15:00           1,126   .00             635   .00       0       0 14.02         613          29   .00         40          32   .00
15:15           1,000   .00             284   .00       0       0  1.80         724          23   .00         30          28   .00
15:30           1,780   .00             960   .00       1       0  3.30         717          19   .00         44          46  3.33
15:45           2,947   .00           4,832   .00       1       1  4.00       3,856       3,706   .00         59          34  5.37
16:00             807   .00             175   .00       0       0  1.72         634          20   .00         29          29   .00
16:15           1,069   .00             428   .00       0       0  2.46         673          20   .00         34          28   .00
16:30           1,032   .00             367   .00       0       0   .31         730          12   .00         33          33   .00
16:45             673   .00             163   .00       0       0  1.80         511          12   .00         31          31   .00
17:00             586   .00             121   .00       0       0   .00         472          16   .00         29          29   .00
17:15             678   .00             202   .00       0       0   .00         495          28   .00         27          27   .00
17:30             647   .00             109   .00       0       0   .00         549          20   .00         23          23   .00
17:45             587   .00             106   .00       0       0   .00         484          14   .00         25          25   .00
18:00             574   .00             111   .00       0       0   .00         469          15   .00         22          22   .00
18:15             575   .00             109   .00       0       0  1.56         470          15   .00         21          21   .00
18:30             594   .00             113   .00       0       0   .00         474          11   .00         21          21   .00
Itv End                 --  Interval end time (hour and minute)
Datagrams Received      --  Total number of datagrams received
Pct Datagrams Error     --  Percentage of inbound datagrams with errors
Dtgm Req for Transm Tot --  Total number of datagrams requested for transmission
Dtgm Req Transm Dscrd   --  Percentage of datagrams discarded because of errors
Segments Rcvd per Sec   --  Number of TCP segments received per second
Segments Sent per Sec   --  Number of TCP segments sent per second
Segments Pct Retrans    --  Percentage of TCP segments retransmitted relative to segments sent
UDP Datagrams Received  --  Total number of datagrams delivered to UDP users
UDP Datagrams Sent      --  Total number of UDP datagrams sent
Pct UDP Datagrams Error --  Percentage of UDP datagrams (inbound and outbound) with errors
ICMP Messages Received  --  Total number of ICMP messages received
ICMP Messages Sent      --  Total number of ICMP messages sent
Pct ICMP Messages Error --  Percentage of ICMP messages (inbound and outbound) with errors
```

Figure 39. TCP/IP activity

Component Report Selection Criteria: Select Parameters–Sample

```
                                                       Component Report                                                         2/22/01 10:43:05
                                                  Report Selection Criteria                                                             Page   16
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0  MB Started . . . . :  12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . :ABSYSTEM            Version/Release  :    5/ 1.0  Stopped . . . . :  12/07/00 23:45:00
Partition ID  : 00         Feature Code  . :22A8-2252-1519
Select Parameters
                            - No Select parameters were chosen.
Omit Parameters
Pools                       - 01 02 03 04
Jobs                        -      /          /Q*
User IDs                    - QSYS
Subsystems                  - QINTER      QBATCH
Communications Lines        - ETH1        ETH2        ETH3        ETH4        TRLAN1      TRLAN2
                              TRLAN3      TRLAN4
Control Units               - CTRL1       CTRL2       CTRL3       CTRL4
Sections Printed:
                            - Component Interval Activity
                            - Job Workload Activity
                            - IOP Utilizations
                            - Local Work Stations - Response Time Buckets
                            - Exception Occurrence Summary and Interval Counts
                            - Database Journaling Summary
                            - TCP/IP Activity
Sections not printed or partially printed due to Errors:
Sections not printed or partially printed due to Missing data:
```

Figure 40. Report Selection Criteria

Component Report Selection Criteria: Omit Parameters–Sample

```
                                                       Component Report                                                         2/22/01 10:43:05
                                                  Report Selection Criteria                                                             Page   16
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0  MB Started . . . . :  12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . :ABSYSTEM            Version/Release  :    5/ 1.0  Stopped . . . . :  12/07/00 23:45:00
Partition ID  : 00         Feature Code  . :22A8-2252-1519
Select Parameters
                            - No Select parameters were chosen.
Omit Parameters
Pools                       - 01 02 03 04
Jobs                        -      /          /Q*
User IDs                    - QSYS
Subsystems                  - QINTER      QBATCH
Communications Lines        - ETH1        ETH2        ETH3        ETH4        TRLAN1      TRLAN2
                              TRLAN3      TRLAN4
Control Units               - CTRL1       CTRL2       CTRL3       CTRL4
Sections Printed:
                            - Component Interval Activity
                            - Job Workload Activity
                            - IOP Utilizations
                            - Local Work Stations - Response Time Buckets
                            - Exception Occurrence Summary and Interval Counts
                            - Database Journaling Summary
                            - TCP/IP Activity
Sections not printed or partially printed due to Errors:
Sections not printed or partially printed due to Missing data:
```

Figure 41. Report Selection Criteria

Transaction Report

Printing the Transaction Report

Use the PRTTNSRPT command, or select option 1 (Transaction report) on the Print Performance Reports - Trace data display. When you use the PRTTNSRPT command, you can choose to print three types of reports using the report type (RPTTYPE) parameter

- Job Summary Report (*SUMMARY)
- Transaction Report (*TNSACT)

- Transition Report (*TRSIT)

The Transaction and Transition Reports provide detailed information. So, when you print these reports, use the selection values available on the PRTTNSRPT command to select specific jobs, users, or time intervals. That way you can limit the output to relevant information only.

The PRTTNSRPT command requires you to collect trace data with the Start Performance Trace (STRPFRTRC) command.

Notes:

1. In some instances, when a value is too large to fit in the allotted space, a 9 is printed in each numeric field in the report. To see the actual value, you should specify RPTTYPE(*FILE) on the PRTTNSRPT command.
2. The PRTTNSRPT command takes some CPU model values from the BEST/1 hardware table to do some calculations.

PRTTNSRPT Printer Files

The PRTTNSRPT command uses the following printer files:

File **Description**

QPSPDJS
Job summary report output

QPSPDTS
Transaction report output

QPSPDTD
Transition report output

What Is the Transaction Report?

The following are the types of transaction reports:

- **Job Summary Report** provides general job information. Always request this report first.
- **Transaction Report** provides detailed information about each transaction that occurred in the job:
  - Transaction response time
  - Name of the program that is active at the time the transaction starts
  - Processing unit time use
  - Number of I/O requests
- **Transition Report** provides information similar to that of the Transaction Report, but the data (for example, processing unit time, I/O requests) is shown for each job state transition, rather than just the transitions shown when the job is waiting for work station input. The detail shown in this report helps you to determine the program that ran during a transition, or to determine when an unsatisfied lock request occurred.

For samples of each section of the Transaction Report, see "Sample Transaction Reports" on page 107.

For definitions of specific columns in the reports, see "Performance Report Columns" on page 157.

Job Summary Report

The Job Summary Report (RPTTYPE(*SUMMARY)) provides the following sections:

- Job Summary
- System Summary Data
- Distribution of Transactions by CPU/Transaction
- Transaction Significance
- Interactive Transactions by 5-Minute Intervals
- Interactive Throughput by 5-Minute Intervals
- Interactive CPU Utilization by 5-Minute Intervals
- Interactive Response Time by 5-Minute Intervals
- Scatter Diagram of Interactive Transactions by 5-Minute Intervals
- Interactive Program Transaction Statistics
- Summary of Seize/Lock Conflicts by Object
- Report Selection Criteria

Job Summary Section

The Job Summary section of the Job Summary Report shows the following information for each job in the system:

- The name and type of job (for example, interactive, batch)
- The number of transactions in the job
- The average transaction response time
- The average processing unit time per transaction
- The average number of disk I/O requests per transaction
- The number of lock waits
- The number of seize conflicts
- The key/think time per transaction

If the Job Summary section shows jobs that have high response times, high disk I/O activity, high processing unit utilization, or a number of lock requests, use the Transaction Report to investigate further.

If the number of seizes or number of conflicts (**Number Sze Cft** or **Number Lck Cft** columns on this report) is “high”, look at the Transaction or Transition reports for the job to see how long the conflict lasted, the job that held the object, the name and type of object being held, and what the job was waiting for.

The exact meaning of the term “high” is dependent on the application. One example is the number of **lock-waits**. An application that has many users accessing a database at the same time could, under normal conditions, have numerous lock-waits.

You must evaluate each situation individually. If the values are difficult to explain (an application should have very few locks and yet many are reported), then further analysis will be required. The Transaction and Transition Reports can help in this analysis.

System Summary Data Section (First Part)

The first part of the System Summary Data section of the Job Summary Report includes the following:

- Trace Periods for Trace Date

- CPU by Priority for All Jobs for Total Trace Period

See the sample report shown in Figure 43 on page 109.

System Summary Data (Second Part)

The second part of the System Summary Data section of the Job Summary Report includes the following:

- CPU and Disk I/O per Job Type for All Jobs for Total Trace Period
- Interactive Transaction Averages by Job Type

See the sample report shown in Figure 44 on page 109.

System Summary Data (Third Part)

The Analysis by Interactive Transaction Categories part of the System Summary Data section provides a breakdown of the transactions into the categories very simple, simple, medium, and complex, relative to their processing unit utilization.

The boundary values that are used to categorize the transactions by processing unit model were updated to more accurately reflect a typical customer workload. The boundary values have almost doubled. For the typical customer workload, this update causes the number of transactions categorized as simple and medium to increase, and those categorized as complex and very complex to decrease. This does not change the data itself or how it is collected. The update only changes how individual transactions are categorized by the Transaction Report.

Note: The Total/Avg is only a total or average of the simple, medium, and complex categories. The very simple category is a part of the simple category. The very complex category is a part of the complex category.

These transaction categories depend on the processing unit model. They are introduced here and in some of the following reports as a way to highlight the differences that exist in the work being done on the system.

When you are considering adding new applications, determine the new application's transaction characteristics. For example, determine if a high volume of complex transactions is typical with this new application. By analyzing the transaction characteristics of new applications, you may be able to foresee the need to acquire additional hardware resources for the new application.

If you obtain a new application from a supplier, it is reasonable to ask for information about the application's transaction characteristics.

The Analysis by Interactive Response Time part of the System Summary Data section provides transaction information sorted by response time categories.

The Analysis by Interactive Key/Think Time part of the System Summary Data section provides information about the key/think time.

See the sample report shown in Figure 45 on page 110.

Distribution by CPU/Transaction Section

The Distribution of Transactions by CPU/Transaction section of the Job Summary Report provides a graphical view of the distribution of simple, medium, and complex transactions. This chart shows the number of transactions versus the processing unit time per transaction in seconds.

See the sample report shown in Figure 46 on page 111.

Transaction Significance Section

The Transaction Significance section of the Job Summary Report provides a graphical view of the processing unit use, categorized by simple, medium, and complex transactions. This chart shows the percent of available processing unit time used versus the processing unit time per transaction in seconds.

See the sample report shown in Figure 47 on page 112.

Transactions by Intervals Section

The Interactive Transactions by 5-Minute Intervals section of the Job Summary Report provides a count of the number of active jobs during a 5-minute interval that performed at least one transaction. It also shows the number of jobs that were signed on and off during the 5-minute intervals. Transaction rates per 5-minute intervals are shown in several different formats.

See the sample report shown in Figure 48 on page 112.

Interactive Throughput Section

The Interactive Throughput by 5-Minute Intervals section of the Job Summary Report gives simple, medium, and complex transactions relative to the number of transactions according to an interval end time.

See the sample report shown in Figure 49 on page 113.

Interactive CPU Utilization Section

The Interactive CPU Utilization by 5-Minute Intervals section of the Job Summary Report gives simple, medium, and complex transactions relative to their processing unit utilization.

See the sample report shown in Figure 50 on page 113.

Interactive Response Time Section

The Interactive Response Time by 5-Minute Intervals section of the Job Summary Report gives the response components relative to the resulting response time.

See the sample report shown in Figure 51 on page 113.

Scatter Diagram Section

The Scatter Diagram section of the Job Summary Report gives the average of measured response times for 5-minute intervals compared to transaction rates.

See the sample report shown in Figure 52 on page 114.

Interactive Program Transaction Statistics Section

The Interactive Program Transaction Statistics section of the Job Summary Report arranges the programs by the number of transactions associated with the programs.

See the sample report shown in Figure 53 on page 115.

Seize/Lock Conflicts by Object Section

The Summary of Seize/Lock Conflicts by Object section of the Job Summary Report gives information about the locks and seizes associated with objects. The unnamed object, shown as ADDR 00000E00, is the Licensed Internal Code database in-use table. It often appears in this report when there are a high number of database file opens and closes.

See the sample report shown in Figure 54 on page 115.

Special System Information

In general, the information identifies exceptional conditions and events that occur over the measurement period. If you analyze these exceptions, you might find jobs and programs you need to examine. A summary of these sections of the Job Summary Report follows.

- Priority-Jobtype-Pool Statistics section
- Job Statistics section
- Interactive Program Statistics section
- Individual Transaction Statistics section
- Longest Seize/Lock Conflicts section
- Longest Holders of Seize/Lock Conflicts section
- Batch Job Analysis section
- Concurrent Batch Job Statistics section
- Report Selection Criteria section

To Print

Use OPTION(*SS) on the PRTTNSRPT command.

Priority-Jobtype-Pool Statistics Section

The Priority-Jobtype-Pool Statistics section of the Job Summary Report shows the total processing unit seconds and physical I/O requests for each category of priority-jobtype and pool combination recorded during the overall test period. The number of total transactions is shown for job type I only.

To Print

Use OPTION(*SS) on the PRTTNSRPT command.

See the sample report shown in Figure 55 on page 116.

Job Statistics Section

The Job Statistics section of the Job Summary Report shows the 10 jobs with the:

- Most transactions (shown in Figure 56 on page 116)
- Largest average response time
- Largest average processing unit time per transaction
- Largest synchronous disk I/O per transaction

  A synchronous disk I/O is a disk access operation that must complete before program operation can continue.
- Largest asynchronous disk I/O per transaction.

  An asynchronous disk I/O is a disk access operation that is not expected to complete before program operation can continue.

- Most seize conflicts
- Most record lock conflicts
- Most active-to-ineligible occurrences
- Most wait-to-ineligible occurrences
- Most event wait occurrences

To Print

Use OPTION(*SS) on the PRTTNSRPT command.

See the sample report shown in Figure 56 on page 116.

Interactive Program Statistics Section

The Interactive Program Statistics section of the Job Summary Report gives additional program information showing the top 10 programs with the largest average:

- Processing unit time per transaction (shown in Figure 57 on page 117)
- Synchronous disk I/O per transaction
- Asynchronous disk I/O per transaction
- Response time per transaction
- Synchronous database reads per transaction
- Synchronous database writes per transaction
- Synchronous nondatabase reads per transaction
- Synchronous nondatabase writes per transaction

See the sample report shown in Figure 57 on page 117.

Individual Transaction Statistics Section

The Individual Transaction Statistics section of the Job Summary Report lists the 10 transactions with the least or most:

- Response time (shown in Figure 58 on page 117)
- Processing unit service time
- Total synchronous disk I/O
- Total asynchronous disk I/O
- Synchronous database reads
- Synchronous database writes
- Synchronous nondatabase reads
- Synchronous nondatabase writes
- Asynchronous database reads
- Asynchronous database writes
- Asynchronous nondatabase reads
- Asynchronous nondatabase writes
- Short-wait-extended time
- Short-wait time
- Lock-wait time
- Excessive activity-level wait time
- Active time
- Binary overflow exceptions

- Decimal overflow exceptions
- Floating point overflow exceptions
- Process access group fault exceptions
- Permanent writes

To Print

Use OPTION(*SS) on the PRTTNSRPT command.

See the sample report shown in Figure 58 on page 117

Longest Seize/Lock Conflicts Section

The Longest Seize/Lock Conflicts section of the Job Summary Report shows the 30 longest lock or seize conflicts during the trace period.

To Print

Use OPTION(*SS) on the PRTTNSRPT command.

See the sample report shown in Figure 59 on page 118.

Longest Holders of Seize/Lock Conflicts Section

The Longest Holders of Seize/Lock Conflicts section of the Job Summary Report shows the holders of the longest lock or seize conflicts for all job types during the trace period.

To Print

Use OPTION(*SS) on the PRTTNSRPT command.

See the sample report shown in Figure 60 on page 118.

Batch Job Analysis Section

Note: The Batch Job Analysis section does not print if you also specify a value on the select job (SLTJOB) parameter or the omit job (OMTJOB) parameter.

The Batch Job Analysis section of the Job Summary Report shows information on the batch job workload during the trace period.

To Print

Use OPTION(*SS) on the PRTTNSRPT command.

See the sample report shown in Figure 61 on page 118.

Concurrent Batch Job Statistics

The Concurrent Batch Job Statistics section of the Job Summary Report shows information on the batch job workload during the trace period according to job sets.

By looking at the first lines for a particular priority, you can quickly determine if the system was fully utilizing all available batch activity levels during the trace period.

Collection Services begins identifying concurrent jobs when it starts collecting data. All jobs that are currently active are assigned to a job set. There will often be several jobs that are continuously active during the trace period, such as an autostart job for SNADS.

If another job starts during the trace period and none of the original jobs have ended, it is assigned to a new job set. If a job ends and another job of the same priority starts, the new job is considered to be a second job in the same job set.

For example, if the job queue entry for QBATCH has a MAXACT parameter of 3 and you submit 8 jobs to QBATCH during the trace period, there will probably be 3 job sets on the report with a total of 8 jobs shared between them.

The job sets are sorted by job priority. Thus, for the above example where the first job set was running for a total of 8 minutes and 50 seconds and the second job set was running for a total of 6 minutes and 55 seconds, the order of reporting shows the statistics for the second job set, then the third, and then the first and assigns them sequential numbers.

To Print

Use OPTION(*SS) on the PRTTNSRPT command.

Note: The Concurrent Batch Job Statistics section does not print if you also specify a value on the select job (SLTJOB) parameter or the omit job (OMTJOB) parameter.

See the sample report shown in Figure 62 on page 119.

Report Selection Criteria Section

The Report Selection Criteria section of the Job Summary Report gives the selection values you chose to produce the report.

Use the SELECT parameters on the Report Selection Criteria Report to select pools, jobs, user IDs or functional areas. Or use the OMIT parameters to omit them

If you did not use SELECT parameters, the `No Select parameters were chosen` message appears.

If you did not use OMIT parameters, the `No Omit parameters were chosen` message appears.

The options which were selected are also given.

To Print

Use OPTION(*SS) on the PRTTNSRPT command.

See the sample report shown in Figure 63 on page 119.

Transaction Report

The Transaction Report (RPTTYPE(*TNSACT)) provides detailed information about each transaction that occurred in the job:

- Transaction response time
- Name of the program that is active at the time the transaction starts
- Processing unit time use

- Number of I/O requests

The Transaction Report output has two parts:

- The details, which show data about each transaction in the job
- The summary, which shows data about overall job operation

To Print

Use RPTTYPE(*TNSACT) on the PRTTNSRPT command.

See the sample report shown in Figure 64 on page 120.

Job Summary Data

The Job Summary Data section of the Transaction Report includes averages of the job data. Some of this information is also found in the Job Summary section of the Job Summary Report.

Transition Report

The Transition Report (RPTTYPE(*TRSIT)) provides information similar to that of the Transaction Report, but the data (for example, processing unit time, I/O requests) is shown for each job state transition, rather than just the transitions shown when the job is waiting for work station input. The detail shown in this report helps you to determine the program that ran during a transition, or to determine when an unsatisfied lock request occurred.

The Transition Report is composed of two sections:

- Transition Detail, which shows each state transition made by the job (going from one state to another, such as active-to-ineligible)
- Summary, which shows the same data as the summary output from the Transaction Report

To Print

Use RPTTYPE(*TRSIT) on the PRTTNSRPT command.

See the sample report shown in Figure 65 on page 120.

Transition Detail

The job transitions for jobs using data queues are in the State column of the Transition Detail report. If a job uses data queues (CALL QSNDDTAQ or CALL QRCVDTAQ), each access to the queue is marked with an EOT2-SOT2 pair. If data is received by a queue when the data queue currently has no entries, the transition detail report shows a job state of wait (`W` in the `STATE` column), but leaves the job in the activity level up to a short wait time (2 seconds) or until the interval time set for the time slice end.

When either the time-out value of the QRCVDTAQ API ends or data is returned from the queue, the transition report records an `-->A` in the `STATE` column.

If a job is doing interactive I/O operations to an ICF file, the transition detail records a `W<--` and `-->A` pair under the `STATE` column for start (W) and completion (A) of the write or read operation. For example, if the job is doing APPC I/O operations within an interactive transition with a display device:

Time stamp `SOT1`

```
Time stamp W<--
Time stamp -->A
Time stamp W<--
Time stamp -->A
 | job processing
Time stamp EOR1
Time stamp EOT1
```

If the wait code column has an EORn, EOTn, or SOTn, the two program names on the left are filled in with information from the transaction boundary trace record, and the two program names on the right are blank.

The program name under *Last* contains the following information:

Transaction
    Name

Display I/O
    Display device

Data queue
    Data queue library

MRT Display device

Pass-through
    Device description

The program name under *Second* contains the following information:

Transaction
    Name

Display I/O
    Display file

Data queue
    Data queue

MRT Display file

Source pass-through
    Target control point

Target pass-through
    Source control point

WSF target pass-through
    Controller description

The values ADR=000000 or ADR=UNKWN can also appear as the program name. The ADR=000000 occurs when there was no program active at that level in the job when the trace record was created. ADR=UNKWN indicates that the program did not exist on the system at the time the trace record data was dumped to a database file. This happens if you have deleted (or replaced) the program before dumping the file. The program names are put into the trace record when you issue the End Performance Trace (ENDPFRTRC) command and the trace data is put into a database file or when the Dump Trace (DMPTRC) command is used.

Summary

The summary section of the Transition Report shows the same information as the summary section of the Transaction Report, described in "Job Summary Data" on page 104.

Table 10 shows jobs with a W← (wait) job state and 130 for a decimal qualifier. The job went from an active-to-wait state and dropped from the activity level (this defines the end of a transaction in the report).

Table 10. W← Job States and Decimal Qualifiers

State W A I	Wait Code	Decimal Qualifier	Description
W←	–	130	Dequeue wait (Flag X'64).
W←	EVT	130	Wait on event (Flag X'A4).
W←	LKW	130	Lock wait (Flag X'34').
W←	HDW	130	Hold wait (Flag X'2C').
Note: For the W← entry (going to long wait and not holding an activity level position) the WRITES value includes the I/O to write the PAG to disk as well as any other write operations that have occurred since the last trace entry. You can verify this by comparing it to output from extended trace job by looking at the WRITES values across a WAIT entry (on the TRCJOB command). You cannot exactly compare the times in the MPL trace data records with the times from TRCJOB or storage management trace. Each uses a different method to convert to an HH:MM:SS.SSS value from an 8-byte hexadecimal clock.			

Table 11 shows jobs with a W (wait) job state and a decimal qualifier of 134. The job went from active-to-wait state but stayed in the activity level (for example, a short wait).

Table 11. W Job States and Decimal Qualifiers

State W A I	Wait Code	Decimal Qualifier	Description
W	–	134	Dequeue wait (Flag X'64').
W	EVT	134	Wait on event (Flag X'A4').

Table 12 shows jobs with an I (ineligible) job state.

Table 12. I Job States and Decimal Qualifiers

State W A I	Wait Code	Decimal Qualifier	Description
→I	–	128	A new task cannot start.
→I	–	132	Wait-to-ineligible transition.
→I	TSE	136	Active-to-ineligible (time slice end).

Table 13 shows jobs with an A (active) job state.

Table 13. A Job States and Decimal Qualifiers

State W A I	Wait Code	Decimal Qualifier	Description
A	–	142	Wait-to-active but already in the activity level.

Table 13. A Job States and Decimal Qualifiers (continued)

State W A I	Wait Code	Decimal Qualifier	Description
A←	–	129	Ineligible-to-active transition.
A	–	131	Message received while the task was in the current MPL.
A	–	133	Dequeue after time-out, task in current MPL when message received.
→A	–	135	Job went from wait-to-active state (this defines the beginning of a transaction in the report).
A	WTO	137	Wait timed out.
A	TSE	139	Active-to-active (external time slice end based on time slice value in class) For example, a time slice end occurred and no jobs were waiting for an activity level.
A	TSE	145	Active-to-active (internal time slice end based on time slice value defined on STRPFRTRC command).

Sample Transaction Reports

See "Performance Report Columns" on page 157 for an alphabetized list containing definitions for each column in the reports.

Job Summary–Sample

```
                                                        Job Summary Report                                                  12/13/00 12:16:05
                                                           Job Summary                                                              Page 0001
                                                       Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                     *On/Off*    T  P  P  Tot  Response Sec        CPU Sec        ---- Average DIO/Transaction -----   Number  K/T
   Job     User Name/  Job        y  t  r  Nbr  -------------  -----------------  ------ Synchronous ----- --Async--    Cft    /Tns
   Name    Thread      Number  Pl p  y  g  Tns    Avg    Max   Util   Avg    Max   DBR  NDBR  Wrt  Sum  Max  Sum  Max  Lck Sze  Sec
---------- ---------- ------  -- -- -- - ----  ------ ------  ---- ------ ------  ---- ---- ---- ---- ---- ---- ----  --- --- -----
SCPF       QSYS       000000  02 X  40
QDBSRV01   QSYS       008309  02 S  09
QDBSRV02   QSYS       008310  02 S  16
QDBSRV03   QSYS       008311  02 S  16
QDBSRV04   QSYS       008312  02 S  52
QDBSRV05   QSYS       008313  02 S  52
QDCPOBJ1   QSYS       008314  02 S  60
QDCPOBJ2   QSYS       008315  02 S  60
QPFRADJ    QSYS       008316  02 S  00                                                               2
QSPLMAINT  QSYS       008317  02 S  20
QJOBSCD    QSYS       008318  02 S  00
QALERT     QSYS       008319  02 S  20
QLUR       QSYS       008320  02 S  00
QFILESYS1  QSYS       008321  02 S  00
QDBSRVXR   QSYS       008322  02 S  00
Q400FILSVR QSYS       008323  02 S  20
QQQTEMP1   QSYS       008324  02 S  20
QQQTEMP2   QSYS       008325  02 S  20
QDBSRVXR2  QSYS       008326  02 S  00
QSYSCOMM1  QSYS       008327  02 S  00
QCMNARB01  QSYS       008328  02 S  00
QCMNARB02  QSYS       008329  02 S  00
QCMNARB03  QSYS       008330  02 S  00
QSYSARB    QSYS       008302  02 S  00
QLUS       QSYS       008307  02 S  00
QSYSARB2   QSYS       008303  02 S  00
QSYSARB3   QSYS       008304  02 S  00
QSYSARB4   QSYS       008305  02 S  00
QSYSARB5   QSYS       008306  02 S  00
QCTL       QSYS       008335  02 M  00
QSYSWRK    QSYS       008336  02 M  00
QIWVPPJT   QUSER      008338  02 BJ 20
QSPL       QSYS       008347  02 M  00
QUSRWRK    QSYS       008348  02 M  00
QSERVER    QSYS       008350  02 M  00
QSNADS     QSYS       008353  02 M  00
QZDAINIT   QUSER      008356  02 BJ 20
QZDSTART   QSNADS     008359  02 A  40
QSYSSCD    QPGMR      008360  02 B  10
QPWFSERVS2 QUSER      008366  02 BJ 20
QINTER     QSYS       008368  02 M  00
QROUTER    QSNADS     008364  02 B  40
QPWFSERVSS QUSER      008369  02 BJ 20
QBATCH     QSYS       008371  02 M  00
```

Figure 42. Job Summary: Job Summary

System Summary Data (First Part)–Sample

```
                                                          Job Summary Report                                      12/13/00 12:16:05
                                                         System Summary Data                                             Page 0006
                                                         Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
TRACE PERIODS FOR TRACE DATE.
                                         Elapsed
      Started         Stopped            Seconds
      --------        --------          ---------
      11.53.31        11.53.54                 22
CPU BY PRIORITY FOR ALL JOBS FOR TOTAL TRACE PERIOD.
                             CPU       Cum CPU       CPU
 Pty         CPU             Util        Util         QM
 ----   --------------      ------     -------      -------
 00             .068         .30          .30        1.003
 01                                       .30        1.003
 09                                       .30        1.003
 10                                       .30        1.003
 11                                       .30        1.003
 13                                       .30        1.003
 15                                       .30        1.003
 16             .001                      .30        1.003
 19                                       .30        1.003
 20             .008         .03          .33        1.003
 25             .049         .22          .55        1.005
 35                                       .55        1.005
 36                                       .55        1.005
 40                                       .55        1.005
 49                                       .55        1.005
 50             .002                      .55        1.005
 52                                       .55        1.005
 60                                       .55        1.005
 68             .001                      .55        1.005
 84             .007         .03          .58        1.005
 98                                       .58        1.005
```

Figure 43. Job Summary: System Summary Data - 1

System Summary Data (Second Part)–Sample

```
                                                          Job Summary Report                                      12/13/00 12:16:05
                                                         System Summary Data                                             Page 0007
                                                         Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
CPU AND DISK I/O PER JOB TYPE FOR ALL JOBS FOR TOTAL TRACE PERIOD.
     Job            Nbr         CPU        CPU      --Disk I/O Requests--    CPU Sec/     Sync I/O
     Type           Jobs      Seconds      Util       Sync        Async      Sync DIO     /Elp Sec
---------------   -------   ----------    -----    ---------   ---------     --------     --------
INTERACTIVE            10           .0       .0            0           0       .0000           .0
BATCH A,B,C,D,X       328           .1       .5            0           0       .0000           .0
SPOOL WTR/RDR           2           .0       .0            0           0       .0000           .0
SYSTEM JOBS            39           .0       .0            2           0       .0000           .1
SYSTEM TASKS          337           .0       .0           58         102       .0000          2.6
---------------  --------  ------------   -----    ---------   ---------     --------     --------
   ** TOTALS **       716           .1       .5           60         102       .0017          2.7
DATA FOR SELECTED TIME INTERVAL (OR TOTAL TRACE PERIOD IF NO TIME SELECTION).
  INTERACTIVE TRANSACTION AVERAGES BY JOB TYPE.
 T                                    Avg     CPU/    ----- Sync Disk I/O Rqs/Tns -----  Async   W-I     Excp    Key/    Active  Est
 y       Nbr     Nbr    Pct    Tns    Rsp     Tns     DB     DB    NDB    NDB            DIO    Wait    Wait    Think    K/T    Of
 p  Prg  Jobs    Tns    Tns   /Hour  (Sec)   (Sec)   Read  Write   Read  Write    Sum    /Tns   /Tns    /Tns     /Tns    /Tns   AWS
 -- ---  ----  ------  -----  -----  ------  ------  -----  -----  -----  -----  -----  -----  ------  -------  ------  ------  ---
 I  YES    10       6  100.0    981   .006    .001      0      0      0      0      0      0   .000     .003   5.720   5.720    2
  EXCEPTIONAL WAIT BREAKDOWN BY JOB TYPE.
                       A-I         Short      Short       Seize      Lock       Event      Excs       EM3270     DDM Svr      Other
                       Wait        Wait       WaitX       Wait       Wait       Wait       ACTM        Wait       Wait        Wait
Type        Purge      /Tns        /Tns       /Tns        /Tns       /Tns       /Tns       /Tns        /Tns       /Tns        /Tns
----        -----     ------      ------     ------      ------     ------     ------     ------      ------     -------     ------
 I           YES        .000        .000       .000        .000       .000       .000       .003        .000        .000        .000
```

Figure 44. Job Summary: System Summary Data - 2

System Summary Data (Third Part)–Sample

```
                                                         Job Summary Report                                      12/13/00 12:16:05
                                                        System Summary Data                                             Page 0008
                                                        Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
ANALYSIS BY INTERACTIVE TRANSACTION CATEGORIES.
                    Avg            Cum     ----- Sync Disk I/O Rqs/Tns -----   Async                       Avg      Excp      Avg    Est
                    CPU     CPU    CPU      DB     DB     NDB    NDB            DIO    Nbr    Pct          Rsp      Wait      K/T    Of
    Category        /Tns    Util   Util    Read   Write   Read  Write   Sum     /Tns   Tns    Tns         /Tns     /Tns      /Tns   AWS
----------------  -------  -----  -----   -----  -----  -----  -----  -----    -----  -----  -----      -------  -------  -------  ---
VERY SIMPLE   VS      .001                                                                 6  100.0       .006      .003    5.720    2
----------------
  ** SIMPLE    S      .001                                                                 6  100.0       .006      .003    5.720    2
      -Boundary-      .071
  ** MEDIUM    M
      -Boundary-      .097
  ** COMPLEX   X
----------------
VERY COMPLEX  VX
----------------  -------  -----  -----   -----  -----  -----  -----  -----    -----  -----  -----      -------  -------  -------  ---
Total/Avg of **       .001                                                                 6  100.0       .006      .003    5.720    2
ANALYSIS BY INTERACTIVE RESPONSE TIME.
                    Avg                     Cum     Avg              Cum     ----- Sync Disk I/O Rqs/Tns -----   Async   Excp      Avg
                    Rsp     Nbr    Pct      Pct     CPU      CPU     CPU      DB     DB     NDB    NDB            DIO    Wait      K/T
    Category        /Tns    Tns    Tns      Tns     /Tns     Util    Util    Read   Write   Read  Write   Sum     /Tns   /Tns      /Tns
----------------  -------  -----  -----    -----  -------   -----   -----   -----  -----  -----  -----  -----    -----  -------  -------
Sub-Second            .006      6  100.0    100.0     .001                                                                 .003    5.720
1 - 1.999 Sec                               100.0
2 - 2.999 Sec                               100.0
3 - 4.999 Sec                               100.0
5 - 9.999 Sec                               100.0
GE 10 Seconds                               100.0
ANALYSIS BY INTERACTIVE KEY/THINK TIME.
                    Avg                     Cum     Avg              Cum     ----- Sync Disk I/O Rqs/Tns -----   Async    Avg      Excp
                    K/T     Nbr    Pct      Pct     CPU      CPU     CPU      DB     DB     NDB    NDB            DIO     Rsp      Wait
    Category        /Tns    Tns    Tns      Tns     /Tns     Util    Util    Read   Write   Read  Write   Sum     /Tns    /Tns      /Tns
----------------  -------  -----  -----    -----  -------   -----   -----   -----  -----  -----  -----  -----    -----  -------  -------
LT 2 Seconds          .001      2   33.3     33.3     .002                                                                 .004     .002
 2 -  14.999 Sec    11.439      2   33.3     66.6     .002                                                                 .004     .001
15 -  29.999 Sec                             66.6
30 -  59.999 Sec                             66.6
60 - 299.999 Sec                             66.6
GE 300 Seconds                               66.6
```

Figure 45. Job Summary: System Summary Data - 3

Distribution of Simple, Medium, and Complex Processing Unit Transactions–Sample

```
                                                         Job Summary Report                                     9/05/98 14:08:50
                                         Distribution of Transactions by CPU/Transaction                          Page 0083
                                                    Transaction Report Summary
Member  . . . : Q981421246 Model/Serial  . : 500-2142/10-1803D   Main storage . . :  128.0 M   Started  . . . . :05/22/98 12:47:42
  Library . . : THREAD1    System name . . :         ABSYSTEM   Version/Release  :   4/ 2.0   Stopped  . . . . :05/22/98 12:53:25
Number
  Of
 Tns
------
   25+
   24+
   23+
   22+
   21+
   20+
   19+
   18+
   17+
   16+
   15+
   14+
   13+
   12+     S
   11+     S
   10+    SS S
    9+    SS S
    8+    SS S
    7+    SS S
    6+    SS S
    5+    SS S
    4+   SSS S
    3+   SSSSS S
    2+   SSSSS S
    1+   SSSSSSS                                X                    X
    1-   SSSSSSS                                X                    X
        +----+----+----+----+----+----+----+----+----+----+----+----+----+----+ +++
     .000      .050      .100      .150      .200      .250      .300      .350
                                CPU/Transaction  (Seconds)
Transaction Categories:
     S = Simple Transactions
     m = Medium Transactions
     X = Complex Transactions
```

Figure 46. Job Summary: Distribution of Processing Unit Transactions

Transaction Significance–Sample

```
                                                       Job Summary Report                                       12/13/00 12:16:05
                                                   Transaction Significance                                          Page 0010
                                                     Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
Percent
  CPU
-------
   .1+                                                                X
   .1+                                                                X
   .1+                                                                X
   .1+       S                                                        X
   .1+       S                                                        X
   .1+       S                                                        X
   .1+       S                                                        X
   .1+       S                                                        X
   .1+     S S                                   X                    X
   .1+     S S                                   X                    X
   .1+     S S                                   X                    X
   .0+     S S                                   X                    X
   .0+     S S                                   X                    X
   .0+     S S                                   X                    X
   .0+     S S                                   X                    X
   .0+     S S                                   X                    X
   .0+    SS S S                                 X                    X
   .0+    SS S S                                 X                    X
   .0+    SS S S                                 X                    X
   .0+    SS S S                                 X                    X
   .0+    SSSS S                                 X                    X
   .0+    SSSS S                                 X                    X
   .0+    SSSS S                                 X                    X
   .0+    SSSSSS                                 X                    X
   .0+   SSSSSSS                                 X                    X
   .0-   SSSSSSS                                 X                    X
        +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+ +++
      .000      .050      .100      .150      .200      .250      .300      .350
                                CPU/Transaction  (Seconds)
Transaction Categories:
     S = Simple Transactions
     m = Medium Transactions
     X = Complex Transactions
```

Figure 47. Job Summary: Transaction Significance

Interactive Transactions by 5-Minute Intervals–Sample

```
                                                      Job Summary Report                                       12/13/00 12:16:05
                                         Interactive Transactions by 5 Minute Intervals                             Page 0011
                                                     Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                           --- Pct Of Tns ---  Pct CPU By  Nbr   Nbr    Sync  Async    Avg     Excp    Pct    Seize  Active  Est
 Itv   Active   Nbr    Tns  --- Categories ---  Categories  Sign  Sign   DIO   DIO     Rsp     Wait   Ex-Wt   Wait    K/T    Of
 End    Jobs    Tns   /Hour %VS* %S %M %X *%VX   %S %M %X  offs  ons    /Tns  /Tns    /Tns    /Tns   /Rsp   /Tns    /Tns   AWS
-----  ------  -----  ----- ---- --+--+-- ----  ---+--+---  ----  ----  -----  -----  -------  -------  -----  ------  ------  ---
 ***
11.55*      1      6     72  100*100  0  0 *  0    0  0   0                               .005     .003    60           5.500
     * Denotes Partial Interval Data
```

Figure 48. Job Summary: Interactive Transactions by 5-Minute Intervals

Interactive Throughput by 5-Minute Intervals–Sample

```
                                                            Job Summary Report                                   12/13/00 12:16:05
                                               Interactive Throughput by 5 Minute Intervals                               Page 0012
                                                           Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                            Number Of Transactions Per Hour
 Itv
 End
        0      400      800      1200      1600      2000      2400      2800
-----   +----+----+----+----+----+----+----+----+----+----+----+----+----+----+
 ***
15/05    XXXXXXXXXXXXXXXXXXSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
Throughput Components:
     S = Simple Transactions
     m = Medium Transactions
     X = Complex Transactions
```

Figure 49. Job Summary: Interactive Throughput by 5-Minute Intervals

Interactive CPU Utilization by 5-Minute Intervals–Sample

```
                                                                                                                Job Summary Report
                                            Interactive CPU Utilization by 5 Minute Intervals                               Page 0013
                                                           Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                      Percent CPU Utilization
 Itv
 End    0   10   20   30   40   50   60   70   80   90  100
-----   +----+----+----+----+----+----+----+----+----+----+
 ***
15/05    XXXX
CPU Components:
     S = Simple Transactions
     m = Medium Transactions
     X = Complex Transactions
```

Figure 50. Job Summary: Interactive CPU Utilization by 5-Minute Intervals

Interactive Response Time by 5-Minute Intervals–Sample

```
                                                                                                                Job Summary Report
                                             Interactive Response Time by 5 Minute Intervals                              Page 0014
                                                           Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                           Average Response Time (Seconds)
 Itv
 End
        0      1.00      2.00      3.00      4.00      5.00      6.00      7.00
-----   +----+----+----+----+----+----+----+----+----+----+----+----+----+----+
 ***
15/05    RRRRRRRRRRRR
Response Components:
     R = CPU + Disk + Wait-to-Ineligible
     w = Exceptional Wait
```

Figure 51. Job Summary: Interactive Response Time by 5-Minute Intervals

Scatter Diagram of Interactive Transactions by 5-Minute Intervals–Sample

```
                                         Interactive Response Time by 5 Minute Intervals                                     Page 0014
                                                       Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                           Average Response Time (Seconds)
 Itv
 End    0      1.00      2.00      3.00      4.00      5.00      6.00      7.00
-----   +----+----+----+----+----+----+----+----+----+----+----+----+----+----+
Response Components:
     R = CPU + Disk + Wait-to-Ineligible
     w = Exceptional Wait
                                                        Job Summary Report                                           12/13/00 12:16:05
                                Scatter Diagram of Interactive Transactions by 5 Minute Intervals                            Page 0015
                                                       Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                    Response Time vs Number of Transactions per Hour
                    ------------------------------------------------

    OVFLW
    -----
    7.00+
        -
 R      -
 E      -
 S  6.00+
 P      -
 O      -
 N      -
 S  5.00+
 E      -
        -
 T      -
 I  4.00+
 M      -
 E      -
        -
 I  3.00+
 N      -
        -
 S      -
 E  2.00+
 C      -
 O      -
 N      -
 D  1.00+
 S      -
        -
        -                                            0
    0.00+----+----+----+----+----+----+----+----+----+----+----+----+----+----+:O
        0       100       200       300       400       500       600       700:F
                                Number of Transactions per Hour
 Legend:     1-9 Indicates the Number of Occurrences.
              *  Indicates more than 9 Occurrences.
              0  Identifies Average of All Occurrences.
```

Figure 52. Job Summary: Interactive Transactions by 5-Minute Intervals

Interactive Program Statistics–Sample

```
                                                        Job Summary Report                                          5/07/98 13:52:10
                                                  Interactive Program Statistics                                           Page 0019
Member  . . . : CAJ0503    Model/Serial  . : 510-2144/10-08BCD   Main storage . . :  384.0 M   Started  . . . . : 05 03 98 14:59:44
  Library . . : QPFRDATA   System name . . :         ABSYSTEM    Version/Release  :   4/ 2.0   Stopped  . . . . : 05 03 98 15:04:36

                                             Cum    ----- Sync Disk I/O Rqs/Tns -----    Async           Short    Seize            Cum
      Number  Program         CPU    CPU     CPU    DB     DB     NDB    NDB              DIO      Rsp    Wait     Wait      Pct    Pct
Rank   Tns    Name           /Tns    Util    Util   Read   Write  Read   Write    Sum     /Tns     /Tns   /Tns     /Tns      Tns    Tns
----  ------  ----------   ------   ----    ----   -----  -----  -----  -----  -----    -----   ------  ------   ------    ----   ----
  1      147  QUIINMGR       .085    4.3     4.3                1      4     11     15       10     .792              .031   65.3   65.3
  2       32  QSPDSPF        .007     .1     4.3                       1             1        1     .047                     14.2   79.6
  3       19  QPTPRCSS       .023     .2     4.5                       1             1              .051                      8.4   88.0
  4       17  QUYLIST        .063     .4     4.9                      11      2     13        2     .411                      7.6   95.6
  5        3  QSUBLDS        .101     .1     5.0                      32            32             1.021                      1.3   96.9
  6        2  QUOCPP         .034            5.0                       6      5     11        2     .433              .035     .9   97.8
  7        2  QUIALIST       .013            5.0                              1      1              .034                       .9   98.7
  8        1  *TRACEOFF*    9.508    3.3     8.2     27    209   1852   2570   4658     2118  157.268              .039     .4   99.1
  9        1  QMHDSMSS       .062            8.3                       3             3              .135                       .4   99.6
 10        1  QUOCMD         .044            8.3                       1             1              .068                       .4  100.0
```

Figure 53. Job Summary: Interactive Program Statistics

Summary of Seize/Lock Conflicts by Object–Sample

```
                                                        Job Summary Report                                          5/07/98 13:52:10
                                              Summary of Seize/Lock Conflicts by Object                                    Page 0032
Member  . . . : MON3D7CRT  Model/Serial  . : 510-2144/10-08BCD   Main storage . . :  384.0 M   Started  . . . . :05 13 98 11:14:15
  Library . . : QPFRDATA   System name . . :         ABSYSTEM    Version/Release  :   4/ 2.0   Stopped  . . . . :05 13 98 12:14:01
                                                     -------- Interactive Waiters ---------    ------- Non-Interactive Waiters -------
                                                     ----- Locks -----    ---- Seizes -----    ----- Locks -----    ----- Seizes -----
 Type      Library       File       Member      Number    Avg Sec    Number    Avg Sec      Number    Avg Sec    Number      Avg Sec
------   ----------  ----------   ----------    ------   --------    ------   --------      ------   --------    ------     --------
DS       CVTV3R2CAJ  QAPMJOBS                                                                                         3         .080
DS       CVTV3R2CAJ  QAPMLIOP                                                                                         2         .001
DS       CVTV3R2CAJ  QAPMPOOL                                                                                         2         .106
DS       CVTV3R2CAJ  QAPMRESP                                                                                         2         .087
DS       QUSRSYS     QASNADSQ                                                               1       .406
DSI      CVTV3R2CAJ  QAPMCONF                                                                                         2         .006
DSI      CVTV3R2CAJ  QAPMLIOP                                                                                         2         .013
DSI      CVTV3R2CAJ  QAPMPOOL                                                                                         1         .015
FILE     QSPL        Q04079N003                                                            14       .428
JOBQ     QSYS        QNMSVQ                                                                 3       .017              1         .062
JOBQ     QSYS        QSYSNOMAX                                                                                        8         .020
LIB                  QRECOVERY                                                                                        2         .092
LIB                  QSPL                                                                                             8         .046
LIB                  QSVMSS                                                                                          14         .038
LIB                  QUSRSYS                                                                                          8         .197
LIB                  SOFIACN                                                                                          1
MI Q     QUSRSYS     QS2RRAPPN                                                              2      1.263
MSGQ     QSYS        QHST                                                                   7       .038              8         .343
OUTQ     QUSRSYS     QEZJOBLOG                                                                                        6         .021
SMIDX    QSVMSS      QCQJMSMI                                                                                         2
SPLCB                QSPSCB                                                                 6      2.556
USRPRF               MORIHE                                                                                           4         .071
USRPRF               QDBSHR                                                                                          22         .039
USRPRF               QSVCCS                                                                                          21         .043
USRPRF               QSYS                                                                                             1         .038
1E0101                                                                                                                1         .029
---------------------------------------------   ------   --------    ------   --------      ------   --------    ------     --------
* Total Conflicts and Avg Sec/Conflict                                                     36       .847            191         .065
                                                 ------               ------
* Total Transactions With Conflicts
                                                 ------               ------
* Averages Per Conflict Transaction
```

Figure 54. Job Summary: Summary of Seize/Lock Conflicts by Object

Priority-Jobtype-Pool Statistics–Sample

```
                                                         Job Summary Report                                           12/13/00 12:16:05
                                                  Priority-Jobtype-Pool Statistics                                           Page 0016
                                                        Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
          Job                      CPU        --- Disk I/O Requests ----       Number
Pty      Type      Pool          Seconds         Sync          Async            Tns
---      ----      ----        -----------    -----------    -----------     ----------
00        L         01              .056            58            102
00        L         02              .004
00        L         04              .007
00        M         02
00        S         02              .001             2
01        B         02
09        S         02
10        B         02
10        BJ        02
11        B         02
13        B         02
15        A         02
16        B         02              .001
16        S         02
19        B         02
20        A         02
20        B         02
20        BD        02
20        BJ        02
20        I         04              .008                                            5
20        L         01
20        S         02
25        B         02              .049
25        BD        02
25        BJ        02
35        B         02
36        L         01
36        L         04
40        A         02
40        B         02
40        X         02
49        L         01
50        A         02
50        B         02              .002
50        W         03
52        L         01
52        S         02
60        S         02
68        L         01              .001
84        L         01              .007
98        L         01
```

Figure 55. Job Summary: Priority-Jobtype-Pool Statistics

Job Statistics–Sample

```
                                                                                                                   Job Summary Report
                                                           Job Statistics                                                    Page 0017
                                                        Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
JOBS WITH MOST TRANSACTIONS
                                          T  P                                     Cum    Sync  Async                      Number          Cum
         Job       User Name/  Job        y  t    Nbr     Rsp     CPU    CPU    CPU    DIO    DIO   Nbr  Nbr  Nbr  Conflict  Pct    Pct
Rank     Name      Thread      Number  Pl  p  y    Tns    /Tns    /Tns   Util   Util   /Tns   /Tns  W-I  A-I  Evt  Lck  Sze  Tns    Tns
----  ---------- ---------- ------  --  -  --  -----  ------  ------  ----   ----  -----  -----  ---  ---  ---  ---  ---  ----  ----
   1  QPADEV0009 SUSTAITA    013832  04  I  20     43    .035    .018    .2     .2                                           93.5  93.5
   2  QPADEV0026 SOLBERG     013841  04  I  20      3   4.918    .179    .2     .4    154                                     6.5 100.0
   3
   4
   5
   6
   7
   8
   9
  10
JOBS WITH LARGEST AVERAGE RESPONSE TIME
```

Figure 56. Job Summary: Job Statistics

Interactive Program Statistics–Sample

```
                                                       Job Summary Report                                         12/13/00 12:16:05
                                                 Interactive Program Statistics                                           Page 0022
                                                      Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
PROGRAMS WITH HIGHEST CPU/TNS
                                          Cum    ----- Sync Disk I/O Rqs/Tns -----   Async         Short    Seize          Cum
      Number  Program        CPU   CPU    CPU     DB    DB     NDB   NDB              DIO     Rsp    Wait     Wait    Pct    Pct
Rank  Tns     Name          /Tns   Util   Util   Read  Write   Read  Write   Sum     /Tns    /Tns    /Tns     /Tns    Tns    Tns
----  ------  ----------   ------  ----   ----   -----  -----  -----  -----  -----   -----  ------  ------   ------   ----   ----
  1        2  QUIINMGR      .002                                                            .005                     33.3   33.3
  2        1  *TRACEOFF*    .002                                                            .003                     16.7   50.0
  3        3  QSCTI1        .001                                                            .007                     50.0  100.0
  4
  5
  6
  7
  8
  9
 10
```

Figure 57. Job Summary: Interactive Program Statistics

Individual Transaction Statistics–Sample

```
                                                       Job Summary Report                                         12/13/00 12:16:05
                                               Individual Transaction Statistics                                          Page 0025
                                                      Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
TRANSACTIONS WITH LONGEST RESPONSE TIMES
Rank         Value          Time         Program        Job Name      User Name      Number   Thread    Pool   Type   Priority
----     ------------   ------------   ----------     ----------     ----------     ------  --------   ----   ----   --------
  1              .015   11.53.31.746   QSCTI1         QPADEV000P     SUSTAITA       011615              04     ID       20
  2              .005   11.53.31.753   QUIINMGR       QPADEV000P     SUSTAITA       011615              04     ID       20
  3              .004   11.53.54.633   QSCTI1         QPADEV000P     SUSTAITA       011615              04     ID       20
  4              .004   11.53.45.609   QUIINMGR       QPADEV000P     SUSTAITA       011615              04     ID       20
  5              .003   11.53.54.636   *TRACEOFF*     QPADEV000P     SUSTAITA       011615              04     ID       20
  6              .003   11.53.31.746   QSCTI1         QPADEV000P     SUSTAITA       011615              04     ID       20
  7                                                                                                             D
  8                                                                                                             D
  9                                                                                                             D
 10                                                                                                             D
TRANSACTIONS WITH LONGEST CPU SERVICE TIME
Rank         Value          Time         Program        Job Name      User Name      Number   Thread    Pool   Type   Priority
----     ------------   ------------   ----------     ----------     ----------     ------  --------   ----   ----   --------
  1              .002   11.53.54.636   *TRACEOFF*     QPADEV000P     SUSTAITA       011615              04     ID       20
  2              .002   11.53.45.609   QUIINMGR       QPADEV000P     SUSTAITA       011615              04     ID       20
  3              .001   11.53.54.633   QSCTI1         QPADEV000P     SUSTAITA       011615              04     ID       20
  4              .001   11.53.31.753   QUIINMGR       QPADEV000P     SUSTAITA       011615              04     ID       20
  5              .001   11.53.31.746   QSCTI1         QPADEV000P     SUSTAITA       011615              04     ID       20
  6              .001   11.53.31.746   QSCTI1         QPADEV000P     SUSTAITA       011615              04     ID       20
  7                                                                                                             D
  8                                                                                                             D
  9                                                                                                             D
 10                                                                                                             D
```

Figure 58. Job Summary: Individual Transaction Statistics

Longest Seize/Lock Conflicts–Sample

```
                                                                                                       Job Summary Report
                                                       Longest Seize/Lock Conflicts                              Page 0027
                                                           Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                                  Job     User Name/  Job                     Holder- Job Name.. User Name. Number   Pool  Type  Pty
Rank     Value        Time        Name    Thread      Number Pl Typ Pty S/L Object- Type.. Library... File...... Member.... RRN......
---- ------------ ------------ ---------- ---------- ------ -- --- --- --- ---------------------------------------------------------
  1        20.679 08.00.43.582 QPADEV0017   0000000D 023398 04  I    01  L  HOLDER- QPADEV0016 COOK       023399    04    I     20
                                                                            OBJECT- DS     PFREXP     CSTFIL                000002000
  2        15.999 08.00.09.324 QPADEV0017   0000000D 023398 04  I    01  L  HOLDER- QPADEV0016 COOK       023399    04    I     20
                                                                            OBJECT- DS     PFREXP     CSTFIL                000001000
  3        14.183 08.01.16.807 QPADEV0017   0000000D 023398 04  I    01  L  HOLDER- QPADEV0016 COOK       023399    04    I     20
                                                                            OBJECT- DS     PFREXP     CSTFIL                000003000
  4          .034 08.00.25.331 QPADEV0017   0000000D 023398 04  I    01  L  HOLDER- QPADEV0016 COOK       023399    04    I     20
                                                                            OBJECT- DS     PFREXP     ITMFIL                000001000
  5          .023 08.01.04.268 QPADEV0017   0000000D 023398 04  I    01  L  HOLDER- QPADEV0016 COOK       023399    04    I     20
                                                                            OBJECT- DS     PFREXP     ITMFIL                000002000
  6          .022 08.01.30.999 QPADEV0017   0000000D 023398 04  I    01  L  HOLDER- QPADEV0016 COOK       023399    04    I     20
                                                                            OBJECT- DS     PFREXP     ITMFIL                000003000
```

Figure 59. Job Summary: Longest Seize/Lock Conflicts

Longest Holders of Seize/Lock Conflicts–Sample

```
                                                                                                       Job Summary Report
                                                 Longest Holders of Seize/Lock Conflicts                         Page 0028
                                                           Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                                 Job     User Name/  Job                        --------------------- Object -----------------------
Rank    Value       Time         Name    Thread      Number  Pl  Typ Pty  S/L  Type     Library     File        Member      RRN
----  --------  ------------  ---------- ---------- ------  --  --- ---  ---  ------  ----------  ----------  ----------  ---------
  1     20.679  08.00.43.581  QPADEV0016   0000000D 023399  04   I   20   L   DS      PFREXP      CSTFIL                  000002000
  2     15.999  08.00.09.324  QPADEV0016   0000000D 023399  04   I   20   L   DS      PFREXP      CSTFIL                  000001000
  3     14.183  08.01.16.808  QPADEV0016   0000000D 023399  04   I   20   L   DS      PFREXP      CSTFIL                  000003000
  4       .034  08.00.25.332  QPADEV0016   0000000D 023399  04   I   20   L   DS      PFREXP      ITMFIL                  000001000
  5       .023  08.01.04.269  QPADEV0016   0000000D 023399  04   I   20   L   DS      PFREXP      ITMFIL                  000002000
  6       .022  08.01.30.999  QPADEV0016   0000000D 023399  04   I   20   L   DS      PFREXP      ITMFIL                  000003000
```

Figure 60. Job Summary: Longest Holders of Seize/Lock Conflicts

Batch Job Analysis–Sample

```
                                                            Job Summary Report                                     12/13/00 12:16:05
                                                            Batch Job Analysis                                       Page 0029
                                                           Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
                                 T   P                                                   Sync     Async    --- Synchronous ---     Excp
   Job     User Name/  Job       y   t                       Elapsed      CPU      CPU    Disk     Disk      BCPU   --DIO/Sec--     Wait
   Name    Thread      Number Pl p   y  Start     Stop       Seconds     Seconds   Util   I/O      I/O      /DIO   Elp Act Ded     Sec
---------- ---------- ------ -- -- -- -------- -------- ---------- ---------- ----- -------- -------- -------- --- --- --- ---------
QIWVPPJT   QUSER      008338 02 BJ 20 11.53.31 11.53.54     22.907                                                               22.90
QZDAINIT   QUSER      008356 02 BJ 20 11.53.31 11.53.54     22.907                                                               22.90
QSYSSCD    QPGMR      008360 02 B  10 11.53.31 11.53.54     22.906                                                               22.90
QPWFSERVS2 QUSER      008366 02 BJ 20 11.53.31 11.53.54     22.906                                                               22.90
QROUTER    QSNADS     008364 02 B  40 11.53.31 11.53.54     22.906                                                               22.90
QPWFSERVSS QUSER      008369 02 BJ 20 11.53.31 11.53.54     22.906                                                               22.90
QPWFSERV   QUSER      008375 02 BJ 20 11.53.31 11.53.54     22.906                                                               22.90
QZDASSINIT QUSER      008378 02 BJ 20 11.53.31 11.53.54     22.906                                                               22.90
QNMAPINGD  QUSER      008379 02 BJ 25 11.53.31 11.53.54     22.906                                                               22.90
   .
   .
   .
```

Figure 61. Job Summary: Batch Job Analysis

Concurrent Batch Job Statistics–Sample

```
                                                     Job Summary Report                                               12/13/00 12:16:05
                                                Concurrent Batch Job Statistics                                               Page 0037
                                                     Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
 Job                 Number       Elapsed         CPU          Excp        Sync         Async
 Set        Pty       Jobs        Seconds       Seconds        Wait      Disk I/O      Disk I/O
------      ---      ------      --------      --------      --------    --------      --------
   1         10          1         22.906                     22.900
   2         10          1         22.906                     22.900
   3         10          1         22.907                     22.900
   4         10          1         22.907                     22.900
   5         10          1         22.907                     22.900
   6         10          1         22.907                     22.900
   7         20          1         22.906                     22.900
   8         20          1         22.906                     22.900
   9         20          1         22.906                     22.900
  10         20          1         22.906                     22.900
  11         20          1         22.906                     22.900
  12         20          1         22.906                     22.900
  13         20          1         22.906                     22.900
  14         20          1         22.906                     22.900
  15         20          1         22.906                     22.900
  16         20          1         22.906                     22.900
  17         20          1         22.906                     22.900
  18         20          1         22.906                     22.900
  19         20          1         22.907                     22.900
  20         20          1         22.907                     22.900
   .
   .
   .
```

Figure 62. Job Summary: Concurrent Batch Job Statistics

Report Selection Criteria-Sample

```
                                                     Job Summary Report                                               12/13/00 12:16:05
                                                  Report Selection Criteria                                                   Page 0040
                                                     Report type *SUMMARY
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM       Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM            Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Partition ID  : 00         Feature Code  . :22A8-2252-1519
Select Parameters
                            - No Select parameters were chosen.
Omit Parameters
                            - No Omit parameters were chosen.
Options Selected            - SS  INCLUDE SPECIAL SUMMARY REPORTS
```

Figure 63. Job Summary Report: Report Selection Criteria

Transaction Report Option–Sample

Note: This Transaction Report ran a collection with thread activity. The report header shows the thread identifier because the job is a secondary thread.

```
                                                        Transaction Report                                                 12/13/00 12:03:40
                                                       Report type *TNSACT                                                        Page 0001
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM        Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM             Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Job name  . . : QPFRADJ    User name . . . :       QSYS          Job number . . . :   008316   TDE/Pl/Pty/Prg . :    01EC/02/00/
Partition ID  : 00         Feature Code  . :22A8-2252-1519
         E           T   CPU   ---- Physical I/O Counts ----- ***** Transaction Response Time (Sec/Tns) ****** -BMPL-
         x           y   Sec   ----- Synchronous ------ Async  ******  - Activity Level Time -  Inel    Long   C    I Seize
         c    Program  p   Per    DB   DB  NDB   NDB       Disk   ****           Short   Seize   Time    Wait   u    n  Hold   Key/
  Time   p    Name     e   Tns   Read  Wrt Read  Wrt  Sum  I/O     **    Active   Wait     Cft   A-I/W-I Lck/Oth r    l  Time  Think
-------- - ---------- - ------- ---- ---- ---- ---- ---- ----- -------- ------- ------- ------- ------- ------- --  -- ----- ------
11.53.31   QWCPMNRR        .001             1    1    2     0     .038    .038                                      1              .0
-----------------------------------------------
J O B   S U M M A R Y   D A T A   (T O T A L S)
-----------------------------------------------
        Average            .001    0    0    1    1    2     0     .038    .038    .000    .000    .000    .000           .0     .0
        Count                                                     1       1
        Minimum            .001                        2           .038    .038                                                  .0
        Maximum            .001                        2           .038    .038                                                  .0
        Total/Job          .001                        2     0   22.907 Elapsed       .0 Percent CPU Utilization
```

Figure 64. Transaction Report

Transition Report Option–Sample

Note: This Transition Report ran a collection with thread activity. The report header shows the thread identifier because the job is a secondary thread.

```
                                                        Transition Report                                                  12/13/00 12:09:58
                                                        Report type *TRSIT                                                         Page 0001
Member  . . . : TRACESVT   Model/Serial  . : 270/10-45WFM        Main storage . . : 2048.0 MB  Started  . . . . :12/13/00 11:53:31
  Library . . : TRACESVT   System name . . :ABSYSTEM             Version/Release  :   5/ 1.0   Stopped  . . . . :12/13/00 11:53:54
Job name  . . : SCPF       User name . . . :       QSYS          Job number . . . :   000000   TDE/Pl/Pty/Prg . :    0188/02/40/
Partition ID  : 00         Feature Code  . :22A8-2252-1519
Job type  . . : X       Elapsed Time -- Seconds            Sync/Async Phy I/O    -MPL-
                        -----------------------         ------------------------ C   I     Last 4 Programs in Invocation Stack
             State Wait   Long    Active    Inel     CPU    DB    DB  NDB   NDB       u   n -------------------------------------------
    Time     W A I Code   Wait     /Rsp*    Wait     Sec    Read  Wrt Read  Wrt  Tot r   l    Last      Second      Third     Fourth
------------ ----- ---- ------- ------- ------- -------- ---- ---- ---- ---- ---- -- -- ---------- ---------- ---------- ----------
11.53.31.739 *TRACE ON
11.53.54.645      /OFF
11.53.54.645 *TRACE OFF
 ----------  *TRACEOFF*           .000*                 0    0    0    0    0*
-----------------------------------------------
J O B   S U M M A R Y   D A T A   (T O T A L S)
-----------------------------------------------
                        CPU   ---- Physical I/O Counts -----  ***** Transaction Response Time (Sec/Tns) ******  -BMPL-
                        Sec   ----- Synchronous ------ Async   ******  - Activity Level Time -  Inel    Long    C    I Seize
                        Per    DB   DB  NDB   NDB       Disk    ****           Short   Seize   Time    Wait    u    n  Hold   Key/
                        Tns   Read  Wrt Read  Wrt  Sum  I/O      **    Active   Wait     Cft   A-I/W-I Lck/Oth  r    l  Time  Think
                        ------- ---- ---- ---- ---- ---- -----  -------- ------- ------- ------- ------- -------  --  -- ----- ------
        Average          .000    0    0    0    0    0     0      .000    .000    .000    .000    .000    .000           .0     .0
        Count
        Minimum                                                                                                                   .0
        Maximum                                                                                                                   .0
        Total/Job        .000                        0     0    22.907 Elapsed       .0 Percent CPU Utilization
```

Figure 65. Transition Report

Lock Report

Printing the Lock Report

Use the PRTLCKRPT command. The PRTLCKRPT command uses trace output from the STRPFRTRC command, so you must run the STRPFRTRC command first, and then end the trace with the ENDPFRTRC command.

When you use the PRTLCKRPT command, the following file is used as input:

File **Description**

QAPMDMPT
: Database file that is created by the CRTPFRDTA command and updated by the PRTTNSRPT command.

See “QTRDMPT File” on page 152 for a description of the database file.

Following are the output files from the PRTLCKRPT command:

File **Description**

QPPTLCK
: Printer file

QAPTLCKD
: Database file

See “QAPTLCKD File” on page 156 for the database file description.

Note: In the following description, the term *lock* means lock or seize unless otherwise noted.

The PRTLCKRPT command produces several report formats. An optional detail list of the resource management trace records from QAPMDMPT prints first. This list may be sorted by the times that a lock occurred, the name of the job requesting the lock, the name of the job holding the lock, or the name of the locked object. The list may print four times (once for each of these sequences).

Consider the following points when you use the PRTLCKRPT command:

- The PRTTNSRPT output may show a high incidence of wait-to-ineligible state transitions in the transaction summary output. If this situation occurs, it could mean that many jobs are waiting for internal system object locks and holding an activity level while waiting. The PRTLCKRPT report may identify these locks.
- The Detailed Lock Conflicts Report (shown in Figure 67 on page 123) shows each object lock conflict that meets the specified selection values. Do not assume that each conflict shown for an object lock is associated with a separate request for the object from the program that originally requested it.

  When multiple requests (from multiple jobs) cause contention for an object, the requests are processed in the order received, by job priority. When conflicts occur, multiple lock requests are made by internal programs in behalf of the program that originally made the request, until the lock is granted. These internal requests appear on the summary, resulting in more conflicts than actually occurred from the originating program’s viewpoint.

  PRTLCKRPT processing does not analyze the internal lock conflicts and relate them to the original request.

What Is the Lock Report?

The Lock Report provides information about lock and seize conflicts during system operation. With this information you can determine if jobs are being delayed during processing because of unsatisfied lock requests or internal machine seizes. These conditions are also called waits. If they are occurring, you can determine which objects the jobs are waiting for and the length of the wait.

Next, these summaries print detail listings summarized by:

- Requesting job
- Holding job

- Object name

Figure 67 on page 123 shows a sample of the detail listing, sorted by time of day (in this case). The report options were selected to include only locks lasting at least two seconds that occurred between 13:33:00 and 13:34:00 (as noted in the footer printed at the bottom of the detail page).

Figure 68 on page 124 shows a sample of the Requesting Job Summary section of the same report. The other summary sections have a similar format.

See “Sample Lock Reports” on page 123.

See “Performance Report Columns” on page 157 for definitions of specific columns in the reports.

Analyzing Seize/Lock Conflicts

Seizes/locks are system-locking functions that ensure integrity during certain operations. For example, the system uses a seize during logical file maintenance when the underlying physical files are changed.

Conflicts occur when one job has an object lock or seize and another job requests control of the same object. A common example of a lock conflict is when a job reads a record for update and a second job requests a lock for the same record.

If the Print Transaction Report (PRTTNSRPT) job summary output shows a high number for either the number of lock or the number of seize conflicts, look at the Transaction Detail Report and Transition Detail Report to further analyze the situation. You can also use the PRTLCKRPT command to print the Seize/Lock Conflict Report to see what conflicts occurred.

If the PRTTNSRPT command output shows several lock waits, or system throughput is low and the processing unit time and disk use is also low, these conditions could be caused by lock-wait conflicts occurring in jobs due to contention for files, records, or other objects. Analyze the resource management trace data using the PRTLCKRPT command to determine a cause.

You can normally expect to see some conflicts occur for a short period of time on some objects. If you see several lock conflicts occur for nondatabase objects, it may be a normal situation (such as writers and jobs contending for output queues). However, if the locks last a long time (more than 5 to 10 seconds), and they cause objectionable delays to end users, this situation could indicate that you need to make some changes to the operational environment.

If the report shows several database record locks that last for more than 5 to 10 seconds, a program may have read a record for update and continued processing without releasing (writing) the record. This situation is normal in many applications. However, in a heavily loaded system, the job that holds the record lock may reach the end of its time slice while it holds the lock. When this condition occurs, it delays other jobs that need the record.

If the report shows several seizes that last for a period of time (over 1 second), this condition can indicate object contention problems. To ensure the accuracy of the object, the system does not allow access to the object until all the necessary changes are made.

Thread Data

As you will see in the Lock Report examples, if the data collection contains thread activity, and if the job is a secondary thread, the detail in the report shows the job name/thread identifier/job number value. If there is no thread activity, the detail shows the job name/user name/number value. Figure 66 shows a comparison between a job that is a secondary thread and a job that is not a secondary thread.

```
 9/24/98  7:40:08                           Seize/Lock Wait Statistics by Time of Day                                  Page   1
 TOD of  Length                                                                       Object                                     Record
  Wait   of Wait L Requestor's Job Name         Holder's Job Name             Type    Object Name                        Number
-------- ------- - ---------------------------- ---------------------------- ------ ---------------------------------- ----------
13.01.28     179   MNTASK                       QPADEV0009 SUSTAITA   013917 LIB    QUSRSYS
13.04.40      20   TPCRTMAX   00000057   013922 TPCRTMAX   SUSTAITA   013923 LIB    QUSRSYS
Member LOCKDATA       Library RWSDATA        Period from 00.00.00 through 23.59.59          0 ms minimum wait
 9/24/98  7:40:08                              Seize/Lock Wait Statistics Summary                                      Page   2
                                                        Locks                           Seizes
Requestor's Job Name                            Count        Avg Length          Count        Avg Length
-------------------------------------       ------------- -------------     ------------- -------------
MNTASK                                                  2           104
TPCRTMAX   SUSTAITA   013922 000000B8                   1           193
Member LOCKDATA       Library RWSDATA        Period from 00.00.00 through 23.59.59          0 ms minimum wait
```

Figure 66. Example of a Detail Listing with Thread Data

Sample Lock Reports

See "Performance Report Columns" on page 157 for an alphabetized list containing definitions for each column in the reports.

Lock Report–Detail

```
12/14/00 12:46:01                           Seize/Lock Wait Statistics by Time of Day                                  Page   1
                                                         Report type *ALL
 TOD of  Length                                                                       Object                                     Record
  Wait   of Wait L Requestor's Job Name         Holder's Job Name             Type    Object Name                        Number
-------- ------- - ---------------------------- ---------------------------- ------ ---------------------------------- ----------
12.05.39    4264 L QPADEV0006 SUSTAITA   012538 QPADEV000R SUSTAITA   012535 PGM    QAVCPP     QPFR
12.05.41    6866 L QPADEV000S SUSTAITA   012537 QPADEV0006 SUSTAITA   012538 PGM    QAVCPP     QPFR
12.05.55    7858 L QPADEV0006 SUSTAITA   012538 QPADEV000R SUSTAITA   012535 PGM    QAVCPP     QPFR
12.05.57    8988 L QPADEV000S SUSTAITA   012537 QPADEV0006 SUSTAITA   012538 PGM    QAVCPP     QPFR
Member LCKTRC1        Library TRACESVT       Period from 00.00.00 through 23.59.59        500 ms minimum wait12/14/00 12:46:01                           Sei
                                                         Report type *ALL
 TOD of  Length                                                                       Object                                     Record
  Wait   of Wait L Requestor's Job Name         Holder's Job Name             Type    Object Name                        Number
-------- ------- - ---------------------------- ---------------------------- ------ ---------------------------------- ----------
12.05.41    6866 L QPADEV000S SUSTAITA   012537 QPADEV0006 SUSTAITA   012538 PGM    QAVCPP     QPFR
12.05.57    8988 L QPADEV000S SUSTAITA   012537 QPADEV0006 SUSTAITA   012538 PGM    QAVCPP     QPFR
12.05.39    4264 L QPADEV0006 SUSTAITA   012538 QPADEV000R SUSTAITA   012535 PGM    QAVCPP     QPFR
12.05.55    7858 L QPADEV0006 SUSTAITA   012538 QPADEV000R SUSTAITA   012535 PGM    QAVCPP     QPFR
Member LCKTRC1        Library TRACESVT       Period from 00.00.00 through 23.59.59        500 ms minimum wait
12/14/00 12:46:01                           Seize/Lock Wait Statistics by Holding Job                                  Page   3
                                                         Report type *ALL
 TOD of  Length                                                                       Object                                     Record
  Wait   of Wait L Requestor's Job Name         Holder's Job Name             Type    Object Name                        Number
-------- ------- - ---------------------------- ---------------------------- ------ ---------------------------------- ----------
12.05.39    4264 L QPADEV0006 SUSTAITA   012538 QPADEV000R SUSTAITA   012535 PGM    QAVCPP     QPFR
12.05.55    7858 L QPADEV0006 SUSTAITA   012538 QPADEV000R SUSTAITA   012535 PGM    QAVCPP     QPFR
12.05.41    6866 L QPADEV000S SUSTAITA   012537 QPADEV0006 SUSTAITA   012538 PGM    QAVCPP     QPFR
12.05.57    8988 L QPADEV000S SUSTAITA   012537 QPADEV0006 SUSTAITA   012538 PGM    QAVCPP     QPFR
Member LCKTRC1        Library TRACESVT       Period from 00.00.00 through 23.59.59        500 ms minimum wait
12/14/00 12:46:01                              Seize/Lock Wait Statistics by Object                                    Page   4
                                                         Report type *ALL
 TOD of  Length                                                                       Object                                     Record
  Wait   of Wait L Requestor's Job Name         Holder's Job Name             Type    Object Name                        Number
-------- ------- - ---------------------------- ---------------------------- ------ ---------------------------------- ----------
12.05.39    4264 L QPADEV0006 SUSTAITA   012538 QPADEV000R SUSTAITA   012535 PGM    QAVCPP     QPFR
12.05.41    6866 L QPADEV000S SUSTAITA   012537 QPADEV0006 SUSTAITA   012538 PGM    QAVCPP     QPFR
12.05.55    7858 L QPADEV0006 SUSTAITA   012538 QPADEV000R SUSTAITA   012535 PGM    QAVCPP     QPFR
12.05.57    8988 L QPADEV000S SUSTAITA   012537 QPADEV0006 SUSTAITA   012538 PGM    QAVCPP     QPFR
Member LCKTRC1        Library TRACESVT       Period from 00.00.00 through 23.59.59        500 ms minimum wait
```

Figure 67. Example of a Detail Listing

Lock Report–Summary

```
12/14/00 12:46:01                              Seize/Lock Wait Statistics Summary                                     Page   5
                                                        Report type *ALL
                                                       Locks                          Seizes
Requestor's Job Name                             Count       Avg Length         Count       Avg Length
-------------------------------------        ------------- -------------     ------------- -------------
QPADEV000S SUSTAITA   012537                             2         7,927
QPADEV0006 SUSTAITA   012538                             2         6,061
Member LCKTRC1        Library TRACESVT      Period from 00.00.00 through 23.59.59       500 ms minimum wait
 12/14/00 12:46:01                              Seize/Lock Wait Statistics Summary                                     Page   6
                                                        Report type *ALL
                                                       Locks                          Seizes
Holder's Job Name                                Count       Avg Length         Count       Avg Length
-------------------------------------        ------------- -------------     ------------- -------------
QPADEV000R SUSTAITA   012535                             2         6,061
QPADEV0006 SUSTAITA   012538                             2         7,927
Member LCKTRC1        Library TRACESVT      Period from 00.00.00 through 23.59.59       500 ms minimum wait
12/14/00 12:46:01                              Seize/Lock Wait Statistics Summary                                     Page   7
                                                        Report type *ALL
Object                                                 Locks                          Seizes
 Type  Object Name                               Count       Avg Length         Count       Avg Length
------ --------------------------------      ------------- -------------     ------------- -------------
PGM    QAVCPP     QPFR                                   4         6,994
Member LCKTRC1        Library TRACESVT      Period from 00.00.00 through 23.59.59       500 ms minimum wait
```

Figure 68. Example of Summary by Requesting Job

Job Interval Report

Printing the Job Interval Report

Use the Print Job Report (PRTJOBRPT) command, or select option 3 (Job report) on the Print Performance Reports - Sample data display.

What Is the Job Interval Report?

This report, like other similar reports, is produced from the sample data that you collected. The four major sections of this report show information on all or selected intervals and jobs, including detail and summary information for interactive jobs and for noninteractive jobs. Because the report can be long, you may want to limit the output by selecting the intervals and jobs you want to include. For example, you might want to specify OMTSYSTSK(*YES) on the PRTJOBPRT command to print only the user jobs and omit the system tasks. Or, you can specify OMTSYSTSK(*NO) and include the system tasks.

If a value is too large to fit in the allotted space, a 9 is printed in each numeric field in the report.

The following are sections of the Job Interval Report:

- Interactive Job Summary
- Noninteractive Job Summary
- Interactive Job Detail
- Noninteractive Job Detail
- Report Selection Criteria

Interactive Job Summary

The Interactive Job Summary section of the Job Interval Report lists one line for all selected interactive jobs that existed during each selected interval (a total of one line per interval).

The information included in this section includes only valid interactive jobs with CPU activity different than zero, or with any I/O activity.

See the sample report shown in Figure 69 on page 126.

Noninteractive Job Summary

The Noninteractive Job Summary section of the Job Interval Report lists one line for all selected noninteractive jobs that existed during each selected interval (a total of one line per interval).

The information included in this section includes only valid non-interactive jobs with CPU activity different than zero, or with any I/O activity.

See the sample report shown in Figure 70 on page 127.

Interactive Job Detail

The Interactive Job Detail section of the Job Interval Report gives detailed information by interval and job. One line is printed for each selected interactive job that existed during each selected interval (generally more than one line per interval).

See the sample report shown in Figure 71 on page 128.

Noninteractive Job Detail

The Noninteractive Job Detail section of the Job Interval Report gives detailed information by interval and job. One line is printed for each selected noninteractive job that existed during each selected interval (generally more than one line per interval).

See the sample report shown in Figure 72 on page 129.

Report Selection Criteria

The Report Selection Criteria section of the Job Interval Report gives the selection values you chose to produce the report.

See the sample report shown in Figure 73 on page 130.

Sample Job Interval Reports

See "Performance Report Columns" on page 157 for an alphabetized list containing definitions for each column in the reports.

Interactive Job Summary–Sample

```
                                                       Job Interval Report                                                12/11/00 16:47:01
                                                     Interactive Job Summary                                                       Page   1
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM        Main storage  . . : 2048.0 MB Started . . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM            Version/Release . :     5/1.0 Stopped . . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
 Itv    Act      Tns        Rsp/   ------------------ Number of I/O --------------------     Tns/      CPU    PAG      Perm    Arith
 End    Jobs     Count      Tns       DDM        Sync       Async      Logical      Cmn       Hour      Util  Fault    Write   Ovrfl
-----  ------  ----------  ------  ---------  ---------  ---------  ---------  ---------  ---------- ----  ------  -------  ------
12:30       2          11     .24          0        142         41          0          0          44   .0       0       86       0
12:45       3          33     .09          0        176         42        258          0         156   .0       0      115       0
13:00       1           5     .00          0          2          0          0          0          19   .0       0        0       0
13:45       1           5     .20          0         56         11        157          0          26   .0       0       25       0
14:00       1           4   17.72          0        654        118         33          0          20   .0       0      194       0
14:30       1           2     .08          0         21          1          0          0           8   .0       0        1       0
14:45       1          11     .13          0         62         10        277          0          44   .0       0       33       0
15:00       4         102     .14          0        894        146        295          0         408   .0       0      388       0
15:15       3          18     .20          0        327         36          0          0         133   .0       0       95       0
15:30      21         145     .30          0       4175        445        152          0         580   .2       0     1222       0
15:45      15         411     .27          0       2965        697         49          0       1,644   .3       0     1396       0
16:00       5          20     .18          0        580        194        258          0          80   .0       0      457       0
16:15       2          16     .04          0         35         10        274          0          63   .0       0       24       0
16:45       3          10     .05          0         57          3        258          0          40   .0       0       17       0
18:06       1           0     .00          0          9          3          0          0           0   .0       0        7       0
19:00       7           3     .02          0       4156         76          0          0          12   .6       0      992       0
19:15       3           0     .00          0      14223       1262          0          0           0  1.9       0     4073       0
19:30       1           4  374.17          0       4975        926          0          0          15   .6       0     1769       0
21:50       3           0     .00          0       1340         93          0          0           0   .0       0      288       0
Itv End                -- Interval end time (hour and minute)
Act Jobs               -- Number of active jobs in the interval
Tns Count              -- Number of transactions
Rsp/Tns                -- Average response time (seconds)
DDM                    -- Number of logical DB I/O  operations for DDM server jobs
Sync                   -- Number of synchronous disk I/O operations
Async                  -- Number of asynchronous disk I/O operations
Logical                -- Number of logical disk I/O operations
Cmn                    -- Number of communications I/O operations
Tns/Hour               -- Average number of transactions per hour
CPU Util               -- Percentage of available CPU time used.  This is the average of all processors
PAG Fault              -- Number of faults involving the Process Access Group
Perm Write             -- Number of permanent writes
Arith Ovrfl            -- Number of arithmetic overflow exceptions
```

Figure 69. Interactive Job Summary Section

Noninteractive Job Summary–Sample

```
                                                      Job Interval Report                                        12/11/00 16:47:01
                                                   Non-Interactive Job Summary                                             Page   2
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM         Main storage  . . : 2048.0 MB Started . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM             Version/Release . :     5/1.0 Stopped . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
 Itv    Act    CPU     ---- Number of I/O Per Second ---- -- CPU/ I/O ---   Line     Page     PAG       Perm      Arith
 End    Jobs   Util      Sync    Async   Logical    Cmn    Sync    Async   Count    Count    Fault     Write     Ovrflw
----- -------  ----    -------  -------  -------  ------- ------- ------- --------- -------  -------  ---------  -------
12:30     29    .1         .4       .0       .1       .0       2      14        76        2        0        249        0
12:45     28    .2         .4       .0       .9       .0       4      22         0        0        0        218        0
13:00     30    .1         .6       .1       .3       .0       2      17         0        0        0        377        0
13:15     30    .2         .6       .1       .3       .0       3      20         0        0        0        436        1
13:30     27    .1         .4       .0       .1       .0       3      15         0        0        0        215        0
13:45     31    .1         .5       .1       .2       .0       2      14         0        0        0        287        0
14:00     33    .1        1.8       .1       .1       .0       0      10         0        0        0        345        0
14:15     31    .2         .8       .1       .3       .0       2      15         0        0        0        481        2
14:30     32    .2        1.0       .3       .2       .0       2       7       887       16        0        577        0
14:45     39    .6        2.4       .6      1.4       .0       2      10     1,097       20        0      1,446        0
15:00     37    .4        2.4       .4      1.5       .0       1       8       264        9        0        984        0
15:15     36    .2         .8       .2       .3       .0       3      13         0        0        0        556        1
15:30     41    .2         .6       .1       .1       .0       3      10         0        0        0        398        0
15:45     51    .4        2.7      1.0       .4       .0       1       4         0        0        0      1,735        0
16:00     31    .1         .5       .1       .1       .0       2      12         0        0        0        271        0
16:15     38    .3        1.0       .1       .8       .0       3      19         0        0        0        634        2
16:30     39    .4        1.6       .4       .3       .0       2      10       102        8        0        933        0
16:45     32    .1         .4       .1       .1       .0       3      13         0        0        0        233        0
17:00     29    .1         .4       .1       .1       .0       3      13         0        0        0        236        0
17:15     34   3.5       70.6     22.5      4.3       .0       0       1         0        0        0     53,594        1
17:30     32   1.3       27.6      9.0       .5       .0       0       1         0        0        0     22,005        0
17:45     30    .1         .4       .1       .1       .0       3      13         0        0        0        245        0
18:00     31    .1         .4       .1       .1       .0       3      14         0        0        0        235        0
18:15     32    .2         .7       .1       .3       .0       3      20         0        0        0        438        2
18:30     31    .1         .5       .1       .1       .0       3      13         0        0        0        303        0
Itv End                 -- Interval end time (hour and minute)
Act Jobs                -- Number of jobs that were active during the interval
CPU Util                -- Percentage of available CPU time used.  This is the average of all processors
Sync I/O Per Second     -- Average number of synchronous disk I/O operations per second
Async I/O Per Second    -- Average number of asynchronous disk I/O operations per second
Logical I/O Per Second  -- Average number of logical disk I/O operations per second
Cmn I/O Per Second      -- Average number of communications I/O operations per second
CPU/ Sync I/O           -- Avg number of CPU milliseconds per synchronous disk I/O operation
CPU/ Async I/O          -- Avg number of CPU milliseconds per asynchronous disk I/O operation
Line Count              -- Number of lines printed
Page Count              -- Number of pages printed
PAG Fault               -- Number of faults involving the Process Access Group
Perm Write              -- Number of permanent writes
Arith Ovrflw            -- Number of arithmetic overflow exceptions
```

Figure 70. Noninteractive Job Summary Section

Interactive Job Detail–Sample

```
                                                             Job Interval Report                                            12/11/00 16:47:01
                                                           Interactive Job Detail                                                    Page   4
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM        Main storage  . . : 2048.0 MB Started . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM            Version/Release . :     5/1.0 Stopped . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
                                                                        -------- Physical I/O Per Transaction --------         SYNC
 Itv      Job       User Name/  Job                TNS    Rsp     CPU    ---- Synchronous -----  ---- Asynchronous ----  CPU    I/O
 End      Name      Thread      Number  PL  Pty    /HR    /Tns    /Tns    DBR   DBW  NDBR  NDBW   DBR   DBW  NDBR  NDBW  Util   /Sec
-----  ----------  ----------  ------  --  ---   ----  ------ -------- ----  ----  ----  ----  ----  ----  ----  ----  ----  ------
12:29  QPADEV000D  CLUSTER1    008694   4   20    378     .04   .0060    .0    .1   3.1   1.6    .0    .1    .0    .4    .0      .5
12:30  QPADEV000N  SUSTAITA    008603   4   20      4    2.28   .0320    .0    .0   4.0  49.0    .0    .0    .0  36.0    .0      .0
12:32  QPADEV000D  QSECOFR     008695   4   20    808     .13   .0070    .0    .0   1.7   3.5    .0    .0    .0   1.5    .1     1.5
12:32  QPADEV000D  QSECOFR     008696   4   20   2700     .01   .0040    .0    .0    .3   3.0    .0    .3    .0   1.0    .3     3.5
12:45  QPADEV000D  UNTERHOL    008697   4   20     37     .01   .0070    .0    .0    .7    .2    .0    .0    .0    .2    .0      .0
13:00  ABSYSTEM    NOORDYKE    008646   4   20     19     .00   .0020    .0    .0    .4    .0    .0    .0    .0    .0    .0      .0
13:45  QPADEV000M  MDKONKEL    008714   4   20     26     .20   .0260    .0    .0   5.4   3.6    .0    .0    .0   2.2    .0      .0
14:00  QPADEV0003  HJHJALM     008722   4   20     20   17.72   .1430   1.0    .0 112.2  22.2    .0   5.0   1.5  23.0    .0      .9
14:30  QPADEV0003  HJHJALM     008722   4   20      8     .08   .0030    .0    .0  10.0    .0    .0    .0    .0    .5    .0      .0
14:45  ABSYSTEM    NOORDYKE    008646   4   20     44     .13   .0150    .0    .0   2.4   2.2    .0    .0    .0    .9    .0      .0
14:51  QPADEV000D  UNTERHOL    008697   4   20      0     .00   .0000    .0    .0    .0    .0    .0    .0    .0    .0    .0      .1
15:00  QPADEV000N  SUSTAITA    008603   4   20    116     .14   .0040    .1    .0   4.7   1.9    .0    .0    .0   1.6    .0      .2
15:00  QPADEV0003  HJHJALM     008722   4   20    268     .14   .0030    .0    .0   3.9   3.3    .0    .0    .0   1.1    .0      .6
15:00  ABSYSTEM    NOORDYKE    008646   4   20     24     .09   .0160    .0    .0    .6   2.0    .0    .0    .0   1.3    .0      .0
15:15  QPADEV000D  UNTERHOL    008762   4   20     76     .23   .0140    .2    .1  25.5   1.8    .1    .2    .0   1.2    .0      .6
15:06  QPADEV0003  HJHJALM     008722   4   20     84     .19   .0060    .0    .1   1.2   6.3    .0    .3    .0   2.0    .0      .2
Itv End                  -- Interval end time (hour and minute)
Job Name                 -- Job name
User Name/Thread         -- User name or secondary thread identifier
Job Number               -- Job number
PL                       -- Pool in which the job ran
Pty                      -- Priority of the job
TNS/HR                   -- Average number of transactions per hour
Rsp/Tns                  -- Average response time (seconds)
CPU/Tns                  -- Average number of CPU seconds per transaction
Physical I/O per Trans   -- Average physical disk I/O per transaction
    Synchronous DBR      -- Average synchronous data base reads per transaction
    Synchronous DBW      -- Average synchronous data base writes per transaction
    Synchronous NDBR     -- Average synchronous non-data base reads per transaction
    Synchronous NDBW     -- Average synchronous non-data base writes per transaction
    Asynchronous DBR     -- Average asynchronous data base reads per transaction
    Asynchronous DBW     -- Average asynchronous data base writes per transaction
    Asynchronous NDBR    -- Average asynchronous non-data base reads per transaction
    Asynchronous NDBW    -- Average asynchronous non-data base writes per transaction
CPU Util                 -- Percentage of available CPU time used.  This is the average of all processors
Sync I/O /Sec            -- Average number of synchronous disk I/O operations per second
```

Figure 71. Job Interval Report: Interactive Job Detail Section

Noninteractive Job Detail –Sample

```
                                                   Job Interval Report                                        12/11/00 16:47:01
                                               Non-Interactive Job Detail                                              Page   7
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM         Main storage  . . : 2048.0 MB Started . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM             Version/Release . :      5/1.0 Stopped . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
 Itv      Job      User Name/  Job                            Elapsed   CPU    --- Nbr I/O /Sec -- -- CPU / I/O -- --- Printer ---
 End      Name     Thread      Number     Pool    Type  Pty     Time    Util   Sync   Async   Lgl   Sync    Async    Lines   Pages
-----  ----------  ----------  ------     ----    ----  ---   -------   -----  -----  -----  ----- ------- ------- --------- -------
12:30  ADMIN       QTMHHTTP    008647       2      B     25     15:00     .00      0      0      0     227       0         0       0
12:15  CRTPFRDTA   QSYS        008684       2      B     50      0:30     .10      1      0      0       0       4        76       2
12:30  LDAPCGI     QTMHHTTP    008441       2      B     25     15:00     .00      0      0      0     219       0         0       0
12:30  QECS        QSVSM       008412       2      B     50     15:00     .00      0      0      0       0       0         0       0
12:30  QGLDPUBA    QDIRSRV     008380       2      A     50     15:00     .00      0      0      0       0       2         0       0
12:30  QIJSSCD     QIJS        008415       2      B     35     15:00     .00      0      0      0      30      15         0       0
12:30  QNETWARE    QSYS        008424       2      B     50     15:00     .00      0      0      0       0       0         0       0
12:30  QNNDIRQS    QNOTES      008411       2      B     35     15:00     .00      0      0      0       0       0         0       0
12:30  QRWTLSTN    QUSER       008434       2      B     20     15:00     .00      0      0      0       0       0         0       0
12:19  QRWTSRVR    QUSER       008678       2      BJ    20      4:47     .00      0      0      0       0       2         0       0
12:29  QRWTSRVR    QUSER       008679       2      BJ    20     14:47     .00      0      0      0      11      41         0       0
12:30  QRWTSRVR    QUSER       008690       2      BJ    20      9:59     .00      0      0      0       6       0         0       0
12:30  QRWTSRVR    QUSER       008691       2      BJ    20      9:59     .00      0      0      0      31     124         0       0
12:30  QSNMPSA     QTCP        008463       2      B     35     15:00     .00      0      0      0       6       0         0       0
12:30  QTFTP00268  QTCP        008522       2      B     25     15:00     .00      0      0      0       0       0         0       0
12:30  QTFTP00283  QTCP        008530       2      B     25     15:00     .00      0      0      0       0       0         0       0
12:30  QTFTP00345  QTCP        008521       2      B     25     15:00     .00      0      0      0       0       0         0       0
12:30  QTFTP00352  QTCP        008520       2      B     25     15:00     .00      0      0      0       0       0         0       0
12:30  QTFTP00417  QTCP        008607       2      B     25     15:00     .00      0      0      0       0       0         0       0
12:26  QTLPD00041  QTCP        008689       2      B     25     11:44     .00      0      0      0       0       2         0       0
12:20  QTLPD00042  QTCP        008686       2      B     25      5:02     .00      0      0      0       0       1         0       0
12:30  QTLPD00043  QTCP        008692       2      B     25      9:58     .00      0      0      0       2      16         0       0
12:30  QTLPD00044  QTCP        008693       2      B     25      3:16     .00      0      0      0       2      15         0       0
12:30  QTMSNMP     QTCP        008456       2      B     35     15:00     .00      0      0      0       0       0         0       0
12:30  QTOVMAN     QTCP        008464       2      B     25     15:00     .00      0      0      0       0       0         0       0
Itv End                 -- Interval end time (hour and minute)
Job Name                -- Job name
User Name/Thread        -- User name or secondary thread identifier
Job Number              -- Job number
Pool                    -- Pool in which the job ran
Type                    -- Type and subtype of the job
Pty                     -- Priority of the job
Elapsed Time            -- Elapsed time for job during interval (minutes and seconds)
CPU Util                -- Percentage of available CPU time used.  This is the average of all processors
Sync I/O /Sec           -- Average number of synchronous disk I/O operations per second
Async I/O /Sec          -- Average number of asynchronous disk I/O operations per second
Lgl I/O /Sec            -- Average number of logical disk I/O operations per second
CPU/ Sync I/O           -- Avg number of CPU milliseconds per synchronous disk I/O operation
CPU/ Async I/O          -- Avg number of CPU milliseconds per asynchronous disk I/O operation
Printer Lines           -- Number of lines printed
Printer Pages           -- Number of pages printed
```

Figure 72. Job Interval Report: Noninteractive Job Detail Section

Job Interval Report Selection Criteria: Select Parameters–Sample

```
Select Parameters

Pools                   - 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16

Jobs                    - 012345/Useridwxyz/Jobname123 00000005
                          987654/Useridabcd/Jobname456 *ALL

User IDs                - User1      User2      User3      User4     User5      User6
                          User7      User8      User9      User10    User11     User12

Subsystems              - Subsystem1 Subsystem2 Subsystem3 Subsystem4 Subsystem5 Subsystem6
                          Subsystem7 Subsystem8 Subsystem9 Subsystema Subsystemb Subsystemc

Communications Lines    - Line1      Line2      Line3      Line4     Line5      Line6
                          Line7      Line8      Line9      Line10    Line11     Line12

Control Units           - Ctlr1      Ctlr2      Ctlr3      Ctlr4     Ctlr5      Ctlr6
                          Ctlr7      Ctlr8      Ctlr9      Ctlr10    Ctlr11     Ctlr12

Functional Areas        - Accounting            Payroll              Research
                          Development           ProjectX             MrNolansStaff

                        - No Select parameters were chosen.
```

Figure 73. Job Interval Report: Select Parameters

Job Interval Report Selection Criteria: Omit Parameters–Sample

```
Omit Parameters

Pools                   - 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16

Jobs                    - 012345/Useridwxyz/Jobname123 00000005
                          987654/Useridabcd/Jobname456 *ALL

User IDs                - User1      User2      User3      User4     User5      User6
                          nnnnnn     User8      User9      User10    User11     User12

Subsystems              - Subsystem1 Subsystem2 Subsystem3 Subsystem4 Subsystem5 Subsystem6
                          Subsystem7 Subsystem8 Subsystem9 Subsystema Subsystemb Subsystemc

Communications Lines    - Line1      Line2      Line3      Line4     Line5      Line6
                          Line7      Line8      Line9      Line10    Line11     Line12

Control Units           - Ctlr1      Ctlr2      Ctlr3      Ctlr4     Ctlr5      Ctlr6
                          Ctlr7      Ctlr8      Ctlr9      Ctlr10    Ctlr11     Ctlr12

Functional Areas        - Accounting           Payroll              Research
                          Development          ProjectX             MrNolansStaff

                        - No Omit parameters were chosen.
```

Figure 74. Job Interval Report: Omit Parameters

Pool Interval Report

Printing the Pool Interval Report

Use the Print Pool Report (PRTPOLRPT) command, or select option 4 (Pool report) on the Print Performance Reports - Sample data display.

What Is the Pool Interval Report?

The Pool Report contains a section on subsystem activity and a section on pool activity. Data is shown for each sample interval. Because the report can be long, you may want to limit the output by selecting the intervals and jobs you want to include.

If a value is too large to fit in the allotted space, a 9 is printed in each numeric field in the report.

For samples of each section of the Pool Report, see “Sample Pool Interval Reports”.

For definitions of specific columns in the reports, see “Performance Report Columns” on page 157.

Subsystem Activity

The Subsystem Activity section of the Pool Interval Report gives the performance information on the subsystems during each selected interval. One line is printed for each subsystem and active pool combination that existed during each selected interval.

See the sample report shown in Figure 75 on page 132.

Pool Activity

The Pool Activity section of the Pool Interval Report gives the performance information on the storage pools at various time intervals. One line is printed for each active pool that existed during each selected interval.

See the sample report shown in Figure 76 on page 133.

Report Selection Criteria

The Report Selection Criteria section of the Pool Interval Report gives the selection values you chose to produce the report.

See the sample report shown in Figure 77 on page 133.

Sample Pool Interval Reports

See “Performance Report Columns” on page 157 for an alphabetized list containing definitions for each column in the reports.

Subsystem Activity–Sample

```
                                                        Pool Interval Report                                                    12/11/00 16:47:12
                                                         Subsystem Activity                                                            Page   1
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM         Main storage  . . : 2048.0 MB Started . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM             Version/Release . :     5/1.0 Stopped . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
                                   --------- Physical I/O per Transaction -------- ---------------- Job Maximums ----------------
 Itv  Subsystem     CPU            ----- Synchronous ----- ---- Asynchronous ----- CPU       Phy
 End  Name       PL Util     Tns    DBR   DBW   NDBR  NDBW  DBR   DBW   NDBR  NDBW  Util      I/O      Tns   Rsp    A-W   W-I  A-I
----- ---------- -- ---- ---------- ----- ----- ----- ----- ----- ----- ----- ----- ----  ---------- ----- ------ ------ ---- ----
12:30 QHTTPSVR   2   .0          0                                                   .0           1     0    .00  3,516    0    0
12:30 QINTER     4   .0         11                3.1   5.9                    3.6   .0         125    10   2.28     13    0    0
12:30 QSOC       2   .0          0                                                   .0           0     0    .00    174    0    0
12:30 QSYSWRK    2   .0          0                                                   .1         182     0    .00    358    0    0
12:45 QHTTPSVR   2   .0          0                                                   .0           2     0    .00  3,515    0    0
12:45 QINTER     4   .0         33                1.3   2.6                    1.2   .3         188    22    .13     33    0    0
12:45 QSOC       2   .0          0                                                   .0           0     0    .00    176    0    0
12:45 QSYSWRK    2   .1          0                                                   .0         181     0    .00    357    0    0
13:00 QBATCH     2   .0          0                                                   .4           7     0    .00      0    0    0
13:00 QHTTPSVR   2   .1          0                                                   .0         110     0    .00  3,531    0    0
13:00 QINTER     4   .0          5                 .4                                .0           2     5    .00      5    0    0
13:00 QSOC       2   .0          0                                                   .0           0     0    .00    176    0    0
13:00 QSYSWRK    2   .0          0                                                   .0         241     0    .00    359    0    0
13:15 QBATCH     2   .0          0                                                   .0          21     0    .00      0    0    0
13:15 QHTTPSVR   2   .0          0                                                   .0           0     0    .00  3,515    0    0
13:15 QSOC       2   .0          0                                                   .0           0     0    .00    174    0    0
13:15 QSYSWRK    2   .1          0                                                   .2         183     0    .00    358    0    0
13:30 QHTTPSVR   2   .0          0                                                   .0           1     0    .00  3,516    0    0
Itv End                 -- Interval end time (hour and minute)
Subsystem Name          -- Subsystem name
PL                      -- Pool in which the jobs in the subsystem ran
CPU Util                -- Average CPU utilization by the transactions in the subsystem.  This is the average  of all processors
Tns                     -- Number of transactions in the subsystem
Physical I/O per Trans  -- Average physical disk I/O operations per transaction
    Synchronous DBR     -- Average synchronous data base reads per transaction
    Synchronous DBW     -- Average synchronous data base writes per transaction
    Synchronous NDBR    -- Average synchronous non-data base reads per transaction
    Synchronous NDBW    -- Average synchronous non-data base writes per transaction
    Asynchronous DBR    -- Average asynchronous data base reads per transaction
    Asynchronous DBW    -- Average asynchronous data base writes per transaction
    Asynchronous NDBR   -- Average asynchronous non-data base reads per transaction
    Asynchronous NDBW   -- Average asynchronous non-data base writes per transaction
Job Maximums            -- Maximum values by a job in the subsystem
    CPU Util            -- Highest percentage CPU utilization
    Phy I/O             -- Most physical disk I/O requests
    Tns                 -- Most transactions
    Rsp                 -- Highest average response time (seconds)
    A-W                 -- Most active-to-wait transitions
    W-I                 -- Most wait-to-ineligible transitions
    A-I                 -- Most active-to-ineligible transitions
```

Figure 75. Pool Interval Report: Subsystem Activity

Pool Activity–Sample

```
                                                      Pool Interval Report                                      12/11/00 16:47:12
                                                         Pool Activity                                                    Page  8
 Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM        Main storage  . . : 2048.0 MB Started . . . : 12/07/00 12:10:39
   Library . . : PTNOELIB   System name . . : ABSYSTEM            Version/Release . :     5/1.0 Stopped . . . : 12/07/00 23:45:00
 Partition ID  : 00         Feature Code  . : 22A8-2252-1519
                                              -------- Physical I/O per Transaction --------- ---------------- Job Maximums -------------
 Itv       Act    Size   CPU                  ----- Synchronous ----- ----- Asynchronous ---- CPU     Phy
 End  PL   Lvl     (K)   Util     Tns   DBR   DBW   NDBR  NDBW  DBR   DBW   NDBR  NDBW  Util    I/O     Tns   Rsp    A-W   W-I  A-I
----- -- ----- --------- ---- -------- ----- ----- ----- ----- ----- ----- ----- ----- ---- --------- ----- ------ ------ ---- ----
12:30  2    93   1790172  .1        0                                                   .1      182     0    .00  3,516    0    0
12:30  4    40    151404  .0       11               3.1   5.9                    3.6   .0      125    10   2.28     13    0    0
12:45  2    93   1795144  .2        0                                                   .0      181     0    .00  3,515    0    0
12:45  4    40    143020  .0       33               1.3   2.6                    1.2   .3      188    22    .13     33    0    0
13:00  2    93   1830984  .1        0                                                   .4      241     0    .00  3,531    0    0
13:00  4    40    104852  .0        5                .4                                 .0        2     5    .00      5    0    0
13:15  2    93   1829808  .2        0                                                   .2      183     0    .00  3,515    0    0
13:30  2    93   1828624  .1        0                                                   .0      201     0    .00  3,516    0    0
13:45  2    93   1827932  .1        0                                                  5.8      180     0    .00  3,520    0    0
13:45  4    40    104852  .0        5               5.4   3.6                    2.2   .0       67     5    .20     14    0    0
14:00  2    93   1815648  .1        0                                                   .5      351     0    .00  3,517    0    0
14:00  4    40    104852  .0        4   1.0       112.2  22.2        5.0   1.5  23.0   .0      772     4  17.72     17    0    0
14:15  2    93   1822336  .2        0                                                   .3      211     0    .00  3,521    0    0
 Itv End                -- Interval end time (hour and minute)
 PL                     -- Pool identifier
 Act Lvl                -- Activity level of the pool
 Size (K)               -- Size of the pool (kilobytes)
 CPU Util               -- Average CPU utilization by the transactions in the pool.  This is the average  of all processors
 Tns                    -- Number of transactions in the pool
 Physical I/O per Trans  -- Average physical disk I/O operations per transaction in the pool
     Synchronous DBR     -- Average synchronous data base reads per transaction
     Synchronous DBW     -- Average synchronous data base writes per transaction
     Synchronous NDBR    -- Average synchronous non-data base reads per transaction
     Synchronous NDBW    -- Average synchronous non-data base writes per transaction
     Asynchronous DBR    -- Average asynchronous data base reads per transaction
     Asynchronous DBW    -- Average asynchronous data base writes per transaction
     Asynchronous NDBR   -- Average asynchronous non-data base reads per transaction
     Asynchronous NDBW   -- Average asynchronous non-data base writes per transaction
 Job Maximums           -- Maximum values by a job in the pool
     CPU Util           -- Highest percentage CPU utilization
     Phy I/O            -- Most physical disk I/O requests
     Tns                -- Most transactions
     Rsp                -- Highest average response time (seconds)
     A-W                -- Most active-to-wait transitions
     W-I                -- Most wait-to-ineligible transitions
     A-I                -- Most active-to-ineligible transitions
```

Figure 76. Pool Interval Report: Pool Activity

Report Selection Criteria–Sample

```
                                                      Pool Interval Report                                      12/11/00 16:47:12
                                                   Report Selection Criteria                                              Page  11
 Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM        Main storage  . . : 2048.0 MB Started . . . : 12/07/00 12:10:39
   Library . . : PTNOELIB   System name . . : ABSYSTEM            Version/Release . :     5/1.0 Stopped . . . : 12/07/00 23:45:00
 Partition ID  : 00         Feature Code  . : 22A8-2252-1519
 Select Parameters          - None
 Omit Parameters            - None
```

Figure 77. Pool Interval Report: Report Selection Criteria

Resource Interval Report

Printing the Resource Interval Report

Use the Print Resource Report (PRTRSCRPT) command, or select option 5 (Resource report) on the Print Performance Reports - Sample data display.

What Is the Resource Interval Report?

The major sections of the Resource Interval Report provide resource information on all or selected intervals. Because the report can be long, you may want to limit the output by selecting the intervals you want to include.

If a value is too large to fit in the allotted space, a 9 is printed in each numeric field in the report.

Disk Utilization Summary

The Disk Utilization Summary section of the Resource Interval Report gives detailed disk information by time intervals.

Information is shown for all disk arms that are configured on the system. Also, the disk arm with the highest utilization and the disk arm with the highest average seek time for each time interval are shown. Consistent disk arm utilization at or above the threshold value will affect system performance and cause longer response times and/or less throughput.

See the sample report shown in Figure 78 on page 137.

Disk Utilization Detail

The Disk Utilization Detail section of the Resource Interval Report gives detailed disk information for the selected time intervals.

Information is shown for each disk arm that is configured on the system. Consistent disk arm utilization at or above the threshold value will affect system performance and cause longer response times and/or less throughput.

See the sample report shown in Figure 79 on page 138.

Communications Line Detail

A Communications Line Detail section of a Resource Interval Report contains information about the line activity when performance data was collected for the specified member. One detail section is produced for each protocol in use on the lines for which data was collected. Figure 80 on page 139 through Figure 86 on page 142 are samples of the detail sections for the communications protocols.

Note: Each section appears only if you have communications lines using that particular protocol.

SDLC Protocol

Figure 80 on page 139 is a sample of the report section for communications lines using the synchronous data link control (SDLC) protocol. The data in this example is sorted by the data collection interval end times.

X.25 Protocol

Figure 81 on page 139 is a sample of the report section for communications lines using the X.25 protocol.

TRLAN Protocol

Figure 82 on page 140 is a sample of the report section for communications lines using the token-ring local area network (TRLAN) protocol.

ELAN Protocol

Figure 83 on page 141 is a sample of the report section for communications lines using the Ethernet local area network (ELAN) protocol.

DDI Protocol

Figure 84 on page 141 is a sample of the report section for communications lines using the distributed data interface (DDI) protocol.

FRLY Protocol

Figure 85 on page 142 is a sample of the report section for communications lines using the frame relay (FRLY) protocol.

ASYNC Protocol

Figure 86 on page 142 is a sample of the report section for communications lines using the asynchronous (ASYNC) protocol.

Note: A protocol data unit (PDU) for asynchronous communications is a variable-length unit of data that is ended by a protocol control character or by the size of the buffer.

BSC Protocol

Figure 87 on page 143 is a sample of the report section for communications lines using the binary synchronous communications (BSC) protocol.

ISDN Network Interface

Figure 88 on page 143 is a sample of the report section for the integrated services digital network (ISDN) network interface.

Network Interface Maintenance Channel for ISDN

Figure 89 on page 144 is a sample of the report section for the network interface maintenance channel for the ISDN protocol.

IDLC Protocol

Figure 90 on page 144 and Figure 91 on page 144 are samples of the report section for communications lines using the ISDN data link control (IDLC) protocol. Figure 91 on page 144 indicates which B-channel the IDLC line was using during the interval.

Related Information

| You can find the ISDN information under the Networking topic in the iSeries
| Information Center.

IOP Utilizations

The IOP Utilizations section of the Resource Interval Report contains a combination of the following input/output processor (IOP) utilizations:

- Disk IOP utilizations

  Gives input/output processor (IOP) utilization for direct access storage devices (DASDs). Consistent Disk IOP utilization at or above the threshold value affects system performance and causes longer response times and/or less throughput.
- Multifunction IOP utilizations

  Gives input/output processor (IOP) utilization for DASD, communication, and local workstation devices. Consistent utilization at or above the threshold value affects system performance and causes longer response times and/or less throughput.
- Communications IOP utilizations

  Gives communications input/output processor (IOP) utilization.
- Local work station IOP utilizations

  Gives input/output processor (IOP) utilization for local workstation devices.

See the sample report shown in shown in Figure 92 on page 145.

Note: The total for the I/O processor utilization oftentimes does not match the sum of the three columns (IOP Processor Util Comm, IOP Processor Util LWSC, and IOP Processor Util DASD). This mismatch is caused by the utilization of other small components, such as system time.

Local Work Station Response Times

The local work station response times section provides the following for each data collection interval:

- Local work station IOP utilization
- Number of work stations active on each controller
- Range of response times for the work stations
- Average response time for the work stations

The values for the response time intervals may vary depending on the values that you use.

See the sample report shown in Figure 93 on page 145.

Remote Work Station Response Times

The remote work station response times section gives the following for each data collection interval:

- Number of work stations active on each controller
- Range of response times for the work stations
- Average response time for the work stations

The values for the response time intervals may vary depending on the values that you use.

Note: This section appears only if a 5494 remote controller is included in the data collection. Collection Services does not generate data for remote work stations (file QAPMRWS). This section applies only to performance data generated by the STRPFRMON command prior to V5R1 and converted in V5R1 with the Convert Performance Data (CVTPFRDTA) command.

See the sample report shown in Figure 94 on page 146.

Sample Resource Interval Reports

See “Performance Report Columns” on page 157 for an alphabetized list containing definitions for each column in the reports.

Disk Utilization Summary–Sample

Resource Interval Report 12/11/00 16:44:05
Disk Utilization Summary Page 1

Member . . . : PT51MBR15 Model/Serial . : 270/10-45WFM Main storage . . : 2048.0 MB Started . . . : 12/07/00 12:10:39
Library . . : PTNOELIB System name . . : ABSYSTEM Version/Release . : 5/1.0 Stopped . . . : 12/07/00 23:45:00
Partition ID : 00 Feature Code . : 22A8-2252-1519

Itv End	Average I/O /Sec	Average Reads /Sec	Average Writes /Sec	Average K Per I/O	Avg Util	High Util	High Util Unit	High Srv Time	High Srv Unit	Disk Space Used
12:15	3.3	.4	2.8	6.9	.5	2.3	0008	.0611	0006	92,192
12:30	1.4	.2	1.2	6.4	.2	.5	0010	.0475	0003	92,178
12:45	1.3	.1	1.1	6.4	.2	.6	0006	.0692	0010	92,182
13:00	1.5	.1	1.4	5.8	.2	.7	0010	.0589	0007	92,180
13:15	1.0	.0	.9	12.8	.2	.7	0006	.0983	0004	92,181
13:30	.5	.0	.4	6.4	.1	.2	0010	.5454	0009	92,182
13:45	1.1	.2	.9	6.4	.1	.5	0010	.0864	0013	92,187
14:00	30.6	19.9	10.6	12.7	2.7	11.1	0006	.0330	0017	92,215
14:15	39.0	11.4	27.5	18.4	6.8	30.0	0008	.0540	0009	92,219
14:30	18.4	12.0	6.4	8.1	1.5	6.0	0006	.0782	0017	92,223
14:45	38.2	15.0	23.2	10.2	4.7	21.3	0006	.0355	0011	92,228
15:00	11.9	2.7	9.1	5.9	1.7	7.1	0010	.0487	0011	92,263
15:15	14.5	3.3	11.2	6.2	1.9	8.9	0006	.0327	0007	92,264
15:30	24.0	4.5	19.4	6.6	3.3	15.0	0010	.0342	0005	92,277
15:45	23.7	3.6	20.1	4.7	3.3	12.9	0006	.0361	0005	92,277
16:00	47.2	2.7	44.5	11.2	8.6	42.8	0006	.0445	0005	92,266
16:15	41.5	6.9	34.5	7.8	6.2	28.3	0006	.0587	0015	92,290
16:30	7.8	1.3	6.5	7.7	1.2	4.9	0006	.0554	0004	92,282
16:45	5.8	1.3	4.5	7.9	.8	3.7	0008	.0572	0014	92,282
17:00	3.8	.3	3.5	7.2	.5	2.5	0008	.0899	0007	92,279
17:15	73.7	7.1	66.5	4.8	9.5	26.2	0010	.0376	0010	92,330
17:30	32.0	1.9	30.0	5.1	4.4	13.5	0010	.0360	0010	92,328
17:45	2.4	.0	2.3	5.3	.4	2.1	0008	.0600	0012	92,331
18:00	2.0	.1	1.9	5.1	.3	1.6	0008	.0864	0007	92,329
18:15	2.5	.1	2.4	5.0	.4	2.4	0008	.0942	0009	92,329
18:30	2.3	.0	2.2	4.8	.4	1.7	0008	.0765	0004	92,330
18:45	2.2	.1	2.1	5.0	.3	1.6	0008	.1558	0011	92,331
19:00	35.7	1.2	34.4	26.9	8.8	34.7	0006	.0556	0005	93,122

Itv End -- Interval end time (hour and minute)
Average Phys I/O /Sec -- Average number of physical I/O operations per second
Average Reads / Sec -- Average number of physical reads per second
Average Writes /Sec -- Average number of physical writes per second
Average K Per I/O -- Average number of kilobytes (1024) per I/O operation
Avg Util -- Average percent utilization of all disk arms
High Util -- Highest percent utilization for a disk arm
High Util Unit -- Disk arm with the highest utilization percent
High Srv Time -- Highest average service time in seconds
High Srv Unit -- Disk arm with the highest service time
Disk Space Used -- Total disk space used in millions of bytes

Figure 78. Resource Interval Report: Disk Utilization Summary

Disk Utilization Detail–Sample

```
                                                  Resource Interval Report                                   12/11/00 16:44:05
                                                   Disk Utilization Detail                                           Page   3
Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM        Main storage  . . : 2048.0 MB Started . . . : 12/07/00 12:10:39
  Library . . : PTNOELIB   System name . . : ABSYSTEM            Version/Release . :     5/1.0 Stopped . . . : 12/07/00 23:45:00
Partition ID  : 00         Feature Code  . : 22A8-2252-1519
      IOP Name/            ASP    Itv     -------- I/O Per Second ---------      K Per   Dsk CPU        Queue    Avg Time Per I/O
Unit   (Model)             Id     End        Total        Reads       Writes      I/O     Util   Util  Length   Service     Wait
----  -----------------    ---   -----    ----------   ----------   ----------  -------  -------  ----  -------  -------     ----
0001  CMB01      (6713)     01   12:15         .172         .023         .149      5.8      1.1    .2      .00    .0116    .0001
                                 12:30         .103         .045         .057      5.2      1.0    .2      .00    .0194    .0028
                                 12:45         .043         .002         .041      6.2      1.0    .0      .00    .0000    .0133
                                 13:00         .170         .065         .104      4.9      1.0    .2      .00    .0117    .0017
                                 13:15         .055         .006         .048     29.1      1.0    .2      .00    .0363    .0158
                                 13:30         .070         .048         .021      4.3      1.0    .1      .00    .0142    .0103
                                 13:45         .086         .017         .068      6.4      1.0    .1      .00    .0116    .0084
                                 14:00        8.223        5.865        2.357     10.1      2.7   8.8      .14    .0107    .0069
                                 14:15        6.300        2.233        4.066     14.8      4.3  11.3      .12    .0179    .0023
                                 14:30        4.438        2.443        1.994      6.2      1.9   5.3      .06    .0119    .0021
                                 14:45        9.313        2.838        6.474      8.1      3.9  16.5      .18    .0177    .0028
                                 15:00        2.619         .599        2.020      4.3      1.9   3.9      .04    .0148    .0018
                                 15:15        3.620         .582        3.037      4.6      2.2   5.9      .06    .0162    .0018
                                 15:30        6.345        1.521        4.824      5.0      3.1   9.3      .10    .0146    .0021
                                 15:45        5.774        1.038        4.735      3.8      3.1  11.1      .12    .0192    .0038
                                 16:00       10.651         .472       10.179      8.0      5.7  23.9      .26    .0224    .0028
                                 16:15        9.140        1.185        7.954      5.8      4.8  18.1      .19    .0198    .0020
                                 16:30        1.729         .156        1.572      5.2      1.6   3.6      .03    .0208    .0027
                                 16:45        1.430         .206        1.223      5.2      1.4   2.3      .02    .0160    .0020
                                 17:00        1.208         .024        1.183      4.5      1.3   2.3      .02    .0190    .0023
                                 17:15        5.916         .590        5.326      4.5      8.1  13.5      .15    .0228    .0045
                                 17:30        2.880         .312        2.568      4.7      4.1   6.6      .07    .0229    .0047
                                 17:45         .705         .007         .697      4.6      1.2   1.2      .01    .0170    .0041
                                 18:00         .659         .047         .611      4.2      1.1   1.1      .01    .0166    .0034
                                 18:15         .724         .055         .668      4.3      1.2   1.2      .01    .0165    .0017
                                 18:30         .653         .005         .647      4.4      1.1   1.1      .01    .0168    .0024
Unit                     -- Disk arm identifier
IOP Name/                -- Input/Output processor resource name and
(Model)                     model number of the attached device
ASP ID                   -- Auxiliary storage pool number
Itv End                  -- Interval end time (hour and minute)
I/O /Sec                 -- Average number of I/O operations per second
Reads Per Second         -- Average number of reads per second
Writes Per Sec           -- Average number of writes per second
K Per I/O                -- Average number of kilobytes (1024) per I/O operation
Dsk CPU Util             -- Percentage of Disk CPU Utilization
Util                     -- Average percent of time disk was used (busy)
Queue Length             -- Average length of waiting queue
Average Service Time     -- Average disk service time per I/O operation
Average Wait Time        -- Average disk wait time per I/O operation
```

Figure 79. Resource Interval Report: Disk Utilization Detail

Communications Line Detail–SDLC Sample

```
                                                  Resource Interval Report                                   09/18/98 14:06:00
                                                 Communications Line Detail                                            Page   3
                                               Sample Resource Interval Report
Member  . . . : PMISTGA1   Model/Serial  . : 500-2142/10-1803D    Main storage  . . : 128.0 M   Started . . . : 08/11/98 13:09:04
  Library . . : PM42CRT    System name . . :           ABSYSTEM  Version/Release . :   4/2.0   Stopped . . . : 08/11/98 13:38:40
PROTOCOL = SDLC (SORT BY INTERVAL)
                                                            Percent                         Percent    Pct      -- Congestion ---
          IOP                            Bytes       Total      I Frames   Bytes       Total     Frames     Poll     Local     Remote
 Itv      Name/     Line      Line      Trnsmitd    I Frames   Trnsmitd   Recd        Frames    Received   Retry    Not       Not
 End      Line      Speed     Util      Per Sec     Trnsmitd   in Error   Per Sec     Recd      in Error   Time     Ready     Ready
-----  ----------  --------  ------  ----------  ----------  ---------- ---------- --------  ----------  -------  -------  --------
       CC09
        (2609)
13:14  PMSD1           19.2     4.6          49         322           0         62    2,909           0        0        0         0
13:19  PMSD1           19.2     4.4          47         301           0         60    2,943           0        0        0         0
13:24  PMSD1           19.2     5.4          56         399           0         73    2,889           0        0        0         0
13:29  PMSD1           19.2     4.0          52         159           0         45    3,029           0        0        0         0
13:34  PMSD1           19.2     4.1          54         131           0         43    3,074           0        0        0         0
13:38  PMSD1           19.2     5.9          81         206           0         61    2,762           0        0        0         0
       CC13
        (2609)
13:14  PMSD2           19.2     4.6          63         160           0         49    3,044           0        0        0         0
13:19  PMSD2           19.2     4.4          60         151           0         47    3,072           0        0        0         0
13:24  PMSD2           19.2     5.4          73         200           0         56    3,055           0        0        0         0
13:29  PMSD2           19.2     4.0          45         226           0         52    2,971           0        0        0         0
13:34  PMSD2           19.2     4.1          43         263           0         55    2,966           0        0        0         0
13:38  PMSD2           19.2     5.9          61         411           0         80    2,587           0        0        0         0
```

Figure 80. Resource Interval Report: Communications Line Detail - SDLC

Communications Line Detail–X.25 Sample

```
                                                  Resource Interval Report                                   09/18/98 14:06:00
                                                 Communications Line Detail                                            Page   5
                                               Sample Resource Interval Report
Member  . . . : PMISTGA1   Model/Serial  . : 500-2142/10-1803D    Main storage  . . : 128.0 M   Started . . . : 08/11/98 13:09:04
  Library . . : PM42CRT    System name . . :           ABSYSTEM  Version/Release . :   4/2.0   Stopped . . . : 08/11/98 13:38:40
PROTOCOL = X.25 (SORT BY INTERVAL)
                                 Transmit/                                Percent                                Percent
          IOP                    Receive/      Bytes        Total         I Frames      Bytes        Total      Frames    ------Reset------
 Itv      Name/     Line         Average       Trnsmitd     I Frames      Trnsmitd      Recd         Frames     Recd      -----Packets-----
 End      Line      Speed        Line Util     Per Sec      Trnsmitd      In Error      Per Sec      Recd       In Err    Trnsmitd    Recd
-----  ----------  --------  -----------  ----------   ----------   ----------   ---------   --------  --------  --------  -------
       CC13
        (2609)
13:14  PMX21           19.2     02/02/02          61          535         0             52      1,070      0            0         0
13:14  PMX22           19.2     01/02/02          44          535         0             68      1,070      0            0         0
13:19  PMX21           19.2     02/02/02          57          504         0             48      1,008      0            0         0
13:19  PMX22           19.2     01/02/02          41          504         0             63      1,008      0            0         0
13:24  PMX21           19.2     02/02/02          64          564         0             54      1,128      0            0         0
13:24  PMX22           19.2     01/02/02          47          564         0             71      1,128      0            0         0
13:29  PMX21           19.2     01/02/01          32          391         0             49        782      0            0         0
13:29  PMX22           19.2     01/01/02          44          391         0             37        782      0            0         0
13:34  PMX21           19.2     01/02/02          38          467         0             58        934      0            0         0
13:34  PMX22           19.2     02/01/02          52          467         0             44        934      0            0         0
13:38  PMX21           19.2     02/04/03          69          751         0            106      1,502      0            0         0
13:38  PMX22           19.2     03/03/03          95          751         0             80      1,502      0            0         0
```

Figure 81. Resource Interval Report: Communications Line Detail - X.25

Communications Line Detail–TRLAN Sample

```
                                                   Resource Interval Report                                         12/11/00 16:44:05
                                                  Communications Line Detail                                                  Page  26
 Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM         Main storage  . . : 2048.0 MB Started . . . : 12/07/00 12:10:39
   Library . . : PTNOELIB   System name . . : ABSYSTEM             Version/Release . :     5/1.0 Stopped . . . : 12/07/00 23:45:00
 Partition ID  : 00         Feature Code  . : 22A8-2252-1519
 PROTOCOL = TRLAN/H  (SORT BY INTERVAL)
                                                            ------- Congestion -------
           IOP                               I Frames    I Frames  -- Local  --   -- Remote --                Rsp      Remote LAN
  Itv      Name/        Line      Line   Trnsmitd     Recd       Not    Seq    Not    Seq      Frame   Timer   -- Pct Frames --    MAC
  End      Line        Speed      Util   Per Sec      Per Sec    Ready  Error  Ready  Error    Retry   Ended    Trnsmitd    Recd   Errors
 -----  ----------  --------  ------- ----------  ---------- -----  -----  -----  -----  -------  ------   --------   ----  -------
        CMB01
         (2744)
 12:30  NTRN935A     16000.0       .0          0           0     0      0      0      0        0       0         53     72    4,094
 12:45  NTRN935A     16000.0       .1          0           0     0      0      0      0        0       0         10     69    3,938
 13:00  NTRN935A     16000.0       .1          0           0     0      0      0      0        0       0         36     72    3,985
 13:15  NTRN935A     16000.0       .0          0           0     0      0      0      0        0       0         56     72    3,979
 13:30  NTRN935A     16000.0       .0          0           0     0      0      0      0        0       0         59     73    4,026
 13:45  NTRN935A     16000.0       .0          0           0     0      0      0      0        0       0         44     73    3,813
 14:00  NTRN935A     16000.0       .1          0           0     0      0      0      0        0       0         51     72    3,982
 14:15  NTRN935A     16000.0       .0          0           0     0      0      0      0        0       0         52     72    3,994
 14:30  NTRN935A     16000.0       .0          0           0     0      0      0      0        0       0         56     73    4,095
 14:45  NTRN935A     16000.0       .1          0           0     0      0      0      0        0       0         12     69    3,900
 15:00  NTRN935A     16000.0       .1          0           0     0      0      0      0        0       0         16     70    3,917
 15:15  NTRN935A     16000.0       .0          0           0     0      0      0      0        0       0         34     72    4,027
 15:30  NTRN935A     16000.0       .1          0           0     0      0      0      0        0       0         11     71    5,289
 15:45  NTRN935A     16000.0       .2          0           0     0      0      0      0        1      12          4     64    4,553
 16:00  NTRN935A     16000.0       .1          0           0     0      0      0      0        0       0         27     74    4,695
 16:15  NTRN935A     16000.0       .1          0           0     0      0      0      0        0       0         10     75    5,270
 16:30  NTRN935A     16000.0       .1          0           0     0      0      0      0        0       0          7     73    4,350
 16:45  NTRN935A     16000.0       .1          0           0     0      0      0      0        0       0         17     74    4,168
 17:00  NTRN935A     16000.0       .1          0           0     0      0      0      0        0       0         25     74    4,599
 17:15  NTRN935A     16000.0       .1          0           0     0      0      0      0        0       0         16     73    4,200
 Itv End                 -- End time of the data collection interval or time vary off occurred
 IOP Name/Line           -- IOP resource name and model number, Line ID
 Line Speed              -- Line speed (1000 bits per second)
 Line Util               -- Percent of available line capacity used in this interval
 I Frames Trans /Sec     -- Number of I frames transmitted per second
 I Frames Recd /Sec      -- Number of I frames received per second
 Local Not Ready         -- Percent of the interval that the system could not process incoming data
 Local Seq Error         -- Percent of the interval that the system received frames out of sequence
 Remote Not Ready        -- Percent of the interval that the remote system or device could not process incoming data
 Remote Seq Error        -- Percent of the interval that the remote system or device received frames out of sequence
 Frame Retry             -- The number of attempts to retransmit a frame to a remote controller
 Rsp Timer Ended         -- The number of times the response timer ended waiting for a response from a remote device
 Remote LAN Frames Trans -- Percent of frames transmitted to a LAN connected to the locally attached LAN
 Remote LAN Frames Recd  -- Percent of frames received from a LAN connected to the locally attached LAN
 MAC Errors              -- The number of medium access control errors
```

Figure 82. Resource Interval Report: Communications Line Detail - TRLAN

Communications Line Detail–ELAN Sample

```
                                                     Resource Interval Report                                   09/18/98 14:06:00
                                                    Communications Line Detail                                           Page  10
                                                  Sample Resource Interval Report
Member  . . . : PMISTGA1   Model/Serial  . : 500-2142/10-1803D    Main storage  . . : 128.0 M   Started . . . : 08/11/98 13:09:04
  Library . . : PM42CRT    System name . . :           ABSYSTEM  Version/Release . :   4/2.0   Stopped . . . : 08/11/98 13:38:40
PROTOCOL = ELAN    (SORT BY INTERVAL)
                                                                   -------------- Congestion --------------
         IOP                                  I Frames      I Frames     ----- Local -----     ----- Remote -----                Rsp
 Itv     Name/       Line     Line            Trnsmitd      Recd           Not        Seq        Not        Seq          Frame      Timer
 End     Line        Speed    Util            Per Sec       Per Sec        Ready      Error      Ready      Error        Retry      Ended
-----  ----------  --------  ------         ----------    ----------     -------    -------    -------    -------      -------    -------
       CC03
        (2617)
13:14  PMET2        10000.0      .0                  3             3           0          0          0          0            0          0
13:19  PMET2        10000.0      .0                  2             2           0          0          0          0            0          0
13:24  PMET2        10000.0      .0                  2             1           0          0          0          0            0          0
13:29  PMET2        10000.0      .0                  2             2           0          0          0          0            0          0
13:34  PMET2        10000.0      .0                  1             1           0          0          0          0            0          0
13:38  PMET2        10000.0      .0                  0             0           0          0          0          0            0          0
       CC05
        (2617)
13:14  PMET1        10000.0      .0                  3             3           0          0          0          0            0          0
13:19  PMET1        10000.0      .0                  2             2           0          0          0          0            0          0
13:24  PMET1        10000.0      .0                  1             2           0          0          0          0            0          0
13:29  PMET1        10000.0      .0                  2             2           0          0          0          0            0          0
13:34  PMET1        10000.0      .0                  1             1           0          0          0          0            0          0
13:38  PMET1        10000.0      .0                  0             0           0          0          0          0            0          0
```

Figure 83. Resource Interval Report: Communications Line Detail–ELAN

Communications Line Detail–DDI Sample

```
                                                     Resource Interval Report                                   09/18/98 14:06:00
                                                    Communications Line Detail                                           Page  12
                                                  Sample Resource Interval Report
Member  . . . : PMISTGA1   Model/Serial  . : 500-2142/10-1803D    Main storage  . . : 128.0 M   Started . . . : 08/11/98 13:09:04
  Library . . : PM42CRT    System name . . :           ABSYSTEM  Version/Release . :   4/2.0   Stopped . . . : 08/11/98 13:38:40
PROTOCOL = DDI (SORT BY INTERVAL)
                                                             ------- Congestion -------
         IOP                                I Frames    I Frames    -- Local  --   -- Remote --           Rsp
 Itv     Name/       Line     Line          Trnsmitd    Recd        Not    Seq    Not    Seq     Frame    Timer    MAC
 End     Line        Speed    Util          Per Sec     Per Sec     Ready  Error  Ready  Error   Retry    Ended    Errors
-----  ----------  --------  ------       ----------  ----------   -----  -----  -----  -----  -------  ------  -------
       CC01
        (2618)
13:14  PMDD1       100000.0      .0                3           3       0      0      0      0        0       0        0
13:19  PMDD1       100000.0      .0                0           0       0      0      0      0        0       0        0
13:24  PMDD1       100000.0      .0                2           2       0      0      0      0        0       0        0
13:29  PMDD1       100000.0      .0                0           0       0      0      0      0        0       0        0
13:34  PMDD1       100000.0      .0                1           1       0      0      0      0        0       0        0
13:38  PMDD1       100000.0      .0                0           0       0      0      0      0        0       0        0
       CC02
        (2618)
13:14  PMDD2       100000.0      .0                3           3       0      0      0      0        0       0        0
13:19  PMDD2       100000.0      .0                0           0       0      0      0      0        0       0        0
13:24  PMDD2       100000.0      .0                2           2       0      0      0      0        0       0        0
13:29  PMDD2       100000.0      .0                0           0       0      0      0      0        0       0        0
13:34  PMDD2       100000.0      .0                1           1       0      0      0      0        0       0        0
13:38  PMDD2       100000.0      .0                0           0       0      0      0      0        0       0        0
```

Figure 84. Resource Interval Report: Communications Line Detail–DDI

Communications Line Detail–FRLY Sample

```
                                                   Resource Interval Report                                      09/18/98 14:06:00
                                                  Communications Line Detail                                              Page  14
                                                Sample Resource Interval Report
Member  . . . : PMISTGA1   Model/Serial  . : 500-2142/10-1803D    Main storage  . . : 128.0 M   Started . . . : 08/11/98 13:09:04
  Library . . : PM42CRT    System name . . :           ABSYSTEM  Version/Release . :   4/2.0   Stopped . . . : 08/11/98 13:38:40
PROTOCOL = FRLY (SORT BY INTERVAL)
                                                                ------- Congestion -------
          IOP                           I Frames    I Frames    -- Local  --   -- Remote --           Rsp
 Itv      Name/      Line      Line     Trnsmitd    Recd        Not    Seq    Not    Seq     Frame   Timer    MAC
 End      Line       Speed     Util     Per Sec     Per Sec     Ready  Error  Ready  Error   Retry   Ended    Errors
-----  ----------  --------  ------  ----------  ----------   -----  -----  -----  -----  -------  ------  -------
       CC10
        (2666)
13:14  PMFR1           56.0      .0           0           0       0      0      0      0        0       0        0
13:19  PMFR1           56.0      .0           0           0       0      0      0      0        0       0        0
13:24  PMFR1           56.0      .0           0           0       0      0      0      0        0       0        0
13:29  PMFR1           56.0      .0           0           0       0      0      0      0        0       0        0
13:34  PMFR1           56.0      .0           0           0       0      0      0      0        0       0        0
13:38  PMFR1           56.0      .0           0           0       0      0      0      0        0       0        0
       CC11
        (2666)
13:14  PMFR2           56.0      .0           0           0       0      0      0      0        0       0        0
13:19  PMFR2           56.0      .0           0           0       0      0      0      0        0       0        0
13:24  PMFR2           56.0      .0           0           0       0      0      0      0        0       0        0
13:29  PMFR2           56.0      .0           0           0       0      0      0      0        0       0        0
13:34  PMFR2           56.0      .0           0           0       0      0      0      0        0       0        0
13:38  PMFR2           56.0      .0           0           0       0      0      0      0        0       0        0
```

Figure 85. Resource Interval Report: Communications Line Detail–FRLY

Communications Line Detail–ASYNC Sample

```
                                                   Resource Interval Report                                      09/18/98 14:06:00
                                                  Communications Line Detail                                              Page  16
                                                Sample Resource Interval Report
Member  . . . : PMISTGA1   Model/Serial  . : 500-2142/10-1803D    Main storage  . . : 128.0 M   Started . . . : 08/11/98 13:09:04
  Library . . : PM42CRT    System name . . :           ABSYSTEM  Version/Release . :   4/2.0   Stopped . . . : 08/11/98 13:38:40
PROTOCOL = ASYNC (SORT BY INTERVAL)
          IOP                              Bytes                 Bytes           Total            Pct PDUs
 Itv      Name/      Line      Line        Transmitted           Received        PDUs             Received
 End      Line       Speed     Util        Per Sec               Per Sec         Received         in Error
-----  ----------  --------  ------    ---------------    ------------    ------------    ------------
       CC09
        (2609)
13:14  PMAS1            1.2    17.6                  26               0             106               0
13:19  PMAS1            1.2    10.0                  14               0              64               0
13:24  PMAS1            1.2     7.5                  11               0              55               0
13:29  PMAS1            1.2    13.2                  19               0              72               0
13:34  PMAS1            1.2    11.8                  17               0              47               0
13:38  PMAS1            1.2     7.8                  11               0              36               0
       CC13
        (2609)
13:14  PMAS2            1.2    17.7                   0              26              79               0
13:19  PMAS2            1.2    10.2                   0              15              47               0
13:24  PMAS2            1.2     7.5                   0              11              32               0
13:29  PMAS2            1.2    13.2                   0              19              57               0
13:34  PMAS2            1.2    11.8                   0              17              54               1
13:38  PMAS2            1.2     7.8                   0              11              29               0
```

Figure 86. Resource Interval Report: Communications Line Detail–ASYNC

Communications Line Detail–BSC Sample

Resource Interval Report 09/18/98 14:06:00
Communications Line Detail Page 18
Sample Resource Interval Report

Member . . . : PMISTGA1 Model/Serial . : 500-2142/10-1803D Main storage . . : 128.0 M Started . . . : 08/11/98 13:09:04
Library . . : PM42CRT System name . . : ABSYSTEM Version/Release . : 4/2.0 Stopped . . . : 08/11/98 13:38:40
PROTOCOL = BSC (SORT BY INTERVAL)

Itv End	IOP Name/ Line	Line Speed	Line Util	Bytes Transmitted Per Sec	Total Data Characters Transmitted	Pct Data Characters Transmitted in Error	Bytes Received Per Sec	Total Data Characters Received	Pct Data Characters Received in Error	Line Errors
	CC13 (2609)									
13:14	PMBS1	19.2	.9	7	2,360	0	13	4,124	0	0
13:14	PMBS2	19.2	.9	13	4,124	0	7	2,360	0	0
13:19	PMBS1	19.2	1.1	9	2,990	0	17	5,226	0	0
13:19	PMBS2	19.2	1.1	17	5,226	0	9	2,990	0	0
13:24	PMBS1	19.2	.9	8	2,568	0	15	4,488	0	0
13:24	PMBS2	19.2	.9	15	4,488	0	8	2,568	0	0
13:29	PMBS1	19.2	1.1	10	3,103	0	18	5,423	0	0
13:29	PMBS2	19.2	1.1	18	5,423	0	10	3,103	0	0
13:34	PMBS1	19.2	1.2	11	3,424	0	19	5,984	0	0
13:34	PMBS2	19.2	1.2	19	5,984	0	11	3,424	0	0
13:38	PMBS1	19.2	1.0	9	2,463	0	15	4,302	0	0
13:38	PMBS2	19.2	1.0	15	4,302	0	9	2,463	0	0

Figure 87. Resource Interval Report: Communications Line Detail - BSC

Communications Line Detail–ISDN Network Interface Sample

Resource Interval Report 09/23/98 06:14:04
Communications Line Detail Page 15
Sample Resource Interval Report

Member . . . : ISDNDATA Model/Serial . : 500-2142/10-10DFD Main storage . . : 320.0 M Started . . . : 08/14/98 13:30:23
Library . . : ISDNDATA System name . . : ABSYSTEM Version/Release . : 4/2.0 Stopped . . . : 08/14/98 13:45:27
PROTOCOL = ISDN NETWORK INTERFACE (SORT BY INTERVAL)

Itv End	IOP Name/ Network Interface	Line Speed	--Outgoing-- ---Calls--- Total	Pct Retry	---Incoming--- ----Calls---- Total	Pct Reject	LAPD Total Frames Trnsmitd	LAPD Pct Frames Trnsmitd Again	LAPD Total Frames Recd	LAPD Pct Frames Recd in Error	Loss of Frame Alignment	Local End Code Violation	Collision Detect
	CC05 (2605)												
13:35	X31N00	16.3	0	0	0	0	60	0	60	0	0	0	0
13:35	X31N01	16.3	0	0	0	0	60	0	60	0	0	0	0
13:40	X31N00	16.3	0	0	0	0	60	0	60	0	0	0	0
13:40	X31N01	16.3	0	0	0	0	60	0	60	0	0	0	0
13:45	X31N00	16.3	0	0	0	0	60	0	60	0	0	0	0
13:45	X31N01	16.3	0	0	0	0	60	0	60	0	0	0	0

Itv End	-- End time of the data collection interval or time that vary off occurred
IOP Name/ Network Interface	-- IOP resource name and model number, Network interface description
Line Speed	-- Line speed (1000 bits per second)
Outgoing Calls Total	-- Number of outgoing call attempts
Outgoing Calls Pct Retry	-- Percent of outgoing calls that were rejected by the network
Incoming Calls Total	-- Number of incoming call attempts
Incoming Calls Pct Reject	-- Percent of incoming calls that were rejected
LAPD Total Frames Trnsmitd	-- Number of frames transmitted (applies to D-channel only)
LAPD Pct Frames Trnsmitd Again	-- Percent frames re-transmitted due to error (applies to D-channel only)
LAPD Total Frames Recd	-- Number of frames received (applies to D-channel only)
LAPD Pct Frames Recd in Error	-- Percent frames received in error (applies to D-channel only)
Loss of Frame Alignment	-- Number of times a time period equivalent to two 48 bit frames elapsed without detecting valid pairs of line code violations
Local End Code Violation	-- Number of unintended code violations detected by the TE for frames received on the T interface
Collision Detect	-- Number of times that a transmitted frame corrupted by another frame was detected

Figure 88. Resource Interval Report: Communications Line Detail - ISDN Network Interface

Communications Line Detail–NWI Maintenance Sample

```
                                                  Resource Interval Report                                   11/10/95 08:00:33
                                                 Communications Line Detail                                          Page  13
                                                 User-Selected Report Title

Member  . . . : MONDAY     Model/Serial  . : 200-2050/10-1500500 Main storage  . . :  160.0 M  Started . . . :  11/02/95 14:31:23
  Library . . : QPFRDATA   System name . . :         ABSYSTEM   Version/Release . :   3/ 6.0  Stopped . . . :  11/02/95 16:26:12

PROTOCOL = NWI MAINTENANCE CHANNEL (SORT BY INTERVAL)

          IOP                               Percent
         Name/                    Percent   Severely   -----Detected Access-----   Far End
 Itv     Network      Line        Errored   Errored    ----Transmission Error---   Code
 End     Interface    Speed       Seconds   Seconds        In            Out       Violation
-----    ----------   --------    -------   --------   ----------     ----------   ----------
         CC11
         (2623)

14:46    ISDNSS_A        16.3        50        36             734            83           32
15:01    ISDNSS_A        16.3         6        24              32            14           52
15:16    ISDNSS_A        16.3         0         0               0             0            0
```

Figure 89. Resource Interval Report: Communications Line Detail - NWI Maintenance Channel

Communications Line Detail–IDLC Samples

```
                                                  Resource Interval Report                                   05/22/96 10:29:40
                                                 Communications Line Detail                                          Page  15
Member  . . . : ECL        Model/Serial  . : 500-2142/10-10DFD    Main storage  . . : 320.0 M   Started . . . : 04/15/96 10:35:30
  Library . . : PM37CT     System name . . :            ABSYSTEM  Version/Release . :   3/7.0   Stopped . . . : 04/15/96 12:35:32
PROTOCOL = IDLC (SORT BY INTERVAL)
         IOP                         Transmit/             ---Frames----              ---Frames----
        Name/                        Receive/   Bytes      -Transmitted-  Bytes      --Received---  Receive                       Short
 Itv  Network    Line        Line    Average    Trnsmitd             Pct  Recd                 Pct  CRC       Aborts    Sequence  Frame
 End  Interface  Descriptn   Speed   Line Util  Per Sec    Total     Err  Per Sec    Total     Err  Errors    Recd      Error     Errors
----- ---------- ---------- -----   ---------  --------   --------- ---  -------    --------- ---  -------   -------   --------  -------
       CC05
        (2605)
11:43 ISDNA      IDLCA01     64.0    00/00/00        42         49   4       33          47   2        0         0         0        0
11:43 ISDNB      IDLCB01     64.0    00/00/00         2          1   0        0           0   0        0         0         0        0
```

Figure 90. Resource Interval Report: Communications Line Detail–IDLC

```
                                                  Resource Interval Report                                   05/22/96 10:29:40
                                                 Communications Line Detail                                          Page  17
Member  . . . : ECL        Model/Serial  . : 500-2142/10-10DFD    Main storage  . . : 320.0 M   Started . . . : 04/15/96 10:35:30
  Library . . : PM37CT     System name . . :            ABSYSTEM  Version/Release . :   3/7.0   Stopped . . . : 04/15/96 12:35:32
PROTOCOL = IDLC (SORT BY INTERVAL)
         IOP
        Name/
 Itv  Network     Line
 End  Interface   Description  Channel
----- ----------  -----------  -------
       CC05
        (2605)
11:43 ISDNA       IDLCA01      B1
11:43 ISDNB       IDLCB01      B1
```

Figure 91. Resource Interval Report: Communications Line Detail - IDLC

IOP Utilizations–Sample

```
                                                    Resource Interval Report                                      12/11/00 16:44:05
                                                        IOP Utilizations                                                   Page  30
 Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM         Main storage  . . : 2048.0 MB Started . . . : 12/07/00 12:10:39
   Library . . : PTNOELIB   System name . . : ABSYSTEM             Version/Release . :     5/1.0 Stopped . . . : 12/07/00 23:45:00
 Partition ID  : 00         Feature Code  . : 22A8-2252-1519
IOP Name/          Itv  - IOP Processor Utils -     DASD Ops per sec     - KB per I/O -   KBytes Transmitted    Avail Local
 (Model)           End  Total  Comm  LWSC  DASD    Reads       Writes    Read    Write      IOP      System     Storage (K) Util 2
----------------- ----- ----- ----- ----- ----- ----------- ----------- ------- ------- ----------- ----------- ----------- ------
CC02       (2890) 12:15    .6    .0    .0    .0                                                   0           0      63,561    .0
                  12:30   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  12:45    .8    .0    .0    .0                                                   1           0      63,561    .0
                  13:00    .9    .0    .0    .0                                                   1           0      63,561    .0
                  13:15    .9    .0    .0    .0                                                   1           0      63,561    .0
                  13:30    .8    .0    .0    .0                                                   1           0      63,561    .0
                  13:45    .9    .0    .0    .0                                                   1           0      63,561    .0
                  14:00    .9    .0    .0    .0                                                   1           0      63,561    .0
                  14:15    .8    .0    .0    .0                                                   1           0      63,561    .0
                  14:30   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  14:45   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  15:00   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  15:15   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  15:30   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  15:45   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  16:00   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  16:15   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  16:30   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  16:45   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  17:00   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  17:15   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  17:30   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  17:45   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  18:00   1.0    .0    .0    .0                                                   1           0      63,561    .0
                  18:15   1.0    .0    .0    .0                                                   1           0      63,561    .0
 IOP Name/                -- Input/Output processor resource name and
 (Model)                     model number of the attached device
 Itv End                  -- Interval end time (hour and minute)
 IOP Processor Util Total -- Total utilization for IOP
 IOP Processor Util Comm  -- Utilization of IOP due to communications activity
 IOP Processor Util LWSC  -- Utilization of IOP due to local workstation activity
 IOP Processor Util DASD  -- Utilization of IOP due to DASD activity
 DASD Ops per sec Reads   -- Number of reads per second
 DASD Ops per sec Writes  -- Number of writes per second
 K Per Read               -- Average number of kilobytes (1024) per read operation
 K Per Write              -- Average number of kilobytes (1024) per write operation
 IOP KBytes Transmitted   -- Number of Kbytes transmitted from the IOP to the system across the bus
 System KBytes Transmitted-- Number of Kbytes transmitted from the system to the IOP cross the bus
 Avail Local Storage (K)  -- Number of kilobytes (1024) of local storage that is free
 Util 2                   -- Utilization of co-processor
```

Figure 92. Resource Interval Report: IOP Utilizations

Local Work Station Response Times–Sample

```
                                                    Resource Interval Report                                      12/11/00 16:44:05
                                                Local Work Station Response Times                                          Page  34
 Member  . . . : PT51MBR15  Model/Serial  . : 270/10-45WFM         Main storage  . . : 2048.0 MB Started . . . : 12/07/00 12:10:39
   Library . . : PTNOELIB   System name . . : ABSYSTEM             Version/Release . :     5/1.0 Stopped . . . : 12/07/00 23:45:00
 Partition ID  : 00         Feature Code  . : 22A8-2252-1519
IOP Name/           Work Station  Itv           Active                                                                       Rsp
 (Model)            Controller    End      Util  Wrk Stn    0.0- 1.0     1.0- 2.0     2.0- 4.0     4.0- 8.0     > 8.0    Time
-----------------   ------------  -----    ----  -------    ---------    ---------    ---------    ---------    -------  ------
                                                            ---------    ---------    ---------    ---------    -------  ------
 Total Responses:                                                   0            0            0            0          0     .00
 IOP Name/               -- Input/Output processor resource name and
 (Model)                    model number of the attached device
 Work Station Controller -- Work station controller description name
 Itv End                 -- Interval end time (hour and minute)
 Util                    -- Percentage of utilization for each IOP
 Active Wrk Stn          -- Number of work stations with activity
  0.0- 1.0               -- Number of response times between  0.0 and  1.0 seconds
  1.0- 2.0               -- Number of response times between  1.0 and  2.0 seconds
  2.0- 4.0               -- Number of response times between  2.0 and  4.0 seconds
  4.0- 8.0               -- Number of response times between  4.0 and  8.0 seconds
    > 8.0                -- Number of response times >  8.0 seconds
 Rsp Time                -- Average external response time (in seconds) for
                            work stations on this controller
```

Figure 93. Resource Interval Report: Local Work Station Response Times

Remote Work Station Response Times–Sample

```
                                                    Resource Interval Report                                  09/24/98 07:40:58
                                                Remote Work Station Response Times                                       Page   9
                                                 Sample Resource Interval Report
 Member  . . . : TEST20     Model/Serial  . : 500-2142/10-317CD    Main storage  . . : 128.0 M   Started . . . : 09/19/98 16:47:34
   Library . . : RWSDATA    System name . . :            ABSYSTEM  Version/Release . :   4/2.0   Stopped . . . : 09/19/98 17:12:36
IOP Name/           Work Station   Itv              Active                                                                   Rsp
 (Model)            Controller     End              Wrk Stn     0.0- 1.0     1.0- 2.0     2.0- 4.0     4.0- 8.0     > 8.0    Time
-----------------   ------------  -----             -------    ---------    ---------    ---------    ---------    -------  ------
CC02      (    )       ABSYSTEM   16:52                   1          162            0            0            0          0     .02
                                  16:57                   1          174            0            0            0          0     .02
                                  17:02                   1          195            0            0            0          0     .03
                                  17:07                   2          314            0            0            0          0     .02
                                                                ----------   ----------   ----------   ---------- ----------   ------
 Total Responses:                                                      845            0            0            0          0     .02
 IOP Name/                -- Input/Output processor resource name and
 (Model)                     model number of the attached device
 Work Station Controller -- Work station controller description name
 Itv End                  -- Interval end time (hour and minute)
 Active Wrk Stn           -- Number of work stations with activity
  0.0- 1.0                -- Number of response times between  0.0 and  1.0 seconds
  1.0- 2.0                -- Number of response times between  1.0 and  2.0 seconds
  2.0- 4.0                -- Number of response times between  2.0 and  4.0 seconds
  4.0- 8.0                -- Number of response times between  4.0 and  8.0 seconds
    > 8.0                 -- Number of response times >  8.0 seconds
 Rsp Time                 -- Average external response time (in seconds) for
                             work stations on this controller
```

Figure 94. Resource Interval Report: Remote Work Station Response Times

Batch Job Trace Report

Printing the Batch Job Trace Report

Use the Print Trace Report (PRTTRCRPT) command. Before you print the Batch Job Trace Report, you must use the Start Performance Trace (STRPFRTRC) command with the JOBTRCITV and JOBTYPE options to start the trace data collection and then end the trace data collection with the ENDPFRTRC command. Print the Transaction Report (PRTTNSRPT) command with the *FILE option. The PRTTNSRPT command creates the QTRJOBT file that the Batch Job Trace Report uses.

What Is the Batch Job Trace Report?

The Batch Job Trace Report shows the progression of different job types (for example, batch jobs) traced through time. Resources utilized, exceptions, and state transitions are reported.

See “Performance Report Columns” on page 157 for definitions of specific columns in the reports.

Job Summary

The Job Summary section of the Batch Job Trace Report gives the number of traces, the number of I/O operations, the number of seize and lock conflicts, the number of state transitions for each batch job.

See the sample report shown in Figure 95 on page 147.

Job Summary Report–Sample

```
                                                      Batch Job Trace Report                                                      9/05/98 14:15:10
                                                           Job Summary                                                                   Page    1
                                                     Sample Job Trace Report
Member  . . . : Q981421246 Model/Serial  . : 500-2142/10-1803D   Main storage . . :  128.0  M  Started . . . . :  05/22/98 12:47:35
  Library . . : THREAD1    System name . . :         ABSYSTEM   Version/Release  :    4/ 2.0  Stopped . . . . :  05/22/98 12:52:38
                                                                      ----  Physical   ----    Seize    ---   State    ---
   Job          User       Job            -- Job --   Number   CPU    ----  I/O  Count  ----   and Lock  --- Transitions ---
   Name         Name      Number   Pool   Type  Pty   Traces   Util      Sync        Async    Conflicts     A-A        A-I
----------   ----------   ------   ----   ----  ---   ------   ----   ----------  ----------  ---------  ---------  ---------
QPFRMON      QPGMR        013842    02     B     0        5    11.7          604         235          0          1          0
Job Name                     -- Name of the job
User Name                    -- User name
Job Number                   -- Job number
Pool                         -- Pool in which the job ran
Job Type                     -- Job type and subtype
Job Pty                      -- Priority of the job
Number Traces                -- Number of traces
CPU Util                     -- Percentage of available CPU time used.  This is the average of all processors
Physical I/O Count
    Sync                     -- Number of synchronous I/O operations
    Async                    -- Number of asynchronous I/O operations
Seize and Lock Conflicts     -- Number of seize conflicts and lock waits
State Transitions A-A        -- Number of active-to-active transitions
State Transitions A-I        -- Number of active-to-ineligible transitions
```

Figure 95. Sample of Job Summary Report

Performance Trace Database Files

The Print Transaction Report (PRTTNSRPT) command has options to build formatted database files. These files can extend your performance analysis capabilities beyond what the standard trace reports provide.

Using parameters on this command, you can specify a combination of reports and files to be built in a single run, select specific time ranges and jobs, and limit the amount of report and file data produced. If you specify *FILE on the RPTTYPE parameter of the PRTTNSRPT command, the transaction report creates the files QTRTSUM, QTRJSUM, and QTRJOBT. If you specify *TRCDTA on the RPTTYPE parameter of the PRTTNSRPT command, the report creates the file QTRDMPT.

QTRTSUM and QTRJOBT Files

The transaction summary file (QTRTSUM) and job TSE (time slice end) (QTRJOBT) files have the same format; however, they represent different types of information.

- QTRTSUM (transaction summary) file contains one record for every interactive transaction identified by the PRTTNSRPT command.
- QTRJOBT (job time slice end) file contains one record per time slice end for all jobs. Time slice end records are created if the job CPU usage reaches one of the following values:
  - External CPU time slice value
  - An internal time slice value defined by the Start Performance Trace (STRPFRTRC) command.

In the QTRTSUM file, the summary data represents the activity for the transaction. In the QTRJOBT file, the summary data represents activity that has occurred since the last TSE or other multiprogramming level trace record.

Table 14. QTRTSUM File

Field Name	Description
TRNYEAR	Transaction start year

Table 14. QTRTSUM File (continued)

Field Name	Description
TRNMONTH	Transaction start month
TRNDAY	Transaction start day
TRNHOUR	Transaction start time hour
TRNMIN	Transaction start time minute
TRNSEC	Transaction start time second
TRNSECD	Transaction start time decimal (milliseconds)
TRQUAL	Trace qualifier (QTRJOBT file only) • 139–Job external time slice end. • 145–Job internal time slice end (the CPU time used). The value is specified in the JOBITVTRC parameter on the STRPFRTRC command.
TSKJOB	Job name
TSKUSR	User name
TSKNUM	Task number
TDENUM	TDE number (system assigned)
TSPOOL	Main storage pool in which the job ran
TPRTY	Current job priority
TTYPE	Job type and subtype. Refer to explanation of the *Typ* field in "Job Summary Section" on page 97 for a list of types and subtypes.
TPURGE	Purge attribute (Y/N). Defines whether or not the job is eligible to have its PAG purged at the end of the transaction.
TRSP	Response time (in seconds). The time from the first W→A transition to the last A→W transition in the transaction.
TCPU	CPU time (in seconds) used by this job during the transaction. It does not include the CPU time for asynchronous server tasks such as Licensed Internal Code work station IOM, asynchronous disk I/O tasks, and others
TSDBRD	Synchronous database reads (count)
TSDBWRT	Synchronous database writes (count)
TSNDBRD	Synchronous nondatabase reads (count)
TSNDBWRT	Synchronous nondatabase writes (count)
TADBRD	Asynchronous database reads (count) Refer to the IOPND and SYSYNC fields in the QAITMON file created by the WRKSYSACT command or to the JBIPF and JBIOW fields in the QAPMJOBS sample data file created by Collection Services for the job to see how many asynchronous disk reads were turned into synchronous reads.
TADBWRT	Asynchronous database writes (count)
TANDBRD	Asynchronous nondatabase reads (count) (See field TADBRD.)
TANDBWRT	Asynchronous nondatabase writes (count)
TPAGFLT	Process access group (PAG) faults (count)
TBIN	Binary overflow count
TDEC	Decimal overflow count
TEAOCNT	Reserved

Table 14. QTRTSUM File (continued)

Field Name	Description
TCHKSUM	Reserved
TACT	Time in the activity level (in seconds)
TWAIT	Short wait time in the activity level (in seconds)
TINELW	Wait-to-ineligible (W→I) transition time waiting for activity level (in seconds). This occurs after coming out of a long wait such as start of transaction or the end of a lock wait.
TINELA	Active-to-ineligible (A→I) time slice end (TSE) transition time waiting for activity level (in seconds). This occurs after leaving the activity level at external time slice end because other equal or higher priority jobs were waiting for an activity level.
TAICNT	The number of active-to-ineligible (A→I) transitions. The number of external time slice ends that caused the job to leave the activity level because there were equal or higher priority jobs waiting for an activity level.
TAACNT	The number of active-to-active (A→A) transitions. The number of external time slice ends that did not cause the job to leave the activity level because there were no equal or higher priority jobs waiting for an activity level.
TEXWTM	Total exceptional wait time (in seconds). Sum of the following fields: **TINELA** Active-ineligible wait **TWAIT** Short wait **TSWXTM** Short wait extended **TSZTM** Seize wait **TLCKTM** Lock wait **T3270** 3270 wait **TDDM** DDM wait **TEVTM** Event wait **TXATM** Total excess active time (added only for interactive jobs) **TDELTM** Delay time (added only for noninteractive jobs) *no-name* Miscellaneous wait time. For example save/restore, diskette, or tape mount and respond to mount message.
TSWTM	Total short wait time (in seconds). Short wait time (SW time in the transaction reports) is the time spent waiting for an event (such as work station output complete) while remaining in the active state. When the short wait ends (it ends automatically after 2 seconds), the job goes into the short wait extended state.
TSWXTM	Total short wait extended (short wait time-out) time (in seconds). See field TSWTM. During the time a job is in short wait extended (abbreviated SWX in the transaction reports), it does not hold an activity level (it is in the wait state). The short wait is satisfied when the waited-on event occurs.
TSWXCNT	Total number of short waits extended. The number of short waits where the job was taken out of the activity level after 2 seconds and put into long wait (an A→W transition).

Table 14. QTRTSUM File (continued)

Field Name	Description
TSZTM	Total seize conflict wait time (in seconds). Total time this job waited in the activity level for seize conflicts.
TLCKTM	Total lock conflict wait time (in seconds). Total time this job waited outside the activity level for lock conflicts.
THOLDTM	Total seize/lock conflict hold time to other jobs. The field contains the total time that other jobs waited for objects held by this job. For example, when a job held an object for 2 seconds and for that time two other jobs waited for the object, the THOLDTM value would be 4.
TEVTM	Total event wait time (in seconds)
TXATM	Total excess active time (in seconds). A calculated value, not a measured value, that represents the time a job was in the activity level, could not use the CPU, and is not accounted for by other measurements. It can be the result of waiting behind equal or higher priority jobs for the CPU, waiting to do disk I/O, or waiting for an internal, non-instrumented object such as the free space lock on storage management.
T3270	Total 3270 emulation wait time
TDDM	Total DDM wait time (in seconds)
TMRT	Total MRT wait time (in seconds)
TDELTM	Total long wait time (in seconds) such as key/think wait time or delay time
TSZLCKCT	Seize and lock conflicts encountered by this job (count)
TSZLCKRL	Seize and lock releases done by this job when other jobs waited (count)
TBMPL	Number of jobs holding an activity level in this job's pool at transaction start (count)
TIMPL	Number of jobs waiting for activity level in this job's pool at transaction start (count)
TPGM1	First program name in stack at the end of transaction
TPGM2	Second program name in stack at the end of transaction
TPGM3	Third program name in stack at the end of transaction
TPGM4	Fourth program name in stack at the end of transaction
TPGM	Program that caused transaction (one of these field names is the application in control of the transaction)
TELAP	Elapsed time of transaction (in seconds)
TPVPGM	Previous program name
TIPRTY	Assigned job priority
TTHID	Thread identifier
TTHFLG	Secondary thread flag (0=initial thread, 1=secondary thread)

QTRJSUM File

The job summary file QTRJSUM contains one record for each job or task listed on the PRTTNSRPT job summary report.

Table 15. QTRJSUM File

Field Name	Description
TDENUM	TDE number. Licensed Internal Code task dispatching element.
JOBID	Job name
USERID	User name
JOBNUM	Job number

Table 15. QTRJSUM File (continued)

Field Name	Description
POOL	Storage pool the job started in
JOBTYP	Job type code Refer to explanation of the *Typ* field in Job Summary Section for a list of types and subtypes.
TRCPER	Trace period sequence number (reserved)
JDATE	Job start date MM/DD/YY
JSTART	Job start time HH:MM:SS
JSTOP	Job stop time HH:MM:SS
JELAP	Job total elapsed time (in seconds)
JCPU	Job total CPU time (in seconds)
JDBIO	Job total disk database reads
JNDBIO	Job total disk nondatabase reads
JWRTIO	Job total disk writes

The following fields are totals for the duration of the job, unless the beginning or end time selection option was taken on the PRTTNSRPT command. Then the values are for the selected time only.

TRNNUM	Total number of transactions (type I jobs only)
JBEG	Transaction report selection beginning time HHMMSS
JEND	Transaction report selection ending time HHMMSS
JOBELP	Total elapsed time (in seconds) for the job (job start to job end)
JOBCPU	CPU time (in seconds) the job used
JOBDB	Total disk database reads
JOBNDB	Total disk nondatabase reads
JOBWRT	Total disk writes
JARSP	Average transaction response time (in seconds) (type I jobs only)
JMRSP	Maximum transaction response time (in seconds) (type I jobs only)
JACPU	Average CPU time per transaction (in seconds) (type I jobs only)
JMCPU	Maximum CPU time by a transaction (in seconds) (type I jobs only)
JADBR	Average disk database reads per transaction (type I jobs only)
JANDBR	Average disk nondatabase reads per transaction (type I jobs only)
JAWRT	Average disk writes per transaction (type I jobs only)
JAIO	Average disk I/O per transaction (type I jobs only)
JMIO	Maximum disk I/O by a transaction (type I jobs only)
JWI	Total number of W→I transitions
JAI	Total number of A→I transitions
JLCKS	Total number of lock conflicts
JATM	Total time the job was in an activity level (in seconds)
JWTM	Total short wait time in an activity level (in seconds)
JINELW	Total ineligible time as a result of wait-to-ineligible transitions (in seconds)
JINELA	Total ineligible time as a result of active-to-ineligible transitions (in seconds)

JLKWTM	Total wait time for short wait and short wait extended, QEM wait, DDM wait, and save/restore, diskette, or tape wait.
JKYTK	Total key/think time (in seconds)
TSKID	Combined job name, user ID, and user name fields
JSPRTY	Assigned job priority
JTHID	Thread identifier
JTHFLG	Secondary thread flag (0=initial thread, 1=secondary thread)

QTRDMPT File

The QTRDMPT file is a version of the QAPMDMPT file formatted as a database file. It gives you access to each trace record created. The QAPMDMPT file is built when you end the performance trace (ENDPFRTRC). You specify the member into which you want to dump the trace data. The QAPMDMPT file can also be built with the DMPTRC command.

The field names shown below without asterisks contain information taken directly from the QAPMDMPT file. Field names shown below with an asterisk (*) in front of them contain information created by the transaction report. Unless otherwise specified, numeric values are in decimal.

Table 16. QTRDMPT File

Field Name	Description
DSEQNM	Sequence number in QAPMDMPT (relative record in file)
DTID	Trace ID in hexadecimal X'68' Resource management (seize/lock activity) X'70' MPL trace record (job state transitions) X'73' Trace control record (job/task start/stop/existence) X'AB' Transaction boundary trace record X'AC' Transaction boundary trace record–source pass-through, target pass-through, and WSF (work station function) target pass-through All other trace identifiers are ignored by the transaction report.

Table 16. QTRDMPT File (continued)

Field Name	Description
DTQUAL	Trace qualifier If DTID = X’68’ seize/lock trace (Licensed Internal Code tasks or OS/400 jobs), the trace qualifiers are: 701 Job/task entered seize conflict wait 1001 Job/task released seize that is being waited on 903 Job entered lock conflict wait 906 Job released lock that is being waited on If DTID = X’70’ MPL trace (OS/400 jobs only), the valid trace qualifiers for active state codes are: 129 Ineligible-to-active transition 131 Message received and job was in current activity level when the message was received 133 Dequeue after time-out; job in current activity level when the message was received 135 Wait-to-active 137 Wait timed out, no message received; wait-to-active 139 Active-to-active (job external time slice end) 142 Wait-to-active (job is already in activity level) 145 STRPFRTRC pseudo TSE; active-to-active The trace qualifiers for wait state codes are: 128 Just initiated job cannot get into activity level 130 Active-to-wait transition; drop from activity level 132 Wait-to-ineligible transition 134 Active-to-wait but stay in activity level 136 Time slice end; active-to-ineligible If DTID = X’73’ control trace (OS/400 jobs and SLIC tasks), the valid qualifiers are: 130 Job started while trace was active 133 Job ended while trace was active 127 Job active at start of trace 136 Job active at end of trace 129 SLIC task started while trace was active 132 SLIC task ended while trace was active 126 SLIC task active at start of trace 135 SLIC task active at end of trace
DTRDAT	Transition date YYYYMMDD
DTRTM	Transition time HHMMSSmmm
DTRHR	Transition hour xx.xxxxxxx
DTRELP	Elapsed seconds from previous state
*DPVDAT	Previous transition date YYYYMMDD
*DPVTM	Previous transition time HHMMSSmmm
*DPVHR	Previous transition hour xx.xxxxxxx
DTDEHX	TDE number in hexadecimal
DSPOOL	Pool number in which job ran
DPRTY	Current job priority
DTYPE	Job type and subtype. Refer to explanation of the *Typ* field in “Job Summary Section” on page 97 for a list of types and subtypes.
DPURGE	Job purge attribute: 0=No, 1=Yes
DCPU	Total CPU time (in seconds)

Table 16. QTRDMPT File (continued)

Field Name	Description
*DLPCPU	CPU time since last job state transition (in seconds)
*DCPUPC	Percentage of CPU usage since last job state transition
DJOBNM	Job name
DUSRNM	User name
DJOBNB	Job number
*DTRSTA	Transition to this state; this matches what is shown in the Transition Report
*DTRWAT	Transition wait code; this matches what is shown in the Transition Report
DMPL	Current number of pool activity levels in use
DIPL	Number of ineligible jobs waiting for pool activity level
DCSDR	Synchronous database reads (cumulative)
*DISDR	Synchronous database reads (since last transition)
DCSDW	Synchronous database writes (cumulative)
*DISDW	Synchronous database writes (since last transition)
DCSNR	Synchronous nondatabase reads (cumulative)
*DISNR	Synchronous nondatabase reads (since last transition)
DCSNW	Synchronous nondatabase writes (cumulative)
*DISNW	Synchronous nondatabase writes (since last transition)
DCADR	Asynchronous database reads (cumulative)
*DIADR	Asynchronous database reads (since last transition)
DCADW	Asynchronous database writes (cumulative)
*DIADW	Asynchronous database writes (since last transition)
DCANR	Asynchronous nondatabase reads (cumulative)
*DIANR	Asynchronous nondatabase reads (since last transition)
DCANW	Asynchronous nondatabase writes (cumulative)
*DIANW	Asynchronous nondatabase writes (since last transition)
DCPAG	Process access group (PAG) faults (cumulative)
*DIPAG	Process access group (PAG) faults (since last transition)
DCEAO	Reserved
*DIEAO	Reserved
DCCKSM	Reserved
*DICKSM	Reserved
DCDEC	Decimal overflow exceptions (cumulative)
*DIDEC	Decimal overflow exceptions (since last transition)
DCBIN	Binary overflow exceptions (cumulative)
*DIBIN	Binary overflow exceptions (since last transition)
DCFLP	Floating point overflow exceptions (cumulative)
*DIFLP	Floating point overflow exceptions (since last transition)
DCPWT	Permanent writes (cumulative)
*DIPWT	Permanent writes (since last transition)
DPGM1	Program 1 (last) (DTID = X’70’ only)

Table 16. QTRDMPT File (continued)

Field Name	Description
DPGM2	Program 2 (second from the last) (DTID = X'70' only)
DPGM3	Program 3 (third from the last) (DTID = X'70' only)
DPGM4	Program 4 (fourth from the last) (DTID = X'70' only)
Resource management data. The following three fields contain valid information only for records that have DTID=X'68' (Resource Management Trace).	
DSLJOB	Job/task name of seize/lock waiter/holder
DSLUSR	User name of seize/lock waiter/holder
DSLNBR	Job number of seize/lock waiter/holder
The following five fields can have data that is not valid if the object was destroyed before the trace was dumped to the QAPMDMPT file.	
DSLOTY	Seize/lock object type **Note:** Object types and codes can be found in *iSeries Licensed Internal Code Diagnostic Aids - Volume 1*.
DSLOLB	Seize/lock object library name (may be undefined for machine objects) A **machine object** is a program object that has no defined storage form; the object is defined internally to the machine.
DSLOFL	Seize/lock object file/object name (may be undefined for machine objects)
DSLOMB	Seize/lock object member name (database files only)
DSLRRN	Relative record number of the lock database file (if report is run on same system that it was collected on and the file still exists)
DRSVD1	Reserved
DRSVD2	Reserved
Transaction boundary information. These fields contain valid information only for trace records with DTID = X'AB' or X'AC'.	
DTNTY	Transaction type (in decimal) 1 Display I/O 2 Data queue 3 MRT 4 Source pass-through 5 Target pass-through 6 WSF target pass-through
DTNSTY	Transaction subtype (in decimal) If DTNTY = 1, 2, or 3: 1 Start transaction 2 End transaction 3 End response time transaction (for DTNTY = 1 only) IF DTNTY = 4, 5, or 6: 1 Start transaction 2 End transaction 3 Start session 4 End session
DTNBIT	Reserved

DTNNM1	Name of display device for display I/O transactions Name of data queue library for data queue transactions Name of display device for MRT transactions Name of device description for pass-through transactions
DTNNM2	Name of display file for display I/O transactions Name of data queue for data queue transactions Name of display file for MRT transactions Name of target control point for source pass-through transactions Name of source control point for target pass-through transactions Name of controller description for WSF target pass-through transactions
DTNNM3	Reserved
DTNNM4	Reserved
DTNDAT	Date of transaction YYYYMMDD
DTNTM	Time of transaction HHMMSSmmm
DTNHR	Hour of transaction xx.xxxxxxx
*DTNBDY	Transaction boundary flag: Set to 1 if this trace record is at a transaction boundary; set to 0 if it is not at a transaction boundary.
DTNID	Reserved
DIPRTY	Assigned job priority
DTHID	Thread identifier
DTHFLG	Secondary thread flag (0=initial thread, 1=secondary thread)

QAPTLCKD File

QAPTLCKD is the file created by using the Print Lock Report (PRTLCKRPT) from information in the QAPMDMPT trace data file. This file contains data on seizes and locks. Table 17 shows a description of each field in the QAPTLCKD file.

Table 17. QAPTLCKD File

Field Name	Description
SLWTOD	Time of day (HH.MM.SS) that the requesting job REQNAM had either a seize or lock conflict on the object OBJNAM that was held by job HLDNAM.
SLWLEN	Length of time (in milliseconds) from the start of the object conflict until the holding job released the object. This is not necessarily the amount of time that the requesting job is delayed in getting the object. That time may be longer than the conflict delay.
SLCODE	The type of conflict: blank = Seize, L = Lock. Seizes occur only in Licensed Internal Code or implicitly within high-level MI instructions such as Create Object or Add to a File. Locks occur in jobs running in the OS/400 program and can be explicitly requested.
REQTDE	Requesting job's TDE number

Table 17. QAPTLCKD File (continued)

Field Name	Description
REQNAM	Requesting job's name, user ID, job number **Position** **Value** **1-10** Job name **12-21** User name **23-28** Job number
REQTTH	Requesting job's thread identifier
HLDTDE	Holding job's TDE number
HLDNAM	Holding job's name, user ID, job number **Position** **Value** **1-10** Job name **12-21** User name **23-28** Job number
HLDTTH	Holding job's thread identifier
OBJADR	The address of the object **Position** **Value** **1-8** Segment address **9-12** Offset
OBJNAM	The object type, name, library (if applicable), and member (if applicable) **Position** **Value** **1-6** Object type description **8-17** Name **19-28** Library **30-39** Member (database files and indexes) In some cases the object type may not be translated; instead it may be a 2-byte hexadecimal code. If the object name is not meaningful, it is possible that the object address is one of the system's preassigned addresses.
OBJRRN	Database file record number. Valid only for type DS (data space) when the Print Lock Report (PRTLCKRPT) command created the QAPTLCKD file on the same system that the data was collected on.

Performance Report Columns

>8.0 (Component) The number of times the response time was greater than 8 seconds.

---------- (pgmname)
(Transaction) The transaction totals record. For example, ---------- QUYLIST,

as shown in Figure 65 on page 120. This report line occurs each time the job has an active-to-wait transaction. Totals are created for Rsp* (response time), *CPU Secs*, and I/O counts for the transaction.

A-I Wait /Tns
(Transaction) The average time, in seconds, of active-to-ineligible wait time per transaction. If this value is high, it may be because the time-slice value is set too low for many of the interactive jobs. Consider increasing the time slice-value.

Aborts Recd
(Resource Interval) The number of frames received that contained HDLC abort indicators. This indicates that the remote equipment ended frames before they were complete.

Act Jobs
(Job Interval) The number of selected jobs (interactive or noninteractive, depending on the report section) that were active during the interval.

Act Level
(Component) Initial pool activity level.

Act Lvl
(System, Pool Interval) Activity level. For the Pool Activity section of the Pool Interval Report, the activity level of the pool during the interval. For the Storage Pool Utilization section of the System Report, the activity level at the time of the first sample interval.

Act-Inel
(System, Component) Average number of active-to-ineligible job state transitions per minute.

Act-Wait
(System, Component) Number of transitions per minute from active state to wait state by processes assigned to this pool.

Active Devices
(System) Average number of active devices on the line.

Active display stations (local or remote)
(System) The number of local or remote display stations entering transactions during the measurement period.

Active Jobs
(Transaction) The number of interactive jobs that were active during the interval.

Active Jobs Per Interval
(System) Average number of jobs of this type that were active per sample interval.

Active K/T /Tns
(Transaction) An average think time and keying time (or the delay time between the end of one transaction and the start of the next transaction), in seconds, for the active work stations (described under Est of AWS). Active K/T /TNS delay time differs from Key/Think /TNS delay time in that any delay time greater than 600 seconds has been rounded to 600 seconds. This technique is used to reduce the effect of very casual users (those who may do intermittent work or leave their work stations for long periods of time) on the estimate of active work stations.

Active Wrk Stn
: (Resource Interval) The number of work stations with activity.

Active/Rsp
: (Transaction) The time the job spends (either waiting or active) during transaction processing, while it holds an activity level.

Activity level
: (System) The sum of activity levels for all interactive pools that had interactive job activity running in them.

Activity Level Time
: (Transaction) A breakdown of the transaction time spent *ACTIVE*, waiting on a *SHORT WAIT*, and waiting on a *SEIZE/CFT* (seize conflict). The *SHORT WAIT* and *SEIZE CFT* time are included under *ACTIVITY LEVEL TIME*, because the activity-level slot is not given up during these times. Note that the seize conflict time is included in the active time, not added to it to get transaction/response time, as is the case for waiting time.

Arith Ovrflw
: (Component, Job Interval) The number of arithmetic overflow exceptions that occurred for the selected interactive jobs during the interval.

ASP ID
: (System, Resource Interval) Auxiliary storage pool identifier.

Async
: (System, Component, Transaction, Job Interval) The number of asynchronous disk I/O operations started by the selected interactive jobs during the interval. The job that starts the I/O operation may continue processing without having to wait for the I/O operation to complete. The I/O operation is completed by a background system test.

Async DIO /Tns
: (Transaction) The sum of the averages of the asynchronous DB READ, DB WRITE, NDB READ, and NDB WRITE requests (the average number of asynchronous I/O requests per transaction for the job).

Async Disk I/O
: (System, Component, Transaction) Number of asynchronous disk input/output operations per transaction.

Async Disk I/O per Second
: (Component) Average asynchronous disk I/O operations per second.

Async Disk I/O Requests
: (Transaction) The total number of asynchronous disk I/O requests for the given combination of priority, job type, and pool.

Async I/O /Sec
: (Job Interval) The average number of asynchronous disk I/O operations started per second by the job during the interval. This is calculated by dividing the asynchronous disk I/O count by the elapsed time.

Async I/O Per Second
: (Job Interval) The average number of asynchronous disk I/O operations started per second by the selected noninteractive jobs during the interval.

Async Max
: (Transaction) Listed under Average DIO/Transaction, the maximum number of asynchronous DBR, NDBR, and WRT I/O requests encountered for any single transaction by that job. If the job is not an interactive or autostart job type, the total disk I/O for the job is listed here.

Async Sum
: (Transaction) Listed under Average DIO/Transaction, the sum of the averages of the asynchronous DBR, NDBR, and WRT requests (the average number of asynchronous I/O requests per transaction for the job).

Asynchronous DBR
: (System, Job Interval, Pool Interval) The average number of asynchronous database read operations on the disk per transaction for the job during the intervals. This is calculated by dividing the asynchronous database read count by the transactions processed. This field is not printed if the jobs in the system did not process any transactions. For the Resource Utilization section of the System Report, it is the number of asynchronous database read operations per second.

  Note: The asynchronous I/O operations are performed by system asynchronous I/O tasks.

Asynchronous DBW
: (System, Job Interval) The average number of asynchronous database write operations on the disk per transaction for the selected jobs during the interval. This is calculated by dividing the asynchronous database write count by the transactions processed. This field is not printed if the jobs in the system did not process any transactions. For the Resource Utilization section of the System Report, it is the number of asynchronous database read operations per second.

  Note: The asynchronous I/O operations are performed by system asynchronous I/O tasks.

Asynchronous disk I/O per transaction
: (System) The average number of asynchronous physical disk I/O operations per interactive transaction.

Asynchronous NDBR
: (System, Job Interval, Pool Interval) The average number of asynchronous nondatabase read operations per transaction for the jobs in the system during the interval. This is calculated from the asynchronous nondatabase read count divided by the transactions processed. This field is not printed if the jobs in the system did not process any transactions. For the Resource Utilization section of the System Report, it is the asynchronous nondatabase read operations per second.

  Note: The asynchronous I/O operations are performed by system asynchronous I/O tasks.

Asynchronous NDBW
: (System, Job Interval, Pool Interval) The average number of asynchronous nondatabase write operations per transaction for the jobs in the system during the interval. This is calculated from the asynchronous nondatabase write count divided by the transactions processed. This field is not printed if the jobs in the system did not process any transactions. For the Resource Utilization section of the System Report, it is the number of asynchronous nondatabase write operations per second.

  Note: The asynchronous I/O operations are performed by system asynchronous I/O tasks.

Aut Lookup
: (Component) Number of authority lookups per second. An authority

lookup is the process whereby the Licensed Internal Code determines whether a particular user ID is authorized to access a specific object.

Beginning in V3R7, reduced instruction set computer (RISC) systems store the most recent private authority lookup results in an *authorization lookup cache*. If the next lookup is for one of the authorities stored in the cache, the private authority lookup has a minimal performance degradation over public or owner authority performance.

The cache can store up to 32 private authorities for objects and for authorization lists. Whenever the system looks for a private authority, the system queries the cache. Whenever an authority is granted or revoked for a user, the cache is updated. Performing an IPL clears the cache.

Collection Services counts each authority lookup. The advisor function and the redbook, *AS/400 Performance Management V3R6/V3R7*, SG24-4735, provide CPU utilization estimates based on the number of lookups per second and the processor rating. Because of this caching capability, the counts are incremented as if they were not cached. Therefore, beginning with V3R7, the effect on the CPU utilization counts could be much less than the advisor message and the redbook would indicate.

Avail Local Storage (K)
(Resource Interval) The number of kilobytes of free local storage in the IOP.

Available Storage
(Component) Available local storage (in bytes). The average number of bytes of available main storage in the IOP. The free local storage is probably not joined because it has broken into small pieces.

Average
(Transaction) The average value of the item described in the column for all transactions.

Average Disk Activity Per Hour
(Component) See Disk Arm Seek Distance

Average DIO/Transaction
(Transaction) Seven columns of information about physical disk I/O counts. Physical I/O contrasts with logical I/O shown elsewhere in these reports. A logical I/O is a request sent at the program level that might result in an access to auxiliary storage (DASD). A physical I/O refers to those requests that actually result in access to auxiliary storage.

- Synchronous DBR
- Synchronous NDBR
- Synchronous Wrt
- Synchronous Sum
- Synchronous Max
- Async Sum
- Async Max

Average K per I/O
(Resource Interval) The average number of kilobytes transferred during each disk read or write operation.

Average Phys I/O /Sec
(Resource Interval) The average number of physical disk read and write operations per second made on all disks on the system.

Average Reads/Sec
(Resource Interval) The average number of physical disk read operations per second made on all disks on the system.

Average Response
(System) Average response time (in seconds) for interactive transactions. The Total/Average interactive response time does not include transactions for DDM server jobs.

Average Response Time
(System) Average disk response time per I/O operation.

Average Response Time (seconds)
(System) The average interactive response time.

Average Service Time
(System) Average disk service time per I/O operation. This is the amount of time a request would take if there were no contention.

Average Wait Time
(System) Average disk wait time per I/O operation. Normally due to contention.

Average Writes/Sec
(Resource Interval) The average number of physical disk write operations per second made on all disks on the system.

Avg CPU /Tns
(Transaction) The average number of processing unit seconds per transaction that fell in the given category.

Avg K/T /Tns
(Transaction) The average think time and keying time (or the delay time between transaction boundaries), in seconds, for the interactive jobs.

Avg Length
(Lock) The average number of milliseconds a lock or seize was held.

Avg Rsp (Sec)
(Transaction) The average transaction response time in seconds.

Avg Rsp /Tns
(Transaction) The average response per transaction (in seconds) for the transactions that fell into the given category.

Avg Rsp Time
(Component) Average transaction response time.

Avg Sec Locks
(Transaction) The average length of a lock in seconds attributed to interactive or noninteractive waiters.

Avg Sec Seizes
(Transaction) The average length of a seize in seconds attributed to interactive or noninteractive waiters.

Avg Time per Service
(Resource Interval) The amount of time a disk arm uses to process a given request.

Avg Util
(System, Resource Interval) On the Disk Utilization Summary of the Resource Report, the average percentage of available time that disks were busy. It is a composite average for all disks on the system. On the

Communications Summary of the System Report, the average percentage of line capacity used during the measured time interval.

Batch asynchronous I/O per second
(System) The average number of asynchronous physical disk I/O operations per second of batch processing.

Batch CPU seconds per I/O
(System) The average number of system processing unit seconds used by all batch jobs for each I/O performed by a batch job.

Batch CPU Utilization
(Component) Percentage of available CPU time used by the following types of jobs:

- Batch
- Autostart
- Evoke
- SCPF (Start CPF), spool reader/writer

Note: For a multiple-processor system, this is the average use across all processors.

Batch impact factor
(System) Batch workload adjustment for modeling purposes.

Batch permanent writes per second
(System) The average number of permanent write operations per second of batch processing.

Batch synchronous I/O per second
(System) The average number of synchronous physical disk I/O operations per second of batch processing.

BCPU / Synchronous DIO
(Transaction) The average number of batch processor unit seconds per synchronous disk I/O operation.

Bin (Transaction) The number of binary overflow exceptions.

Binary Overflow
(Component) Number of binary overflows per second.

BMPL - Cur and Inl
(Transaction) The number of jobs currently in the activity level (beginning current multiprogramming level), and the number of jobs on the ineligible queue (beginning ineligible multiprogramming level) for the storage pool that the job ran in when the job left the wait state (the beginning of the transaction).

Note: Multiprogramming level (MPL) is used interchangeably with activity level.

Bundle Writes System
(Component) Number of bundle writes to internal system journals. A bundle write is a group of journal entries which are deposited together by the system.

Bundle Writes User
(Component) Number of bundle writes to user-created journals. A bundle write is a group of journal entries which are deposited together by the system.

Bytes per Second Received
(System) Average number of bytes received per second.

Bytes per Second Transmitted
(System) Average number of bytes transmitted per second.

Bytes Recd per Sec
(Resource Interval) The average number of bytes received per second.

Bytes Trnsmitd per Sec
(Resource Interval) The average number of bytes transmitted per second.

Category
(Transaction) A group of transactions categorized together. In the Analysis by Interactive Transaction Category, the transactions are categorized by the processing unit model. The boundary values that are used to separate the transactions are given in the *Avg CPU /Tns* column. For the Analysis by Interactive Response Time, they are categorized by their response time. For the Analysis by Interactive Key/Think Time, they are categorized by their key/think time.

Cache Hit Statistics
(Component) Statistics data about use of cache including:

- The percent of Device Cache Read Hit for each arm.
- The percent of Controller Cache Read Hit for each arm.
- The percent of efficiency of write cache

Device read
Device Read is the number of Device Cache Read Hits (DSDCRH) divided by number of Device Read Operations (DSDROP), expressed as a percent

Controller read
Controller Read is the number Controller Cache Read Hits (DSCCRH) divided by number of Read Commands (DSRDS), expressed as a percent.

Write efficiency
Write efficiency is the difference between Write Commands (DSWRTS) and Device Write Operations (DSDWOP) divided by Write Commands (DSWRTS), expressed as a percent.

EACS Read
The percent of read hits by the Extended Adaptive Cache Simulator.

EACS Resp
The percent of response time improvement by the Extended Adaptive Cache Simulator.

Channel
(Resource Interval) The B-channel used by the IDLC line. (special condition)

Cmn (Job Interval) The number of communications I/O operations performed by the selected interactive jobs during the interval.

Cmn I/O
(Component) Number of communications operations (Get, Put).

Cmn I/O Per Second
: (Job Interval) The average number of communications I/O operations performed per second by the selected noninteractive jobs during the interval.

Collision Detect
: (Resource Interval) The number of times that the terminal equipment (TE) detected that its transmitted frame had been corrupted by another TE attempting to use the same bus.

Communications I/O Count
: (System) Number of communications I/O operations.

Communications I/O Get
: (System) Number of communication get operations per transaction.

Communications I/O Put
: (System) Number of communication put operations per transaction.

Communications Lines
: (System, Component, Job Interval, Pool Interval) For the Report Selection Criteria, the list of communications lines selected to be included (SLTLINE parameter) or excluded (OMTLINE parameter). These are the communications line names you specify.

Control Units
: (System, Component, Job Interval, Pool Interval) The list of control units selected to be included (SLTCTL parameter) or excluded (OMTCTL parameter). These are the controller names you specify.

Count
: (Transaction, Lock) The number of occurrences of the item in the column. For example, in a lock report, it is the number of locks or seizes that occurred.

CPU
: (Transaction) The total processing unit seconds used by the jobs with a given priority.

CPU /Tns
: (Transaction, Job Interval) The amount of available processing unit time per transaction in seconds.

CPU Model
: (System) The processing unit model number.

CPU per I/O Async
: (System) CPU use per asynchronous I/O.

CPU per I/O Sync
: (System) CPU use per synchronous I/O.

CPU per Logical I/O
: (System) Processing unit time used for each logical disk I/O operation.

CPU QM
: (Transaction) The simple processing unit queuing multiplier.

CPU Sec
: (Transaction) The processing unit time used by the job in this state.

CPU Sec /Sync DIO
: (Transaction) The ratio of CPU seconds divided by synchronous disk I/O requests for each type of job.

CPU Sec Avg and Max
: (Transaction) The average processing unit time per transaction for the job and the largest processing unit time used for a transaction in the job. If the job is not an interactive or autostart job type, then only the total processing unit time for the job is listed under the MAX column heading.

CPU Sec per Tns
: (Transaction) The processing unit time per transaction.

CPU Seconds
: (System, Transaction, Component) Average processing unit seconds used per transaction. For System Summary Data, it is the total available processing unit time used by the jobs during the trace period. For Priority-Jobtype-Pool Statistics, it is the total processing unit seconds used by the jobs with a given combination of priority, job type, and pool. For Batch Job Analysis, it is the amount of available processor unit time used by the job in seconds. For Concurrent Batch Job Statistics, it is the amount of available processor unit time used by the jobs in the job set in seconds.

CPU seconds per transaction
: (System) The average processing unit seconds per transaction.

CPU Util
: (System, Component, Transaction, Job Interval, Pool Interval, Batch Job Trace) Percentage of available processing unit time used. For multiple-processor systems, this is the total utilization divided by the number of processors.

CPU Util per Transaction
: (Component) The result of the CPU Utilization divided by the total number of transactions for the job.

| **CPU Utilization (Batch)**
| The percentage of available CPU time that is used by batch jobs. This is the
| average of all processors.

| **CPU Utilization (Interactive)**
| The percentage of available CPU time that is used by interactive jobs. This
| is the average of all processors.

| **CPU Utilization (Total)**
| The percentage of available CPU time that is used by interactive and batch
| jobs. This is the average of all processors.

CPU/Async I/O
: (Job Interval) The average number of milliseconds of processing unit time taken for each asynchronous disk I/O operation. This is calculated by dividing the milliseconds of the processing unit time the job used by the asynchronous disk I/O count.

CPU/Sync I/O
: (Job Interval) The average number of milliseconds of processing unit time taken for each synchronous disk I/O operation. This is calculated from the milliseconds of the processing unit time used by the job divided by the synchronous disk I/O count.

CPU/Tns
: (Transaction) The average number of processing seconds per transaction for the job during the interval. This is calculated from the amount of processing unit time used divided by the number of transactions processed.

Cpu/Tns (Sec)
(Transaction) The number of processing unit seconds per transaction.

Ctl (Component) Controller identifier.

Cum CPU Util
(Transaction) The cumulative percentage of available processing unit time used by the transactions that have an average response time per transaction equal to or less than the given category. For example, in CPU by Priority for All Jobs for Total Trace Period (System Summary Data), it is the unit time used by the jobs with a priority higher or equal to the given priority.

Cum Pct Tns
(Transaction) Cumulative CPU percent per transaction. For system summary data, it is the cumulative CPU percentage of all transactions that have an average response time per transaction equal to or less than the given category. For Interactive Program Transactions Statistics, it is the cumulative CPU percentage of all transactions through the listed program. For Job Statistics section, it is the cumulative CPU percentage of total transactions through the listed job. For Interactive Program Statistics section, it is the cumulative CPU percentage of all transactions through the listed program.

Cum Util
(System) Cumulative CPU use (a running total).

Note: This is taken from the individual jobs and may differ slightly from the total processing unit use on the workload page.

Cur Inl MPL
(Transaction) The number of jobs waiting for an activity level (ineligible) in the storage pool.

Cur MPL
(Transaction) The number of jobs holding an activity level in the storage pool.

DASD Ops/Sec
(Component) Disk operations per second.

DASD Ops Per Sec Reads
(Resource) Number of reads per second

DASD Ops Per Sec Writes
(Resource) Number of writes per second

| **Datagrams Received**
| (Component) The total number of input datagrams received from
| interfaces. This number includes those that were received in error.

| **DB Cpb Util**
| (Component) The percentage of database capability that is used to perform
| database processing.

DB Fault
(System, Component) Average number of database faults per second.

DB Pages
(System, Component) Average number of database pages read per second.

DB Read
(Transaction) When listed in Physical I/O Counts column, it is the number

of database read requests while the job was in that state. When listed in the Sync Disk I/O Rqs/Tns column, it is the average number of synchronous database read requests per transaction.

DB Write
(Transaction) When listed in the Sync Disk I/O Rqs/Tns column, it is the average number of synchronous database write requests per transaction.

DB Wrt
(Transaction) When listed in the Physical I/O Counts column, it is the number of database write requests while the job was in that state. When listed in the Synchronous Disk I/O Counts column, it is the number of synchronous database write requests per transaction.

DDM I/O
(Component, Job Interval) The number of logical database I/O operations for a distributed data management (DDM) server job.

DDM Svr Wait /Tns
(Transaction) The average time, in seconds, that a source distributed data management (DDM) server job spent waiting for the target system to respond to a request for data per transaction. This value includes line time and time spent by the target system responding to the request for data.

Dec (Transaction) The number of decimal overflow exceptions.

Decimal Data
(Component) Data exception count per second. A data exception occurs when data that is not valid is detected by arithmetic instructions. Examples are signs or digit codes that are not valid in decimal instructions, or an insufficient number of farthest left zeros in multiply instructions.

Decimal Overflow
(Component) Number of decimal overflows per second.

Description
(Component) More detailed description of the exception type.

Detected Access Transmission Error (DTSE) In
(Resource Interval) The number of times the network termination 1 (NT1) end point notified the terminal equipment (TE) of an error in data crossing the ISDN U interface from the line transmission termination (LT) to the NT1 end point. The NT1 end point reports the errors to the TE through the maintenance channel S1.

Detected Access Transmission Error (DTSE) Out
(Resource Interval) The number of times the network termination 1 (NT1) end point notified the terminal equipment (TE) of an error in data crossing the ISDN U interface from the NT1 end point to the LT. The NT1 end point reports the errors to the TE through the maintenance channel S1.

Device
(Component) Device identifier.

DIO/Sec Async
(System) Number of asynchronous I/O operations per second.

DIO/Sec Sync
(System) Number of synchronous I/O operations per second.

Disk Arm Seek Distance
(Component) Average seek distance distributions per hour:

0 Number of zero seeks

1/12 Number of seeks between 0 and 1/12 of the disk

1/6 Number of seeks between 1/12 and 1/6 of the disk

1/3 Number of seeks between 1/6 and 1/3 of the disk

2/3 Number of seeks between 1/3 and 2/3 of the disk

>2/3 Number of seeks greater than 2/3 of the disk

Disk Arms
(System) The number of disk arms for this IOP.

Disk Capacity
(Component) Average amount of disk space used or available.

MB Millions of bytes available on the disk.

Percent
Percent of space available on the disk.

Disk Controllers
(System) The number of disk storage controllers for this IOP.

Disk Feature
(System) The type of disk (9332, 9335, and so on).

Disk I/O Async
(System, Component) Total number of asynchronous disk I/O operations.

Disk I/O Logical
(Component) The number of logical disk operations, such as gets and puts.

Disk I/O per Second
(System) Average number of physical disk I/O operations per second.

Disk I/O Reads /Sec
(Resource Interval) The average number of disk read operations per second by the disk IOP.

Disk I/O Requests
(Transaction) The total number of synchronous and asynchronous disk I/O requests issued by the jobs during the trace period.

Disk I/O Sync
(System, Component) Total number of synchronous disk I/O operations.

Disk I/O Writes /Sec
(Resource Interval) The average number of disk write operations per second by the disk IOP.

Disk IOPs
(System) The number of disk IOP controllers.

Disk mirroring
(System) Indicates whether disk mirroring is active.

Disk Space Used
(Resource Interval) The total disk space used in millions of bytes for the entire system.

Disk transfer size (KB)
(System) The average number of kilobytes transferred per disk operation.

Disk utilization
: (System) The fraction of the time interval that the disk arms were performing I/O operations.

Dsk CPU Util
: (System, Resource Interval) The percentage of CPU used by the disk unit.

Dtgm Req Transm Dscrd
: (Component) The percentage of IP datagrams that are discarded because of the following reasons:
  - No route was found to transmit the datagrams to their destination.
  - Lack of buffer space.

Dtgm Req for Transm Tot
: (Component) The total number of IP datagrams that local IP user-protocols supplied to IP in requests for tranmission.

Elapsed Seconds
: (Transaction, Component) The elapsed time in seconds. For the Batch Job Analysis section of the Transaction Report, it is the number of seconds elapsed from when the job started to when the job ended. For the Concurrent Batch Job Statistics section of the Transaction Report, it is the total elapsed time of all jobs in that job set.

Elapsed Time
: (Job Interval) The amount of time (minutes and seconds) for which the job existed during the interval. This is the same as the interval length unless the job started or ended during the interval, in which case it is less.

Elapsed Time—Seconds
: (Transaction) Shows the time spent by the job, in the following columns:

  Long Wait
  : Elapsed times in the state (such as waiting for the next transaction or lock-wait time).

  Active/Rsp
  : During transaction processing, the time the job spends (either waiting or active) while it holds an activity level. At the end of a transaction (on the transaction totals line), this is the time the job spent processing the transaction in an activity level, for long waits caused by locks, and in the ineligible state.

  Inel Wait
  : The time the job spent in the ineligible wait state waiting for an activity level.

EM3270 Wait /Tns
: (Transaction) The average, in seconds, of the time spent waiting on the host system communications for Systems Network Architecture (SNA) and binary synchronous communications (BSC) 3270DE per transaction. Program logic is required to determine if the emulation program is communicating with the display or the host processing unit. Because there are requirements on event-wait processing, not all transition combinations can be detected.

EORn
: (Transaction) Listed in the Wait Code column, End of response time for transaction n. [1]

EOTn (Transaction) Listed in the Wait Code column, End of transaction for transaction for type n. [1]

Estimated Exposr AP Not Jrnld
(Component) System-estimated access path recovery time exposure in minutes if no access paths were being journaled by the system.

Estimated Exposr Curr System
(Component) System-estimated access path recovery time exposure in minutes.

Est Of AWS
(Transaction) An estimate of the number of active work stations for the trace period or interval. Any delay time greater than 600 seconds has been rounded to 600 seconds. This technique is used to reduce the effect of very casual users (those who may do intermittent work or leave their work stations for long periods of time) on the estimate of active work stations. This value is calculated as shown in Figure 96.

```
                      (AVGRSP + ACTIVE KEY/THINK)
AWS = TNS/HOUR x  ──────────────────────────
                                 3600
```

Figure 96. Equation for the Estimated Number of Active Work Stations

Event Wait /Tns
(Transaction) The average time, in seconds, of the event-wait time per transaction.

Often requests made by a job that runs on the system are made to asynchronous jobs. These asynchronous jobs use an event to signal completion of the request back to the requester. The event-wait time is the time the requesting job waits for such a signal.

EVT (Transaction) Listed in the Wait Code column, Event Wait. This is a long wait that occurs when waiting on a message queue.

Exception Type
(Component) Type of program exception that results from the internal microprogram instructions being run in internal microprogram instructions procedure. Because these exceptions are monitored at a low level within the system, it is difficult to associate these exceptions with specific end-user operations. The counts are meaningful when the processing unit time required to process them affects system performance. A variation in the counts may indicate a system change that could affect performance. For example, a large variation in seize or lock counts may indicate a job scheduling problem or indicate that contention exists between an old application and a new one that uses the same resources.

Note: To see the seize and lock counts, you should collect the trace data by using the Start Performance Trace (STRPFRTRC) command. Run the Print Transaction Report (PRTTNSRPT) to list the objects and jobs that are holding the locks.

1. These codes are in the wait code column, but they are not wait codes. They indicate transaction boundary trace records. For more information see “Chapter 8. Transaction Boundaries—Manager Feature” on page 209.

Exceptional wait

(System) The average exceptional wait time, in seconds, per transaction. An *exceptional wait* is that portion of internal response time that cannot be attributed to the use of the processor and disk. An exceptional wait is caused by contention for internal resources of the system, for example, waiting for a lock on a database record.

Note: This is a calculated value. If the sum of the constant and variable wait time is greater than one second, you should run STRPFRMON measurements with trace data collection and compare the measured exceptional wait value, which PRTTNSRPT provides, with this calculated value. If the values are significantly different, use the value from PRTTNSRPT, dividing it equally between constant and variable wait time.

Constant

The portion of exceptional wait time held constant as throughput increases.

Variable

The portion of exceptional wait time that varies as throughput increases.

Excp (Component, Transaction) For the Component Report, it is the total number of program exceptions that occurred per second (see "Exception Occurrence Summary and Interval Counts" on page 84). For the Transaction Report, a Y in this column means that the transaction had exceptions. The types of exceptions that are included are process access group exceptions, and decimal, binary, and floating point overflow. See the transition report to see which exceptions the transaction had.

Excp Wait

(Transaction) The amount of exceptional wait time for the jobs in the job set in seconds.

Excp Wait /Tns

(Transaction) The average exceptional wait time, in seconds, per transaction. This value is the sum of those waits listed under the Exceptional Wait Breakdown by Job Type part.

Excp Wait Sec

(Transaction) The total amount of exceptional wait time in seconds for the job.

Excs ACTM /Tns

(Transaction) The average time, in seconds, of the excess activity level time per transaction (for example, time spent in the active state but not using the processing unit). If enough activity levels are available and there is plenty of interactive work of higher priority to do, a job waits longer for processing unit cycles. If the value is greater than .3, look at jobs that correspond to particular applications for more information. By looking at these jobs, you might be able to determine which application's jobs are contributing most to this value. Use the Transaction and Transition Reports for these jobs for additional information. The formula for excessive activity-level time is shown in Figure 97.

```
Active Time - [
(multiplier X CPU X Beginning Activity Level) +
(Number of synchronous disk I/O operations X .010)]
```

Figure 97. Formula for Excessive Activity-Level Time

Note: If the beginning activity level is greater than 1, the multiplier equals 0.5. If the beginning activity level is any other value, the multiplier equals 1.

Expert Cache
(System, Component) Directs the system to determine which objects or portions of objects should remain in a shared main storage pool based on the reference patterns of data within the object. Expert cache uses a storage management tuner, which runs independently of the system dynamic tuner, to examine overall paging characteristics and history of the pool.

Some values that you might see in this column are associated with the Work with Shared Pools (WRKSHRPOOL) command:

- 0=*FIXED, which indicates the system does not dynamically adjust the paging characteristics of the storage pool. The system uses default values.
- 3=*CALC, which indicates the system dynamically adjusts the paging characteristics of the storage pool for optimum performance.

Exposed AP System Journaled
(Component) The number of exposed access paths currently being journaled by the system.

Exposed AP System Not Journaled
(Component) The number of exposed access paths currently not being journaled by the system.

/F (System, Resource Interval) The line speed of the protocol reported as full duplex. This indicator applies to the line speeds for an Ethernet (ELAN) token-ring (TRLAN) line, or an asynchronous transfer mode line.

Far End Code Violation
(Resource Interval) The number of unintended code violations detected by the network termination 1 (NT1) end point for frames transmitted to the NT1 end point on the interface for the T reference point. The NT1 end point reports a violation to the termination equipment (TE) through the maintenance channel S1.

Faults (System) A value that represents the total page faults that occurred for each job type or job priority during the collection. This is the same value as shown in the JBTFLT field of the QAPMJOBS or QAPMJOBL file.

File (Transaction) The file that contains the object.

Flp (Transaction) The number of floating point overflow exceptions.

Flp Overflow
(Component) Number of floating point overflows per second.

Frame Retry
(Resource Interval) The number of attempts to retransmit a frame to a remote controller.

Frames Received Pct Err
(Resource Interval) The percentage of frames received in error. Errors can occur when the host system has an error or cannot process received data fast enough.

Frames Received Total
(Resource Interval) The total number of frames received including frames with errors and frames that are not valid.

Frames Transmitted Pct Err
(Resource Interval) The percentage of frames retransmitted due to error.

Frames Transmitted Total
(Resource Interval) The total number of frames transmitted.

Functional Areas
(System, Component, Transaction, Job Interval, Pool Interval) For Report Selection Criteria, the list of functional areas selected to be included (SLTFCNARA parameter) or excluded (OMTFCNARA parameter).

/H (System, Resource Interval) The line speed of the protocol reported as half duplex. This indicator applies to the line speeds for an Ethernet (ELAN) token-ring (TRLAN) line, or an asynchronous transfer mode line.

HDW (Transaction) Listed in the Wait Code column, Hold Wait (job suspended or system request). The job released a lock it had on the object named on the next detail line of the report (OBJECT --). The job that was waiting for the object is named on this line (WAITER --) along with the amount of time the job spent waiting for the lock to be released.

High Srv Time
(Resource Interval) The highest average service time in seconds for a disk arm in the system.

High Srv Unit
The disk arm with the highest service time.

High Util
(Resource Interval) The percentage of use for the disk arm that has the highest utilization.

High Util Unit
(Component, Resource Interval) The disk arm with the highest utilization.

High Utilization Disk
(Component) Percent of utilization of the most utilized disk arm during this interval.

High Utilization Unit
(Component) Disk arm that had the most utilization during this interval.

Holder Job Name
(Transaction) The name of the job that held the object.

Holder Number
(Transaction) The number of the job that held the object.

Holder Pool
(Transaction) The pool that held the job while it was running.

Holder Pty
(Transaction) The priority of the holder's job.

Holder Type
: (Transaction) The type and subtype of the holder's job.

Holder User Name
: (Transaction) The name of the user that held the object.

Holder's Job Name
: (Lock) The name of the job holding the lock.

I Frames Recd per Sec
: (Resource Interval) The number of information frames received per second.

I Frames Trnsmitd per Sec
: (Resource Interval) The number of information frames transmitted per second.

I/O Wait
: (Resource Interval) The amount of time in which a given I/O request is ready to be processed, but the disk arm is not yet available to perform the request.

ICMP Messages Error
: (Component) This is the number of Internet Control Message Protocol (ICMP) messages that the entity received but determined that the messages had errors or are messages that the entity did not send due to problems.

ICMP Messages Received
: (Component) This is the total number of Internet Control Message Protocol (ICMP) messages that the entity received.

ICMP Messages Sent
: (Component) This is the total number of Internet Control Message Protocol (ICMP) messages that the entity attempted to send.

Incoming Calls Pct Retry
: (Resource Interval) The percentage of incoming calls that were rejected by the network.

Incoming Calls Total
: (Resource Interval) The total number of incoming call attempts.

Inel Time A-I/W-I
: (Transaction) The amount of time the job spent in the ineligible state, either coming from time slice end (active-to-ineligible) or from the wait state (wait-to-ineligible).

Inel Wait
: (Transaction) Listed in the Elapsed Time—Seconds column, the time the job spent in the ineligible wait state waiting for an activity level.

Int Feat Util
: (Component) The percentage of Interactive Feature that is used by all jobs.

Inter CPU Utilization
: (Component) Percentage of available processing unit time used by the following types of jobs:

- Interactive
- Multiple requester terminal (MRT)
- System/36 environment interactive
- Pass-through
- Target distributed data management (DDM) servers

- Client Access servers

Note: For a multiple-processor system, this is the average use across all processors.

IOP
(Component) Input/output processor (IOP) Resource name and model number for each communications IOP, DASD IOP, local workstation IOP, and multifunction IOP. Communications IOP is the percent of CPU used in the IOP. The percent does not necessarily mean that the IOP is doing any data transfers. Some of the percent can be attributed to overhead of an active line.

IOP Name/Line
(System, Resource Interval) Input/output (IOP) processor resource name and model number line.

IOP Name(Model)
(Resource Interval) The input/output processor (IOP) identification and the model number in parentheses.

IOP Name
(System, Component) Input/Output processor (IOP) resource name.

IOP Name Network Interface
(Resource Interval) The IOP name of the network interface.

IOP Processor Util Comm
(Component, Resource) Utilization of IOP due to communications activity.

IOP Processor Util LWSC
(Component, Resource) Utilization of IOP due to local workstation activity.

IOP Processor Util DASD
(Component, Resource) Utilization of IOP due to DASD activity.

IOP Processor Util Total
(Component, Resource Interval) The total percent of utilization for each local workstation, disk, and communications IOP.

IOP Util
(System) For the Disk Utilization section of the System Report, it is the percentage of utilization for each input/output processor (IOP).

Note: For the multifunction I/O processors, this is utilization due to disk activity only, not communications activity. For the System Model Parameter section it is the fraction of the time interval the disk IOP was performing I/O operations.

Itv End
(Component, Transaction, Job Interval, Pool Interval, Resource Interval) The time (hour and minute) when the data was collected. For the Exception Occurrence Summary and Interval Counts of the Component Report, it is the ending time for the sample interval in which Collection Services recorded the exception.

Job Maximum A-I
(Pool Interval) The highest number of active-state to ineligible-state transitions by a selected job in the pool or subsystem.

Job Maximum A-W
(Pool) The highest number of active-to-wait state transitions by a selected job in the pool or subsystem.

Job Maximum CPU Util
: (Pool Interval) The highest percentage of available processing unit time used by a selected job in the pool or subsystem.

Job Maximum Phy I/O
: (Pool Interval) The highest number of physical disk input and output operations by a selected job in the pool or subsystem.

Job Maximum Rsp
: (Pool Interval) The highest response time in seconds per transaction by a selected job in the pool or subsystem. The response time is the amount of time spent waiting for and using the resources divided by the number of transactions.

Job Maximum Tns
: (Pool Interval) The highest number of transactions by a selected job in the pool or subsystem.

Job Maximum W-I
: (Pool Interval) The highest number of wait-state to ineligible-state transitions by a selected job in the pool or subsystem.

Job Name
: (Component, Transaction, Job Interval, Batch Job Trace) Name of the job. In the Job Summary Report of the Transaction Report, a job (identical job name, user name, and job number) appears multiple times in this list if the job uses the system Reroute Job (RRTJOB) command.

Job Number
: (Component, Transaction, Job Interval, Batch Job Trace) The number of the job which the summary line describes. In the Transaction Report, an asterisk (*) before the job number indicates the job signed on during the measurement period. An asterisk (*) after the job number indicates the job signed off during the measurement period.

Job Pty
: (Batch Job Trace) Priority of the job.

Job Set
: (Transaction) The number of job sets is the number of batch jobs that could be active at any time during the trace period. If two jobs run sequentially, they show up as two jobs in the same job set. If two jobs run concurrently, they show up in two different job sets.

Job Type
: (All Reports except where noted for the Transaction Report) Job type and subtype.

Possible job type values include the following:

A Autostart

B Batch

BD Batch immediate (Transaction only)

Note: The batch immediate values are shown as BCI on the Work with Active Job display and as BATCHI on the Work with Subsystem Job display.

BE Batch evoke (Transaction only)

BJ Batch pre-start job (Transaction only)

C Programmable workstation application server, which includes 5250 emulation over APPC and Client Access host servers running either APPC or TCP/IP. You can find the host server information under the Client Access topic in the iSeries Information Center.

A job is reported as a Client Access server if any of the following items are true:

- Incoming APPC evoke requests one of the server program names. This also applies to the pre-started jobs for the QSERVER, QCMN, and QSYSWRK subsystems that are already waiting for the named program.
- Incoming IP port number corresponds to one of the service name-description-port-numbers. This also applies to the pre-started jobs for the QSERVER, QCMN, and QSYSWRK subsystems that are already waiting for the assigned IP port number.
- Incoming IPX socket number corresponds to one of the service name-description-port-numbers. This also applies to the pre-started jobs for the QSERVER, QCMN, and QSYSWRK subsystems that are already waiting for the assigned IPX port number.
- Incoming 5250 display emulation jobs that come from APPC data streams sent by 5250 emulation under OS/2 Communications Manager or WARP equivalent.

D Target distributed data management (DDM) server

I Interactive. Interactive includes twinaxial data link control (TDLC), 5250 remote workstation, and 3270 remote workstation. For the Transaction Report, this includes twinaxial data link control (TDLC), 5250 remote workstation, 3270 remote workstation, SNA pass-through, and 5250 Telnet.

L Licensed Internal Code task

M Subsystem monitor

P SNA pass-through and 5250 Telnet pass-through. On the Transaction Report, these jobs appear as I (interactive).

R Spool reader

S System

W Spool writer, which includes the spool write job, and if Advanced Function Printing (AFP) is specified, the print driver job.

WP Spool print driver (Transaction only)

X Start system job

Possible job subtype values include the following:

D Batch immediate job

E Evoke (communications batch)

J Pre-start job

P Print driver job

T Multiple requester terminal (MRT) (System/36 environment only)

3 System/36

Noninteractive job types include:
- Autostart
- Batch
- Evoke
- Spool

Special interactive job categories include:
- Client Access server
- Distributed data management (DDM) server
- Interactive
- Multiple requester terminal (MRT)
- Pass-through
- System/36

Jobs (System, Component, Transaction, Pool Interval, Job Interval) The jobs you specify. The format of the entries is `jobnumber/username/jobname`. For the Report Selection Criteria report, it is the list of jobs selected to be included (SLTJOB parameter) or excluded (OMTJOB parameter). This does not include jobs selected by using the STLFCNARA or OMTFCNARA parameter.

K per I/O
(System, Resource Interval) The average number of kilobytes (1024 bytes) read or written for each disk I/O operation.

K/T /Tns Sec
(Transaction) The average delay time, or time spent keying and thinking between transactions for the job, in seconds. The value represents the time interval between active-to-wait and wait-to-active or wait-to-ineligible job state transitions.

KB per I/O Read
(Resource Interval) The average number of kilobytes (1 KB equals 1024 bytes) transferred per read operation.

KB per I/O Write
(Resource Interval) The average number of kilobytes (1024 bytes) transferred per write operation.

KB Received/Second
(System) The total number of kilobytes (1024) received per second on the specified interface when it was active on the selected intervals, which includes framing characters.

KB Transmitted/Second
(System) The total number of kilobytes (1024) transmitted per second from the specified interface when it was active on the selected intervals, which includes framing characters.

KBytes Transmitted IOP
(Component, Resource Interval) Total kilobytes transmitted from an IOP to the system across the bus.

KBytes Transmitted System
(Component, Resource Interval) Total kilobytes transmitted to the IOP from the system across the bus.

Key/Think
(Transaction) The amount of time spent waiting for the work station user by the program.

Key/Think /Tns
(Transaction) The average think time and keying time (or the delay time between transaction boundaries), in seconds, for the interactive jobs.

L (Lock) Whether this is a lock or seize conflict. The column contains an L if lock, blank if seize.

LAPD Pct Frames Recd in Error
(Resource Interval) The percentage of frames received in error (applies to D-channel only). Errors can occur when the host system has an error or cannot process received data fast enough.

LAPD Pct Frames Trnsmitd Again
(Resource Interval) The percentage of frames retransmitted due to error (applies to D-channel only).

LAPD Total Frames Recd
(Resource Interval) The total number of frames received including frames with errors and frames that are not valid (applies to D-channel only).

LAPD Total Frames Trnsmitd
(Resource Interval) The total number of frames transmitted (applies to D-channel only).

Last 4 Programs in Invocation Stack
(Transaction) The last four programs in the program stack. For example, at the start of a transaction (such as when the work station operator presses the Enter key), you see the program names QT3REQIO, QWSGET, and the program that issued a read operation. At the end of the transaction (such as when the program writes to the display), you see QT3REQIO, QWSPUT, and the program that wrote the display. See Appendix B. Defining Transaction Boundaries, for more information about the transaction boundary.

Usually, the third or fourth program in the stack is the program shown in the transaction summary PGMNAME data. However, if the *Wait Code* column has a value, the program in the column labeled *Last* is the one that caused the trace record.

If there is no program name in a column, the program name was the same as the previous one in the column, and the name is omitted.

Length of Wait
(Lock) The number of milliseconds the requestor waited for the locked object.

Lgl I/O /Sec
(Job Interval) The average number of logical disk I/O operations performed per second by the job during the interval. This is calculated from the logical disk I/O count divided by the elapsed time.

Library
(System, Transaction) The library that contains the object.

Line Count
(Job Interval) The number of lines printed by the selected noninteractive jobs during the interval.

Line Descriptn
(Resource Interval) Line description name.

Line Errors
(Resource Interval) The total of all detected errors. Check the condition of the line if this value increases greatly over time.

Line Speed
(System, Resource Interval) The line speed in kilobits (1 kilobit = 1000 bits) per second.

Line Type/Line Name
(Component, System) The type and name of the line description that is used by the interface. For interfaces that do not use a line descriptions, the Line Name field will be shown as *LOOPBACK, *OPC, or *VIRTUALIP with no Line Type specified.

Line Util
(Resource Interval) The percent of available line capacity used by transmit and receive operations.

LKRL (Transaction) Lock Released. The job released a lock it had on the object named on the next detail line of the report (OBJECT --). The job that was waiting for the object is named on this line (WAITER --) along with the amount of time the job spent waiting for the lock to be released.

LKW (Transaction) Listed in the Wait Code column, Lock Wait. If there are a number of these, or you see entries with a significant length of time in the ACTIVE/RSP* column, additional analysis is necessary. The LKWT report lines that precede this LKW report line show you what object is being waited on, and who has the object.

LKWT
(Transaction) Listed in the Wait Code column, Lock Conflict Wait. The job is waiting on a lock conflict. The time (*/ time /*) is the duration of the lock conflict and, though not equal to the LKW time, should be very close to it. The holder of the lock is named at the right of the report line (HOLDER --). The object being locked is named on the next report line (OBJECT --).

Local End Code Violation
(Resource Interval) The number of times an unintended code violation was detected by the terminal equipment (TE) for frames received at the interface for the ISDN S/T reference point.

Local Not Ready
(Resource Interval) The percent of all receive-not-ready frames that were transmitted by the host system. A large percentage often means the host cannot process data fast enough (congestion).

Local work station IOP utilization
The fraction of the time interval the work station I/O processors are busy.

Local work station IOPs
(System) The resource name and model number for each local workstation IOP.

Lock Conflict
(Component) Number of lock exceptions per second. Database record contention is reflected in this count. For more information, issue the Start Performance Trace (STRPFRTRC) command and use the PRTTNSRPT and PRTLCKRPT commands.

This count could be very high, even under normal system operation. Use the count as a monitor. If there are large variations or changes, explore these variations in more detail.

Lock Wait /Tns
(Transaction) The average time, in seconds, of the lock-wait time per transaction. If the value is high, investigate with the transaction detail calculation and the PRTLCKRPT command.

Logical
(Job Interval) The number of logical disk I/O operations performed by the selected interactive jobs during the interval.

Logical Database I/O Other
(System) Other logical database operations per transaction. This includes operations such as update and delete.

Logical Database I/O Read
(System) Logical database read operations per transaction.

Logical Database I/O Write
(System) Logical database write operations per transaction.

Logical DB I/O
(System) Average number of logical I/O operations per transaction.

Logical DB I/O Count
(System) Number of times an internal database I/O read, write, or miscellaneous function was called. This does not include I/O operations to readers, writers, or I/O operations caused by the Copy Spooled File (CPYSPLF) command or the Display Spooled File (DSPSPLF) command. If you specify SEQONLY(*YES), you see numbers that show each block of records read or written, not the number of individual records read or written. Miscellaneous functions include the following: updates, deletes, force-end-of-data, and releases.

Logical Disk I/O
(Component) Number of logical disk operations (Get, Put, Update, Other).

Logical I/O /Second
(System) Average number of logical disk I/O operations per second.

Logical I/O Per Second
(Job Interval) The average number of logical disk I/O operations performed per second by the selected noninteractive jobs during the interval.

Long Wait
(Transaction) The time the job spent waiting for a system resource. An example of a long wait would be a record-lock conflict. Also listed in the Elapsed Time—Seconds column, it is the elapsed time in the state (such as waiting for the next transaction or lock-wait time).

Long Wait Lck/Oth
(Transaction) The amount of time the job spent waiting for a system resource. An example of a long wait would be a record-lock conflict.

Loss of Frame Alignment
(Resource Interval) The number of times a time period equivalent to two 48-bit frames elapsed without detecting valid pairs of line code violations.

MAC Errors
(Resource Interval) The number of medium access control (MAC) errors.

Main storage (MB)
: (System) The total main storage size, as measured in megabytes (1024^2).

Max Util
: (System) Consistent use at or above the threshold value given will affect system performance and cause longer response times or less throughput. See the *BEST/1 Capacity Planning Tool* for a list of threshold values.

Maximum
: (Transaction) The maximum value of the item that occurred in the column.

Member
: (System, Transaction) For the System Report, this is the name of the performance data member that was specified on the TOMBR parameter of the CRTPFRDTA command. For the Transaction Report, the member that was involved in the conflict.

Minimum
: (Transaction) The minimum value of the item that occurred in the column.

MRT Max Time
: (System) The time spent waiting, after MRTMAX is reached, by jobs routed to a multiple requester terminal.

Note: No value appears in this column if job type is not MRT.

MTU size (bytes)
: (System) The size of the largest datagram that can be sent or received on the interface. The size is specified in octets (bytes). For interfaces that are used for transmitting network datagrams, this is the size of the largest network datagram that can be sent on the interface.

Nbr A-I
: (Transaction) The number of active-to-ineligible state transitions by the job. This column shows the number of times that the job exceeded the time-slice value assigned to the job, and had to wait for an activity-level slot before the system could begin processing the transaction. If a value appears in this column, check the work that the job was doing, and determine if changes to the time-slice value are necessary.

Nbr Evt
: (Transaction) The number of event waits that occurred during the job processing.

Nbr Jobs
: (Transaction) The number of jobs.

Nbr Sign offs
: (Transaction) The number of jobs that signed off during the interval.

Nbr Sign ons
: (Transaction) The number of jobs that signed on during the interval.

Nbr Tns
: (Transaction) The number of transactions in a given category.

Note: The values for transaction counts and other transaction-related information shown on the reports you produce using the PRTTNSRPT command may vary from the values shown on the reports you produce using the PRTSYSRPT and PRTCPTRPT commands. These differences are caused because the PRTTNSRPT command uses trace data as input, while the PRTSYSRPT and

PRTCPTRPT commands use sample data as input. See Appendix B. Defining Transaction Boundaries, for additional information.

If there are significant differences in the values for transaction-related information shown on these reports, do not use the data until you investigate why these differences exist.

Nbr W-I
(Transaction) The number of wait-to-ineligible state transitions by the job. This column shows how many times the job had to wait for a transaction.

NDB Read
(Transaction) Listed in Physical I/O Counts column, it is the number of nondatabase read requests while the job was in that state. Listed in the Sync Disk I/O Rqs/Tns column, it is the average number of synchronous nondatabase read requests per transaction.

NDB Write
(Transaction) Listed in the Sync Disk I/O Rqs/Tns column, it is the average number of synchronous nondatabase write requests per transaction.

NDB Wrt
(Transaction) Listed in Physical I/O Counts column, the number of nondatabase write requests while the job was in that state. Listed under Synchronous Disk I/O Counts column, it is the number of synchronous nondatabase write requests per transaction.

Non-DB Fault
(System, Component) Average number of nondatabase faults per second.

Non-DB Pages
(System, Component) Average number of nondatabase pages read per second.

Non-Unicast Packets Received
(System) The total number of non-unicast packets delivered to a higher-layer protocol for packets received on the specified interface.

Non-Unicast Packets Sent
(System) The total number of packets that higher-level protocols requested to be transmitted to a non-unicast address; therefore, this number includes those packets that were discarded or were not sent as well as those packets that were sent.

Number
(Transaction) The number of the job with which the transaction is associated.

Number I/Os per Second
(System) The number of I/Os per second for this particular IOP.

Number Jobs
(Transaction) The number of batch jobs in the job set.

Number Lck Cft
(Transaction) The number of lock-wait (including database record lock) state conflicts that occurred during the job processing. If this number is high, look at the Transaction and Transition Reports for the job to see how long the lock-wait state conflicts were lasting. In addition, you can do further investigation using the reports produced when you use the PRTLCKRPT command.

Number Lck Conflict
(Transaction) The number of times the job had a lock conflict.

Number Locks
(Transaction) The number of locks attributed to interactive or noninteractive waiters.

Number of batch jobs
(System) The average number of active batch jobs. A batch job is considered active if it averages at least one I/O per 5 minutes.

Number of Jobs
(System) Number of jobs.

Number of Packets Received with Errors
(System) The total number of packets that were received with errors or discarded for other reasons. For example, a packet could be discarded to free up buffer space.

Number Seizes
(Transaction) The number of seizes attributed to interactive or noninteractive waiters.

Number Sze Cft
(Transaction) The number of seize/lock conflicts that occurred during the job processing. If this number is high, look at the Transaction and Transition Reports for the job to see how long the conflicts lasted, the qualified name of the job that held the object, the name and type of object being held, and what the job was waiting for.

Number Sze Conflict
(Transaction) The number of times the job had a seize conflict.

Number Tns
(System, Transaction) Total number of transactions processed. For example, in the System Report it is the total number of transactions processed by jobs in this pool. In the Transaction Report it is the number of transactions associated with the program.

Number Traces
(Batch Job Trace) Number of traces.

Number Transactions
(System) Total number of transactions processed.

Object File
(Transaction) The file that contains the object.

Object Library
(Transaction) The library that contains the object.

Object Member
(Transaction) The member that was involved in the conflict.

Object Name
(Lock) The name of the locked object.

Object RRN
(Transaction) The relative record number of the record involved in the conflict.

Object Type
(Transaction, Lock) The type of the locked object. The following are possible object types:

AG Access group

CB Commit block

CBLK Commit block

CD Controller description

CLS Class

CMD Command

CTLD Controller description

CTX Context

CUD Control unit description

CUR Cursor

DEVD
Device description

DS Data space

DSI Data space index

DTAARA
Data area

EDTD Edit description

FILE File

JOBD Job description

JOBQ Job queue

JP Journal port

JRN Journal

JRNRCV
Journal receiver

JS Journal space

LIB Library

LIND Line description

LUD Logical unit description

MBR Member

MEM Database file member

MSGF Message file

MSGQ
Message queue

ND Network description

OCUR
Database operational cursor

OUTQ
Output queue

PGM Program

PROG Program

PRTIMG
Print image

QDAG
Composite piece - access group

QDDS
Composite piece - data space

QDDSI
Composite piece - dta spe index

QTAG Temporary - access group

QTDS Temporary - data space

QTDSI
Temporary - data space index

SBSD Subsystem description

TBL Table

Omit Parameters
(System, Component, Transaction, Job Interval, Pool Interval) The criteria used to choose the data records to be excluded from the report. The criteria are generally specified using an OMTxxx parameter of the command. Only nondefault values (something other than *NONE) are printed. If a parameter was not specified, it does not appear on the report.

Op per Second
(System) Average number of disk operations per second.

Other Wait /Tns
(Transaction) The average time, in seconds, spent waiting that was not in any of the previous categories per transaction. For example, the time spent waiting during a save/restore operation when the system requested new media (tape or diskette).

Outgoing Calls Pct Retry
(Resource Interval) The percentage of outgoing calls that were rejected by the network.

Outgoing Calls Total
(Resource Interval) The total number of outgoing call attempts.

Over commitment ratio
(System) The main storage over commitment ratio (OCR).

PAG (Transaction) The number of process access group faults.

PAG Fault
(Component, Job Interval) In the Exception Occurrence Summary of the Component Report, it is the total number of times the program access group (PAG) was referred to, but was not in main storage. The Licensed Internal Code no longer uses process access groups for caching data. Because of this implementation, the value will always be 0 for more current releases. In the Exception Occurrence Summary of the Component Report, it is the number of faults involving the process access group per second.

Page Count
(Job Interval) The number of pages printed by the selected noninteractive jobs during the interval.

Pct CPU By Categories
(Transaction) The percentage of available processing unit time used by the transactions that fell into the various categories. See the ANALYSIS by Interactive Transaction Categories part of the System Summary Data Section for an explanation of the categories.

Pct Data Characters Received in Error
(Resource Interval) The percent of data characters received with error.

Pct Data Characters Transmitted in Error
(Resource Interval) The percent of data characters transmitted with error.

Pct Datagrams Error
(Component) The percentage of datagrams that were discarded due to these errors:

- The IP address in the destination field of the IP header was not a valid address to be received at this entity.
- The protocol was unknown or unsupported.
- Not enough buffer space.

Pct Ex-Wt /Rsp
(Transaction) The percentage of the response time that is due to exceptional wait.

Pct ICMP Messages Error
(Component) This is the number of Internet Control Message Protocol (ICMP) messages that the entity received but determined that the messages had errors or are messages that the entity did not send due to problems.

Pct Of Tns Categories
(Transaction) The percentage of all transactions that fell into the various categories. See the Analysis by Interactive Transaction Categories part of the System Summary Data Section for an explanation of the categories.

Pct Packets Received Error
(System) The percentage of packets that were received with errors or discarded for other reasons. For example, a packet could be discarded to free up buffer space.

Pct Packets Sent Error
(System) The percentage of packets that were not sent because of errors or discarded for other reasons. For example, a packet could be discarded to free up buffer space.

Pct PDUs Received in Error
(Resource Interval) The percent of protocol data units (PDUs) received in error during the time interval. These errors can occur if the host system has errors or cannot receive data fast enough (congestion).

Note: A protocol data unit (PDU) for asynchronous communications is a variable-length unit of data that is ended by a protocol control character or by the size of the buffer.

Pct Poll Retry Time
(Resource Interval) The percent of the time interval the line was unavailable while the IOP waited for a response from a work station controller (or remote AS/400 system) that was in disconnect mode.

Note: To minimize this lost time:

- Vary on only the controllers that are turned on.
- Turn on all controllers.
- Use the Change Line Description (SDLC) (CHGLINSDLC) command to set the connect poll timer to a small value (reduces wait time).
- Use the Change Controller Description (CHGCTLxxxx) command (where xxxx is APPC, FNC, RWS, or RTL, as appropriate) to set the NDMPOLLTMR value to a large value (increases time between polls).

Pct Tns
(Transaction) The percentage of the total transactions. For the System Summary section of the Job Summary Report, the transactions are within the given trace period with the given purge attribute. For the Interactive Program Transaction Statistics section of the Job Summary Report, the percentage of transactions that were associated with a program. For the Job Statistics section, it is the percentage of total transactions that were due to this job. For the Interactive Program Statistics section, it is all transactions that were associated to a program.

Pct UDP Datagrams Error
(Component) The percentage of User Datagram Protocol (UDP) datagrams for which there was no application at the destination port or that could not be delivered for other reasons.

Percent Errored Seconds
(Resource Interval) The percentage of seconds in which at least one Detected Access Transmission (DTSE) in or out error occurred.

Percent Frames Received in Error
(Resource Interval) The percent of all received frames that were received in error. Errors can occur when the host system has an error or cannot process received data fast enough (congestion).

Percent Full
(System) Percentage of disk space capacity in use.

Percent I Frames Trnsmitd in Error
(Resource Interval) The percent of transmitted information frames that required retransmission. Retransmissions can occur when a remote device has an error or cannot process received data fast enough (congestion).

Percent Severely Errored Seconds
(Resource Interval) The percent of seconds in which at least three Detected Access Transmission (DTSE) in or out errors occurred.

Percent transactions (dynamic no)
(System) A measure of system main storage utilization. The percent of all interactive transactions that were done with the purge attribute of dynamic NO.

Percent transactions (purge no)
(System) A measure of system main storage utilization. The percent of all interactive transactions that were done with the purge attribute of NO.

Percent transactions (purge yes)
(System) A measure of system main storage utilization. The percent of all interactive transactions that were done with the purge attribute of YES.

Percent Util
(System) Average disk arm utilization (busy). Consistent use at or above

the threshold value provided for disk arm utilization affects system performance, which causes longer response times or less throughput. See utilization guidelines and thresholds in the *BEST/1 Capacity Planning Tool* book for a list of threshold values.

Note: The percent busy value is calculated from data measured in the I/O processor. When comparing this value with percent busy reported by the Work with Disk Status (WRKDSKSTS) command, some differences may exist. The WRKDSKSTS command estimates percent busy based on the number of I/O requests, amount of data transferred, and type of disk unit.

The system-wide average utilization does not include data for mirrored arms in measurement intervals for which such intervals are either in resuming or suspended status.

Perm Write
(Component, Job Interval) The number of permanent write operations performed for the selected jobs during the interval.

Permanent writes per transaction
(System) The average number of permanent write operations per interactive transaction.

Physical I/O Count
(Transaction, Batch Job Trace) For the Job Summary section of the Batch Job Trace Report, the number of synchronous and asynchronous disk operations (reads and writes). For the Transition Report, the next five columns provide information about the number of synchronous and asynchronous disk I/O requests while the job was in the given state. The first line is the synchronous disk I/O requests, and the second line is the asynchronous disk I/O requests.

DB Read
The number of database read requests while the job was in that state.

DB Wrt
The number of database write requests while the job was in that state.

NDB Read
The number of nondatabase read requests while the job was in that state.

NDB Wrt
The number of nondatabase write requests while the job was in that state.

Tot The total number of DB Read, DB Wrt, NDB Read, and NDB Wrt requests.

Pl (Component, Transaction, Job Interval, Pool Interval) The number of the pool in which the subsystem or job ran.

Pool (Transaction, Job Interval, Batch Job Trace) The number of the pool containing the transaction (for example, in which the job ran.)

Pool ID
(System) Pool identifier.

Pool ID Faults
(Component) User pool that had the highest page fault rate.

Pool Mch Faults/Sec
(Component) Average number of machine pool page faults per second.

Pool size (KB)
(System, Component) For the Storage Pool Activity section of the Component Report it is the initial pool size in kilobytes (1024 bytes). For the System Model Parameters section of the System Report, it is the total size in kilobytes of all pools that incurred interactive job activity.

Pool User Faults/Sec
(Component) Average number of user pool page faults per second, for the user pool with highest fault rate during this interval.

Pools (System, Component, Transaction, Job Interval, Pool Interval) In the Report-Selection Criteria section, the list of pools selected to be included (SLTPOOLS parameter) or excluded (OMTPOOLS parameter). Otherwise, the pools you specify. The values can be from 1 through 64.

Prg (Transaction) The purge attribute of the jobs.

Printer Lines
(System, Job Interval) The number of lines printed by the job during the interval.

Printer Pages
(System, Job Interval) The number of pages printed by the job during the interval.

Priority
(System, Transaction) The priority of the job.

Program
(Transaction) The name of the program with which the transaction is associated.

Program Name
(Transaction) For the Job Summary section of the Transaction Report, the name of the program in control at the start of the transaction. Other programs may be used during the transaction. For the Transaction Report section, the name of the program active at the start of the transaction. If ADR=UNKNWN (address unknown) is shown under the column, the program was deleted before the trace data was dumped to the database file. If ADR=000000 is shown under the column, there was not enough trace data to determine the program name, or there was no program active at that level in the job when the trace record was created.

Protocol
(System) Line protocol.

- SDLC
- ASYNC
- BSC
- X25
- TRLAN
- ELAN (Ethernet)
- IDLC
- DDI

- FRLY

Pty (Component, Transaction, Job Interval) Priority of the job. For the Concurrent Batch Job Statistics section of the Transaction Report, it is the priority of the jobs in the job set.

Purge (Transaction) The purge attribute of the jobs.

PWrt (Transaction) The number of permanent write I/O operations.

Queue Length
(Resource Interval) The average number of I/O requests that had to wait in the queue for this unit.

Rank (Transaction) The order. For the Job Summary section, it is the order of the program according to the number of transactions. For the Job Statistics section, it is the order of the job. For the Interactive Program Statistics section, it is the order of the program. For the Individual Transaction Statistics section, it is the order of the transaction according to the data being put in order by importance. For the Largest Seize/Lock Conflicts section, it is the order of the seize or lock conflict.

Ratio of write disk I/O to total disk I/O
(System) The fraction of the total disk activity that is due to writing data to the disks.

Reads per Second
(Resource Interval) The average number of disk read operations performed per second by the disk arm.

Receive CRC Errors
(Resource Interval) The number of received frames that contained a cycle redundancy check (CRC) error. This indicates that the data was not received error free.

Record Number
(Lock) For database file members, the relative record number of the record within the database file member.

Remote LAN Pct Frames Recd
(Resource Interval) The number of frames received from a local area network (LAN) connected to the locally attached LAN.

Remote LAN Pct Frames Trnsmitd
(Resource Interval) The number of frames transmitted to a local area network (LAN) connected to the locally attached LAN.

Remote Not Ready
(Resource Interval) The percentage of all receive-not-ready frames that were received by the host system. A large percentage often means the remote device cannot process data fast enough (congestion).

Remote Seq Error
(Resource Interval) The percent of frames received out of order by a remote device or system. This can occur when the remote device or system cannot process data fast enough.

Requestor's Job Name
(Lock) The name of the job requesting the locked object (the same as in the detail listing).

Reset Packets Recd
(Resource Interval) The number of reset packets received by the network. **Reset packets** are packets retransmitted because an error occurred.

Reset Packets Trnsmitd
(Resource Interval) The number of reset packets transmitted by the network.

Response
(System) Average system response (service) time.

Response Sec Avg and Max
(Transaction) The average (AVG) and maximum (MAX) transaction response time, in seconds, for the job. The average response time is calculated as the sum of the time between each pair of wait-to-active and active-to-wait transitions divided by the number of pairs that were encountered for the job. The MAX response time is the largest response time in the job.

Response Seconds
(System) Average response time in seconds per transaction.

Rsp (Component) Average interactive transaction response time in seconds.

Rsp Time
(Component, Resource Interval) The average external response time (in seconds). For the Local Work Station IOP Utilizations section of the Resource Interval Report, it is the response time for work stations on this controller. For the Remote Work Stations section of the Component Report, it is the response time for this work station.

Rsp Timer Ended
(Resource Interval) The number of times the response timer ended waiting for a response from a remote device.

Rsp/Tns
(Component, Transaction, Job Interval) The average response time (seconds) per transaction. For the Job Summary section of the Job Interval Report, it is the response time per transaction for the selected interactive jobs during the interval (the amount of time spent waiting for or using the system resources divided by the number of transactions processed). This number will not be accurate unless at least several seconds were spent processing transactions.

S/L (Transaction) Whether the conflict was a seize (S) or lock (L) conflict.

Segments Pct Rtrns
(Component) The percentage of segments retransmitted. This number is the TCP segments that were transmitted and that contain one or more previously transmitted octets (bytes).

Segments Rcvd per Second
(Component) The number of segments received per second. This number includes those received in error and those received on currently established connections.

Segments Sent per Second
(Component) The number of segments sent per second. This number includes those sent on currently established connections and excludes those that contain only retransmitted octets (bytes).

Seize and Lock Conflicts
(Batch Job Trace) Number of seize conflicts and lock waits.

Seize Conflict
(Component) Number of seize exceptions per second. For more detailed information, issue the Start Performance Trace (STRPFRTRC) command, and use the PRTTNSRPT or PRTLCKRPT commands.

This count could be very high, even under normal system operation. Use the count as a monitor. If there are large variations or changes, explore these variations in more detail.

Seize Hold Time
(Transaction) The amount of time that the transaction held up other jobs in the system by a seize or lock on an object.

Seize Wait /Tns
(Transaction) The average time, in seconds, for all seize-lock conflicts that occur during an average transaction. More than one seize-lock conflict can occur during a single transaction for the same job. If this number is high, investigate those jobs with seize conflicts. The Transaction Report lists each conflict that occurs, the name of the holder, and the name of the object held.

For the Transaction by 5-Minute Intervals section of the Job Summary Report, it is the average seize wait time per transaction in seconds. This is the average amount of time that the transactions spent in a seize/lock conflict. If this number is high, look at the Transaction and Transition Reports for the jobs that are causing the excessive wait time.

Select Parameters
(System, Component, Transaction, Job Interval, Pool Interval) The criteria used to choose the data records to be included in the report. The criteria are generally specified using an SLTxxx parameter of the command. Only nondefault values (something other than *ALL) are printed. If a parameter is not specified, it does not appear on the report.

Sequence Error
(Resource Interval) The number of frames received that contained sequence numbers indicating that frames were lost.

Short Frame Errors
(Resource Interval) The number of short frames received. A short frame is a frame that has fewer octets between its start flag and end flag than are permitted.

Short Wait /Tns
(Transaction) The average time, in seconds, of short (active) wait time per transaction.

For the Interactive Program Statistics section, if the value is high, it may be due to the use of data queues or to the use of DFRWRT(*NO) or RSTDSP(*YES) in the program display files.

Short WaitX /Tns (Short wait extended)
(Transaction) The average time, in seconds, of wait time per transaction that resulted due to a short (active) wait that exceeded 2 seconds, and caused a long wait transition to occur. The activity level has been released but this time is still counted against your total response time. Waits on data queues or the use of DFRWRT(*NO) and/or RSTDSP(*YES) in the display files could be reasons for this value to be high.

Size (Component) Decimal data overflow and underflow exceptions per second. An indication of improper field size on numeric calculations.

Size (K)
(System, Pool Interval) The size of the pool in kilobytes (1024 bytes).

Size (M)
(System) Disk space capacity in millions of bytes.

SMAPP ReTune
(Component) System-managed access path protection tuning adjustments.

SOTn (Transaction) Listed in the Wait Code column, Start of transaction n. [2]

Spool CPU seconds per I/O
(System) The average number of system processing unit seconds used by all spool jobs for each I/O performed by a spool job.

Spool database reads per second
(System) The average number of read operations to database files per second of spool processing.

Spool I/O per second
(System) The average number of physical disk I/O operations per second of spool processing.

Srv Time
(Component) Average disk service time per request in seconds not including the disk wait time. See Figure 23 on page 80 for disk response time.

Start (Transaction) The time the job started.

Started
(Transaction) The time of the first record in the trace data, in the form HH.MM.SS (hours, minutes, seconds).

State (Transaction) The three possible job states are shown in Figure 98.

```
┌────► W (wait state) not holding an activity level
│
│ ┌──► A  (Active or wait state) holding an activity
│ │                level
│ │ ┌──► I   (ineligible state) waiting for an
│ │ │              activity level
│ │ │    The type of transition is shown below.
│ │ │    The direction and position of the arrow
│ │ │    indicates which transition was made.
│ │ │
│ │ │
W A I
─────
```

Figure 98. Possible Job States

Figure 99 on page 196 shows the possible job state transitions. For example, from **W** to **A** is **y**, or yes, which means it is possible for a job to change from the *wait* state to the *active* state.

2. These codes are in the wait code column, but they are not wait codes. They indicate transaction boundary trace records. For more information see "Chapter 8. Transaction Boundaries—Manager Feature" on page 209.

From state \ To state	A	W	I
A	y	y	y
W	y	-	y
I	y	-	-

A = Active state
W = Wait state
I = Ineligible state

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Figure 99. Job State Transitions

State Transitions A-A
(Batch Job Trace) Number of active-to-active transitions.

State Transitions A-I
(Batch Job Trace) Number of active-to-ineligible transitions.

Stop (Transaction) The time the job ended.

Stopped
(Transaction) The time of the last record in the trace data, in the form HH.MM.SS (hours, minutes, seconds).

Subsystem Name
(Pool Interval) The name of the subsystem.

Subsystems
(System, Component, Pool Interval) For the System Report, the subsystem names you specify. Each name is a 10-character name. For the Component Report, the list of subsystems selected to be included (SLTSBS parameter) or excluded (OMTSBS parameter).

Sum (Transaction) Listed in the Sync Disk I/O Rqs/Tns column, the sum of the averages of the synchronous DB READ, DB WRITE, NDB READ, and NDB WRITE requests (the average number of synchronous I/O requests per transaction for the job).

SWX (Transaction) Listed in the Wait Code column, Short Wait Extended. The short wait has exceeded a 2-second limit and the system has put the transaction into a long wait. This long wait must be charged to the transaction response time. In most cases, this active-to-wait transaction does not reflect a transaction boundary.

Sync (Job Interval) The number of synchronous disk I/O operations performed by the selected interactive jobs during the interval.

Sync DIO /Tns
(Transaction) The average number of synchronous I/O requests per transaction during the interval.

Sync Disk I/O
(System, Component, Transaction) Synchronous disk I/O operations.

Sync Disk I/O per Second
(Component) Average synchronous disk I/O operations per second.

Sync Disk I/O Requests
(Transaction) The total number of synchronous disk I/O requests for the given combination of priority, job type, and pool.

Sync Disk I/O Rqs/Tns
(Transaction) The next five columns provide information about the number of synchronous disk I/O requests per transaction:

DB Read
The average number of synchronous database read requests per transaction.

DB Write
The average number of synchronous database write requests per transaction.

NDB Read
The average number of synchronous nondatabase read requests per transaction.

NDB Write
The average number of synchronous nondatabase write requests per transaction.

Sum The sum of the averages of the synchronous DB READ, DB WRITE, NDB READ, and NDB WRITE requests (the average number of synchronous I/O requests per transaction for the job).

Sync I/O /Elp Sec
(Transaction) The average number of synchronous disk I/O requests for all jobs, per second of elapsed time used by the jobs.

Sync I/O /Sec
(Job Interval) The average number of synchronous disk I/O operations performed per second by the job during the interval. This is calculated from the synchronous disk I/O count divided by the elapsed time.

Sync I/O Per Second
(Job Interval) The average number of synchronous disk I/O operations performed per second by the selected noninteractive jobs during the interval.

Synchronous DBR
(System, Transaction, Job Interval, Pool Interval) The average number of synchronous database read operations. It is the total synchronous database reads divided by the total transactions. For the Pool Interval and Job Interval Reports, it is calculated per transaction for the job during the intervals. For the System Report, it is calculated per second. For the Transaction (Job Summary) it is calculated per transaction. Listed under Average DIO/Transaction, the average number of synchronous database read requests per transaction. This field is not printed if the jobs in the system did not process any transactions.

Synchronous DBW
(System, Transaction, Job Interval, Pool Interval) The average number of synchronous database write operations. It is the total synchronous database writes divided by the total transactions. For the Pool Interval and Job Interval Reports, it is calculated per transaction for the job during the intervals. For the System Report, it is calculated per second. For the Transaction (Job Summary) it is calculated per transaction. Listed under Average DIO/Transaction, the average number of synchronous database read requests per transaction. This field is not printed if the jobs in the system did not process any transactions.

Synchronous DIO / Act Sec
(System, Transaction) The number of synchronous disk I/O operations per active second. The active time is the elapsed time minus the wait times.

Synchronous DIO / Ded Sec
(Transaction) The estimated number of synchronous disk I/O operations per second as if the job were running in dedicated mode. Dedicated mode means that no other job would be active or in contention for resources in the system.

Synchronous DIO / Elp Sec
(Transaction) The number of synchronous disk I/O operations per elapsed second.

Synchronous Disk I/O Counts
(Transaction) The next five columns provide information about the number of synchronous disk I/O requests per transaction:

DB Read
The number of synchronous database read requests per transaction.

DB Wrt
The number of synchronous database write requests per transaction.

NDB Read
The number of synchronous nondatabase read requests per transaction.

NDB Wrt
The number of synchronous nondatabase write requests per transaction.

Sum The sum of the synchronous DB Read, DB Wrt, NDB Read, and NDB Wrt requests (the number of synchronous I/O requests per transaction).

Synchronous disk I/O per transaction
(System, Transaction) The average number of synchronous physical disk I/O operations per interactive transaction.

Synchronous Max
(Transaction) The maximum number of synchronous DBR, NDBR, and WRT I/O requests encountered for any single transaction by that job. If the job is not an interactive or autostart job type, the total disk I/O for the job is listed here.

Synchronous NDBR
(System, Transaction, Job Interval, Pool Interval) The average number of synchronous nondatabase read operations per transaction for the jobs in the system during the interval. For the Transaction Report, the operations on the disk per transaction for the selected jobs in the pool. This is calculated from the synchronous nondatabase read count divided by the transactions processed. This field is not printed if the jobs in the system did not process any transactions.

Synchronous NDBW
(System, Job Interval, Pool Interval) The average number of synchronous nondatabase write operations on the disk per transaction for the selected jobs in the pool. For the System Report, it is the operations per transaction for the jobs in the system during the interval. This is calculated from the synchronous nondatabase write count divided by the transactions processed. This field is not printed if the jobs in the system did not process any transactions.

Synchronous Sum
(Transaction) The sum of the averages of the synchronous DBR, NDBR, and WRT requests (the average number of synchronous I/O requests per transaction for the job).

Synchronous wrt
(Transaction) The average number of synchronous database and nondatabase write requests per transaction.

System CPU per transaction (seconds)
(System) The average number of system processing unit seconds per interactive transaction.

System disk I/O per transaction
(System) The total number of physical disk I/O operations attributed to the system per interactive transaction.

System Starts
(Component) The number of start journal operations initiated by the system.

System Stops
(Component) The number of stop journal operations initiated by the system.

System Total
(Component) The total number of journal deposits resulting from system-journaled objects. These are the deposits performed by system-managed access path protection (SMAPP).

System ToUser
(Component) The number of journal deposits resulting from system-journaled objects to user-created journals.

SZWG
(Transaction) Listed in the Wait Code column, Seize Wait Granted. The job was waiting on a seize conflict. The original holder released the lock that it had on the object, and the lock was then granted to the waiting job. The job that was waiting for the object is named on this line (WAITER --) along with the amount of time the job spent waiting for the seize conflict to be released. The object that is held is named on the next line of the report (OBJECT --).

SZWT (Transaction) Listed in the Wait Code column, Seize/Lock Conflict Wait. The job is waiting on a seize/lock conflict. The time (*/ time /*) is the duration of the seize/lock conflict, and is included in the active time that follows it on the report. The holder of the lock is named at the right of the report line (HOLDER --). The object being held is named on the next report line (OBJECT --).

Teraspace EAO
(Component) Listed in the Exception Occurrence summary and Interval Counts. A teraspace effective address overflow (EAO) occurs when computing a teraspace address that crosses a 16-boundary. A quick estimate indicates that a 1% performance degradation would occur if there were 2,300 EAOs per second.

Thread
(Job Summary, Transaction, Transition) A thread is a unique flow of control within a process. Every job has an initial thread associated with it. Each job can start one or more secondary threads.

The system assigns the thread number to a job as follows:

- The system assigns thread IDs sequentially. When a job is started that uses a job structure that was previously active, the thread ID that is assigned to the initial thread is the next number in the sequence.
- The first thread of a job is assigned a number.
- Any additional threads from the same job are assigned a number that is incremented by 1. For example:

```
 Job Name   User Name/  Job Number
            Thread
QJVACMDSRV   SMITH        023416
QJVACMDSRV    00000006   023416
QJVACMDSRV    00000007   023416
QJVACMDSRV    00000008   023416
```

  A thread value greater than 1 does not necessarily mean the job has had that many threads active at the same time. To determine how many threads are currently active for the same job, use the WRKACTJOB, WRKSBSJOB, or WRKUSRJOB commands to find the multiple three-part identifiers with the same job name.

Time (Transaction) The time when the transaction completed, or when a seize or lock conflict occurred. Also, a column heading that shows the time the transition from one state to another occurred, in the HH.MM.SS.mmm arrangement.

Tns (Component, Pool Interval) The total number of transactions processed by the selected jobs in the pool or subsystem.

Tns Count
(Component, Job Interval) The number of transactions performed by the selected interactive jobs during the interval.

Tns/Hour
(Component, Transaction, Job Interval) The average number of transactions per hour processed by the selected interactive jobs during the interval.

Tns/Hour Rate
(System) Average number of transactions per hour.

TOD of Wait
(Lock) The time of day of the start of the conflict.

Tot (Transaction) Listed in Physical I/O Counts column, the total number of DB Read, DB Wrt, NDB Read, and NDB Wrt requests.

Tot Nbr Tns
(Transaction) The total number of transactions the PRTTNSRPT program determined from the input data that were accomplished for the job.

Total (Component) Total exception counts for the reporting period.

Total /Job
(Transaction) The total (sum) of the items in the column for the job.

Total characters per transaction
(System) The average number of characters either read from or written to display station screens per interactive transaction.

Total CPU Sec /Sync DIO
(Transaction) The ratio of total CPU seconds divided by the total synchronous disk I/O requests.

Total CPU Utilization
(System, Component) Percentage of available processing unit time used by interactive jobs, batch jobs, all system jobs, and Licensed Internal Code tasks. For a multiple-processor system this is the average use across all processors.

For a multiple-processor system, *Total CPU Utilization* is replaced by a utilization value for each processor in the system. Here is an example of this part of the display for a system with two processors:

```
Average CPU utilization . . . . . :    41.9
CPU 1 utilization . . . . . . . . :    41.7
CPU 2 utilization . . . . . . . . :    42.2
```

Note: This value is taken from a system counter. Other processing unit uses are taken from the individual job work control blocks (WCBs). These totals may differ slightly.

Total CPU Utilization (Database Capability)
(System) Shows you the DB2 Universal Database for iSeries activity on your systems. This field applies to all systems running V4R5 or later and includes all database activity, including all SQL and data I/O operations.

Total CPU Utilization (Interactive Feature)
(System) The CPU Utilization (Interactive Feature)shows the CPU utilization for all jobs doing 5250 workstation I/O operations relative to the capacity of the system for interactive work. Depending on the system and associated features purchased, the interactive capacity is equal to or less than the total capacity of the system.

Total Data Characters Received
(Resource Interval) The number of data characters received successfully.

Total Data Characters Transmitted
(Resource Interval) The number of data characters transmitted successfully.

Total Datagrams Requested for Transmission
(Component) The percentage of IP datagrams that are discarded because of the following reasons:

- No route was found to transmit the datagrams to their destination.
- Lack of buffer space.

Total fields per transaction
(System) The average number of display station fields either read from or written to per interactive transaction.

Total Frames Recd
(Resource Interval) The number of frames received, including frames with errors and frames that are not valid.

Total I Frames Trnsmitd
(Resource Interval) The total number of information frames transmitted.

Total I/O
(System) Sum of the read and write operations.

Total PDUs Received
(Resource Interval) The number of protocol data units (PDUs) received during the time interval.

Note: A protocol data unit (PDU) for asynchronous communications is a variable-length unit of data that is ended by a protocol control character or by the size of the buffer.

Total Physical I/O per Second
(Resource Interval) The average number of physical disk I/O operations performed per second by the disk arm.

Total Responses
(Component, Resource Interval) The total number of transactions counted along with the average response time for all active work stations or devices on this controller for the report period.

Total Seize/Wait Time
(Component) The response time in milliseconds for each job.

Total Tns
(Component) Number of transactions processed in this pool.

Transaction Response Time (Sec/Tns)
(Transaction) The response time in seconds for each transaction. This value includes no communications line time. Response times measured at the work station exceed this time by the data transmission time (the time required to transmit data from the work station to the processing unit and to transmit the response data back to the work station from the processing unit).

Transactions per hour (local)
(System) The interactive transactions per hour attributed to local display stations.

Transactions per hour (remote)
(System) The interactive transactions per hour attributed to remote display stations.

Transmit/Receive/Average Line Util
(Resource Interval) In duplex mode, the percentage of transmit line capacity used, the percentage of receive line capacity used, and the average of the transmit and receive capacities.

TSE (Transaction) Listed in the Wait Code column, Time Slice End. The program shown in the stack entry labeled LAST is the program that went to time slice end.

Typ (Component, Transaction) The system job type and subtype. The Component Report allows only one character in this column. The Transaction Report allows two characters. The Transaction Report reports the job type and job subtype directly from the QAPMJOBS fields. The Component Report takes the job type and job subtype values and converts it to a character that may or may not be the value from the QAPMJOBS field. Table 8 on page 72 shows the following information in table format. The possible job types are:

A Autostart

B Batch

BD Batch immediate (Transaction only)

Note: The batch immediate values are shown as BCI on the Work with Active Job display and as BATCHI on the Work with Subsystem Job display.

BE Batch evoke (Transaction only)

BJ Batch pre-start job (Transaction only)

C Programmable work station application server, which includes 5250 emulation over APPC and Client Access host servers running either APPC or TCP/IP. You can find the host server information under the Client Access topic in the iSeries Information Center.

A job is reported as a Client Access server if any of the following items are true:

- Incoming APPC evoke requests one of the server program names. This also applies to the pre-started jobs for the QSERVER, QCMN, and QSYSWRK subsystems that are already waiting for the named program.
- Incoming IP port number corresponds to one of the service name-description-port-numbers. This also applies to the pre-started jobs for the QSERVER, QCMN, and QSYSWRK subsystems that are already waiting for the assigned IP port number.
- Incoming IPX socket number corresponds to one of the service name-description-port-numbers. This also applies to the pre-started jobs for the QSERVER, QCMN, and QSYSWRK subsystems that are already waiting for the assigned IPX port number.
- Incoming 5250 display emulation jobs that come from APPC data streams sent by 5250 emulation under OS/2 Communications Manager or WARP equivalent.

D Target distributed data management (DDM) server

I Interactive. For the Component Report, this includes twinaxial data link control (TDLC), 5250 remote workstation, and 3270 remote workstation. For the Transaction Report, this includes twinaxial data link control (TDLC), 5250 remote workstation, 3270 remote workstation, SNA pass-through, and 5250 Telnet.

L Licensed Internal Code Task

M Subsystem monitor

P SNA pass-through and 5250 Telnet pass-through. On the Transaction Report, these jobs appear as I (interactive).

R Spool reader

S System

W Spool writer, which includes the spool write job, and if Advanced Function Printing (AFP) is specified, the print driver job.

WP Spool print driver (Transaction only)

X Start the system

The possible job subtypes are:

D Batch immediate job

E Evoke (communications batch)

J Pre-start job

P Print driver job

T Multiple requester terminal (MRT) (System/36 environment only)

3 System/36

Notes:

1. Job subtypes do not appear on the Component Report.
2. If the job type is blank or you want to reassign it, use the Change Job Type (CHGJOBTYP) command to assign an appropriate job type.

Type (System, Transaction, Job Interval) One of the transaction types listed in the description of the DTNTY field in Table 16 on page 152.

(System)
The disk type.

(Transaction)
The type and subtype of the job.

(Transaction)
For the Seize/Lock Conflicts by Object section, the type of seize/lock conflict.

UDP Datagrams Received
(Component) The total number of User Datagram Protocol (UDP) datagrams delivered to UDP users.

UDP Datagrams Sent
(Component) The total number of User Datagram Protocol (UDP) datagrams sent from this entity.

Unicast Packets Received
(System) The total number of subnetwork-unicast packets delivered to a higher-layer protocol. The number includes only packets received on the specified interface.

Unicast Packets Sent
(System) The total number of packets that higher-level protocols requested to be transmitted to a subnetwork-unicast address. This number includes those packets that were discarded or were not sent.

Unit (System, Component, Resource Interval) The number assigned by the system to identify a specific disk unit or arm. An 'A' or 'B' following the unit number indicates that the disk unit is mirrored. (For example, 0001A and 0001B are a mirrored pair.)

Unit Name
The resource name of the disk arm.

User ID
(System, Component, Transaction, Job Interval, Pool) The list of users selected to be included (SLTUSRID parameter) or excluded (OMTUSRID parameter).

User Name
(Component, Transaction, Job Interval, Batch Job Trace) Name of the user involved (submitted the job, had a conflict, and so on.)

User Name/Thread
(Component, Transaction) If the job information contains a secondary thread, then this column shows the thread identifier. If the job information does not contain a secondary thread, then the column shows the user name.

The system assigns the thread number to a job as follows:

- The system assigns thread IDs sequentially. When a job is started that uses a job structure that was previously active, the thread ID that is assigned to the initial thread is the next number in the sequence.
- The first thread of a job is assigned a number.
- Any additional threads from the same job are assigned a number that is incremented by 1. For example:

```
 Job Name   User Name/  Job Number
            Thread
QJVACMDSRV   SMITH       023416
QJVACMDSRV    00000006   023416
QJVACMDSRV    00000007   023416
QJVACMDSRV    00000008   023416
```

  A thread value greater than 1 does not necessarily mean the job has had that many threads active at the same time. To determine how many threads are currently active for the same job, use the WRKACTJOB, WRKSBSJOB, or WRKUSRJOB commands to find the multiple three-part identifiers with the same job name.

User Starts
(Component) The number of start journal operations initiated by the user.

User Stops
(Component) The number of stop journal operations initiated by the user.

User Total
(Component) The total number of journal deposits resulting from system-journaled objects.

Util (Component, Resource Interval) The percent of utilization for each local work station, disk, or communications IOP, controller, or drive.

Note: The system-wide average utilization does not include data for mirrored arms in measurement intervals for which such intervals are either in resuming or suspended status.

Util 2 (Component, Resource) Utilization of co-processor.

Value (Transaction) For the Individual Transaction Statistics section of the Job Summary report, it is the value of the data being compared for the transaction. For the Longest Seize/Lock Conflicts section, it is the number of seconds in which the seize or lock conflict occurred.

Verify (Component) Number of verify exceptions per second. Verify exceptions occur when a pointer needs to be resolved, when blocked MI instructions are used at security levels 10, 20, or 30, and when an unresolved symbolic name is called.

This count could be very high, even under normal system operation. Use the count as a monitor. If there are large variations or changes, explore these variations in more detail.

W-I Wait/Tns
(Transaction) The average time, in seconds, of wait-to-ineligible time per transaction. This value is an indication of what effect the activity level has on response time. If this value is low, the number of wait-to-ineligible transitions probably has little effect on response time. If the value is high, adding additional interactive pool storage and increasing the interactive pool activity level should improve response time. If you are unable to increase the interactive pool storage (due to limited available storage),

increasing the activity level may also improve response time. However, increasing the activity level might result in excessive faulting within the storage pool.

Wait Code
(Transaction) The job state transition that causes the trace record to be produced. The values can be as follows:

EVT Event Wait. A long wait that occurs when waiting on a message queue.

EOTn End of transaction for transaction for type n. [3]

EORn End of response time for transaction n. [3]

HDW Hold Wait (job suspended or system request).

LKRL Lock Released. The job released a lock it had on the object named on the next detail line of the report (OBJECT --). The job that was waiting for the object is named on this line (WAITER --) along with the amount of time the job spent waiting for the lock to be released.

LKW Lock Wait. If there are a number of these, or you see entries with a significant length of time in the ACTIVE/RSP* column, additional analysis is necessary. The LKWT report lines that precede this LKW report line show you what object is being waited on, and who has the object.

LKWT
Lock Conflict Wait. The job is waiting on a lock conflict. The time (*/ time /*) is the duration of the lock conflict and, though not equal to the LKW time, should be very close to it. The holder of the lock is named at the right of the report line (HOLDER --). The object being locked is named on the next report line (OBJECT --).

SOTn Start of transaction n. [3]

SWX Short Wait Extended. The short wait has exceeded a 2-second limit and the system has put the transaction into a long wait. This long wait must be charged to the transaction response time. In other words, this active-to-wait transaction does not reflect a transaction boundary.

SZWG
(Transaction) Listed in the Wait Code column, Seize Wait Granted. The job was waiting on a seize conflict. The original holder released the lock that it had on the object, and the lock was then granted to the waiting job. The job that was waiting for the object is named on this line (WAITER --) along with the amount of time the job spent waiting for the seize conflict to be released. The object that is held is named on the next line of the report (OBJECT --).

SZWT Seize/Lock Conflict Wait. The job is waiting on a seize/lock conflict. The time (*/ time /*) is the duration of the seize/lock conflict, and is included in the active time that follows it on the

3. These codes are in the wait code column, but they are not wait codes. They indicate transaction boundary trace records. For more information see “Chapter 8. Transaction Boundaries—Manager Feature” on page 209.

report. The holder of the lock is named at the right of the report line (HOLDER --). The object being held is named on the next report line (OBJECT --).

TSE Time Slice End. The program shown in the stack entry labeled LAST is the program that went to time slice end. Every time a job uses 0.5 seconds of CPU time (0.2 seconds on the faster processors) between long waits, the system checks if there are jobs of equal priority on the CPU queue. If there are, then the next job with equal priority is granted the CPU and the interrupted job is moved to the queue as the last of equal priority. The job, however, retains its activity level. This is an internal time slice end.

When a job reaches the external time slice value, there can be a job state transition from active to ineligible if another job is waiting for an activity level. When a job is forced out of its activity level, its pages are liable to be stolen by other jobs, and cause additional I/O when the job regains an activity level.

The IBM-supplied default values of 2 seconds for interactive jobs and 5 seconds for batch jobs may often be too high, especially for the high-end processors. As an initial value, set the time slice at 3 times the average CPU seconds per transaction.

WTO Wait Timed Out. The job has exceeded the wait time-out limit defined for a wait (such as a wait on a lock, a message queue, or a record).

Wait-Inel
(System, Component) Average number of wait-to-ineligible job state transitions per minute.

Work Station Controller
(Resource Interval) The name of the remote work station controller.

Writes per Second
(Resource Interval) The average number of disk write operations performed per second by the disk arm.

WTO (Transaction) Listed in the Wait Code column, Wait Timed Out. The job has exceeded the wait time-out limit defined for a wait (such as a wait on a lock, a message queue, or a record).

0.0-1.0 (Component, Resource Interval) The number of times the response time was between 0 and 1 second.

1.0-2.0 (Component, Resource Interval) The number of times the response time was between 1 and 2 seconds.

2.0-4.0 (Component, Resource Interval) The number of times the response time was between 2 and 4 seconds.

4.0-8.0 (Component, Resource Interval) The number of times the response time was between 4 and 8 seconds.

Chapter 8. Transaction Boundaries—Manager Feature

A **transaction** is a basic unit of work done on a system. The type of work varies, depending on what kind of work it is or who is doing the work. Performance Tools reports capture information about many kinds of system transactions; you can then use these reports to analyze system performance.

When the Transaction Report counts transactions, it uses only state transactions. For example, when a job goes from wait to active state, this marks the beginning of a transaction. When a job goes from active to wait, the transaction is considered ended. For the display I/O transactions and the data queue transactions, you can specify values *DI and *DQ. These values use existing transaction boundary trace records to count transactions instead of the wait-to-active state transition.

This chapter provides information about the following types of system transactions:

- Display I/O information
- SNA performance measurements
- APPN control point performance
- APPC protocol
- Performance measurement and SNADS
- SNADS sample data
- SNADS performance notes
- Pass-through
- Licensed Internal Code server
- Data queue transactions

Display I/O Transaction Boundary Information

The transaction boundary information in Figure 100 shows how a display I/O transaction uses system resources by showing the relationship between transaction response time and resource usage time.

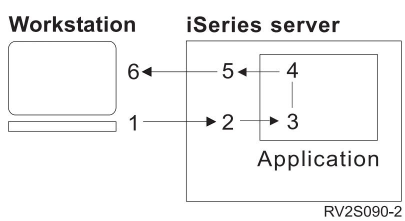


Figure 100. Example: Display I/O Transaction

The numbers 1 through 6 in the following list refer to the same numbers in Figure 100.

1 The user presses Enter or a function key. This begins the response time period perceived by the user. However, the system does not recognize the beginning of the transaction until step 2.

Delays are typical on a remote communication line. They are dependent on the following:

- The amount of current data traffic to and from other work stations on the line.
- How frequently the system polls the control unit for input data.

2 Start of Transaction (SOT) [4]

Identifies the beginning of the System Measured Response Time. Workstation I/O Management (WSIOM) processes input from the display station. This also represents the beginning of application-input queuing time.

This is a trace data point.

3 Start of Resource Utilization Time (SOR)

The application must issue an input operation or accept an input operation. An application program receives the data from WSIOM and begins using system resources to process the transaction. The application-input queuing time ends at this point. Normally, application-input queuing time, like activity-level waiting time, is only a few milliseconds.

4 End of Resource Utilization Time (EOR) [4]

The application program completes using system resources. This normally coincides with the End of Transaction (EOT).

At this point, the program has performed an operation that causes work station I/O to send data to the display station. The following user program operations cause the data to be sent to the display station:

- Read or invite input operation following one or more output operations with the defer write (DFRWRT) parameter set to *YES in the display file description.
- Output operation with DFRWRT(*NO) in the display file description.
- Output operation with the DDS INVITE keyword.
- Combined output/input operation. For example, an EXFMT operation in an RPG/400 program and a SNDRCVF command in a control language (CL) program.
- End of program.

This is a sample data point.

5 End of Transaction (EOT) [4]

The end of the System Measured Response Time. The next transaction may begin. Resource usage by the transaction is measured at this point. This may coincide with the End of Resource Utilization Time (EOR). Any Active-Wait transition is included here.

This is a trace data point.

6 System response displayed to user.

1→6 Display I/O Transaction Path

The complete path taken by the transaction. This is the time from when the user presses Enter or a function key to the time when the user receives a response. This is the user’s perception of the response time.

4. The SOT, EOR, and EOT abbreviations appear on the Transition Report. For an example of a Transition Report, see Figure 65 on page 120.

2→3 Application Input Queuing Time

This is the time the input data waits before the system resources are made available to it. Examples are input data waiting on:

- An activity level
- The program to issue an input operation
- The program to accept input.

The total application queuing time (in hundredths of a second) is stored in the JBAIQT field in the QAPMJOBS file or the QAPMJOBL file. The number of application queuing transactions is stored in the JBNAIQ field in the QAPMJOBS file or the QAPMJOBL file. These fields are also updated by data queue transactions.

3→4 Transaction Resource Usage

The period when system resources are used for processing including periods of waiting, such as object seize/lock conflicts and resource queuing.

The total resource usage time (in seconds) is stored in the JBRUT field in the QAPMJOBS file or the QAPMJOBL file. The number of resource usage transactions is stored in the JBNRU field in the QAPMJOBS file or the QAPMJOBL file. These fields are also updated by data queue transactions.

2→5 System Response Time

The total transaction time (in seconds) is stored in the JBRSP field in the QAPMJOBS file or the QAPMJOBL file. The number of transactions (5250 only) is stored in the JBNTR field in the QAPMJOBS file or the QAPMJOBL file. These fields are also updated by Client Access shared folders transactions and by pass-through transactions.

1→2 Components of response time are not recorded by the system.

5→6 Components of response time are not recorded by the system.

SNA Performance Measurements

The SNA performance measurements provide a different set of internal performance data for each APPC and host controller description. These measurements include the activity created by attached device descriptions and APPN intermediate sessions.

Performance data is collected for a controller description only after the controller is varied on and at least one connection has been established with the adjacent system. Performance data is not collected after the controller description is varied off.

The QAPMSNA file contains the SNA performance measurements. The fields in the QAPMSNA file are categorized as follows:

- Correlation fields
- Connection fields
- Device description fields
- T2 station I/O manager task fields
- Session traffic fields

Correlation Fields

Correlation fields include external configuration names and internal task names that allow the performance measurements to be correlated to other parts of the system.

Correlating the SNA performance measurements with other parts of the system is important. The following correlation fields are defined:

SCTLNM
: Names the APPC or host controller description.

SLINNM
: Names the line description that is attached to the controller description. If *LOCAL is specified for the link type parameter on an APPC controller description, this field is blank.

STSKNM
: Identifies the T2 station IOM task that provides services for the controller description. The QAPMJOBS file or the QAPMJOBL file contains information about processing unit use and disk unit accesses for this task.

SLIOMT
: Identifies the line IOM task that provides services for the line description. The QAPMJOBS file or the QAPMJOBL file contains information about processing unit use and disk unit accesses for this task.

Note: Because the line IOM task could service multiple station IOM tasks, the processing unit use and disk unit access data may not be attributed to a single station IOM task or controller description. For example, multiple controller descriptions are often attached to a single LAN line description.

SACPNM
: Names the adjacent control point. If the controller description is not APPN capable, this field may be blank. The adjacent CP name can be used to correlate with data displayed by the Display APPN Information (DSPAPPNINF) command.

SANWID
: Names the adjacent network ID. The adjacent network ID can be used to correlate with data displayed by the DSPAPPNINF command.

SAPPN
: Indicates whether or not the controller description is APPN capable. If the system uses the APPN support, additional performance measurements can be found in the QAPMAPPN file.

SCTYP
: Indicates whether the controller description is an APPC or host controller.

Connection Fields

Connection fields measure the frequency with which connections are established with the adjacent system.

A connection is established with the adjacent system when the status of the controller description goes from *varied off* or *vary on pending* to *varied on* or *active*. You can view this status using the Work with Configuration Status (WRKCFGSTS) command.

On a non-switched line, the connection is established after the line and controller description are varied on, assuming the adjacent system is ready to establish the connection. The non-switched connection remains until the controller is varied off, an irrecoverable line error occurs, or the adjacent system drops the connection.

On a switched line, the connection is not established until a communications program needs to use the connection (for example, the program acquires a session). The switched connection is usually dropped after the connection has been inactive (for example, all sessions are unbound) for a period of time.

The following connection fields are defined:

STLLBU
: Indicates the date and time when the most recent connection was established.

SNLBU
: Indicates the number of connections that were established with the adjacent system in the time interval. Dropping and re-establishing a connection frequently can degrade performance. Using switched lines, you may frequently re-connect if you have an inappropriate *Switched disconnect* parameter value on the controller description or irrecoverable line errors.

Device Description Fields

Device description fields measure device-related activity. APPN automatically creates, varies on, and deletes devices.

The following device description fields are defined:

STACVO
: Indicates the cumulative elapsed time in milliseconds required to automatically create and vary on APPN devices.

SNACVO
: Indicates the number of APPN devices that were automatically created or varied on.

SNADD
: Indicates the number of APPN devices that were automatically deleted.

Note: If devices are automatically created or deleted excessively, your system's performance can be degraded. Increasing the number of minutes specified on the *Autodelete device* parameter on the controller description reduces the frequency with which APPN automatically deletes devices.

T2 Station I/O Manager Task Fields

These task fields give an estimate of how much work is being done by the T2 (PU type 2) station I/O manager task.

The T2 SIOM task provides services for the controller description. The processing unit utilization and disk unit accesses for the T2 SIOM task are contained in the QAPMJOBS file or the QAPMJOBL file. A description of that file can be found in the iSeries Information Center.

The following T2 SIOM task fields are defined:

SNWAIN
Indicates the number of internal task messages that are received by the T2 SIOM task. This field is an approximation of the amount of work performed by the T2 SIOM task.

SNWAOU
Indicates the number of internal task messages that are sent by the T2 SIOM task.

Session Traffic Fields

Session traffic fields measure the sending and receiving of session traffic. A separate set of identical session traffic fields is collected for each session type and priority level combination.

There are two session types: end point and intermediate sessions. **End point** session traffic is created by the following device types:

- APPC devices
- Host devices (for example: 3270 emulation, RJE)
- DHCF display devices
- NRF display and printer devices

Intermediate session traffic is created by the following:

- APPN intermediate sessions
- SNA pass-through devices

There are four priority levels: network, high, medium and low. **Network priority** session traffic is created by the following:

- APPN
- SNA change to the number of sessions
- Alert support

High priority session traffic is created by the following:

- APPC devices
- APPN intermediate sessions

Medium priority session traffic is created by the following:

- APPC devices
- Host devices (for example, 3270 emulation, RJE)
- DHCF display devices
- NRF display and printer devices
- SNA pass-through devices
- APPN intermediate sessions

Low priority session traffic is created by the following:

- APPC devices
- APPN intermediate sessions

Therefore eight different sets of session traffic fields are collected.

The first two characters of the session traffic field name represent the session type and priority level. The first character specifies the session type:

E End point

I Intermediate

The second character specifies the priority level:

N Network

H High

M Medium

L Low

The remaining four characters represent the function of the field. Figure 101 shows the layout of the session traffic fields in the QAPMSNA file.

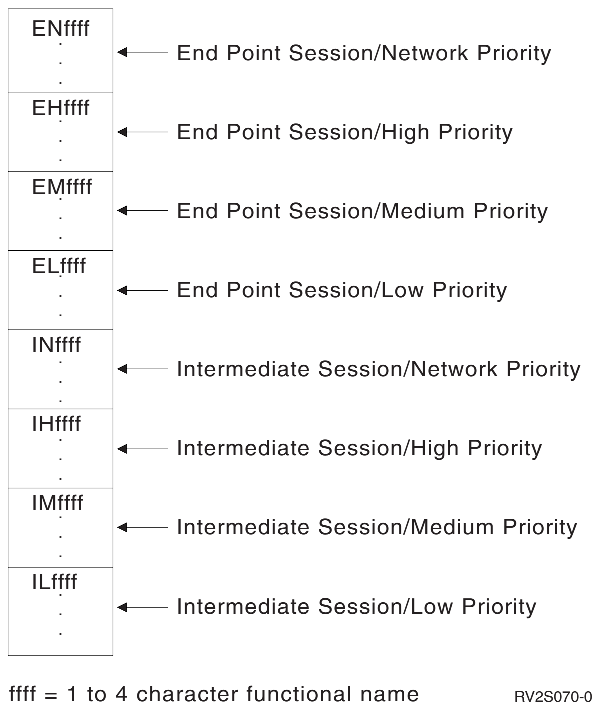


Figure 101. Layout of Session Traffic Fields

Note: Throughout the remainder of this section, the first two characters of the session traffic fields are replaced with the prefix *tp* to generically refer to any session type and priority level combination.

Number of Sessions Started and Ended

The tpNSS and tpNSE fields count the number of sessions that are started and ended, respectively. A session starts when the positive response to an SNA bind command is sent or received. A session ends when an SNA unbind command is sent or received, or the session is abnormally ended (for example, the line fails). Starting and ending sessions can cause significant system overhead.

Number of Brackets Started and Ended

The tpNBB and tpNEB fields count the number of SNA brackets that are started and ended. For sessions that are not LU 6.2, the delimiters for the start and end of a bracket are the bind and unbind command. For LU 6.2, the delimiters for the start and end of a bracket are the begin bracket indicator (BBI) and conditional end bracket indicator (CEBI) in the request header (RH). An LU 6.2 bracket is roughly equivalent to a conversation that is started when a program issues an ICF evoke operation or Common Programming Interface Communications (CPI-C) allocate verb and ends when the Common Programming Interface Communications program issues an ICF detach operation or Common Programming Interface Communications (CPI-C) deallocate verb. An example is a DSPT (display station pass-through) or SNADS session.

Sending Data

The SNA processing required to send data can be classified into the following stages:

- Session-level pacing
- Internal session-level pacing
- Transmission priority
- Line transmission

Session-Level Pacing

Session-level pacing is a technique that allows a receiving session to control the rate at which it receives request units on the normal flow. It is used primarily to prevent a receiver with unprocessed requests from overloading because the sender can create requests faster than the receiver can process them.

The following session-level pacing fields are defined:

tpSPWT
: Specifies the cumulative amount of time that application data was waiting for a pacing response to be received.

tpSPNW
: Specifies the number of times that application data was waiting for a pacing response to be received.

tpSPPW
: Specifies the total number of pacing windows, which is the potential number of times that application data could have waited for a pacing response to be received.

tpSPWS
: Specifies the cumulative pacing window size.

The following information can be derived from the session-level pacing fields:

- The average amount of time spent waiting for a pacing response to be received is: tpSPWT/tpSPNW.
- The percentage of times application data waited for a pacing response to arrive is: (tpSPNW*100)/tpSPPW.
- The average pacing window size is: tpSPWS/tpSPPW.

If excessive waiting is caused by session-level pacing, the OUTPACING (local system) and INPACING (remote system) parameters in the mode description may need to be increased. However, if the average pacing window size is 7 or more, the excessive waiting may be caused by a slow remote system or a slow remote program.

Internal Session-Level Pacing

For APPN and APPC sessions that are adaptively paced, internal session-level pacing is used to limit the amount of bandwidth used by a particular session. It only controls internal flow and does not have any external line flows. A sending session is allowed to transmit a limited number of request units and is not allowed to transmit additional request units until a request unit is successfully delivered to the adjacent system.

The INPACING and OUTPACING parameters in the mode description are used to calculate the limit. The limit used for a given session is (2*n)-1, where n is the INPACING or OUTPACING parameter. On a slow speed line, it may be necessary to configure a small limit for batch traffic and a larger limit for interactive traffic to ensure acceptable interactive response time.

The following internal session-level pacing fields are defined:

tpIPWT
: Specifies the cumulative amount of time that application data was waiting, because of internal session-level pacing.

tpIPNW
: Specifies the number of times that application data was waiting, because of internal session-level pacing.

The following information can be derived from the internal session-level pacing fields:

- The average amount of time spent waiting because of internal session-level pacing is: tpIPWT/tpIPNW.

If excessive waiting is caused by internal session-level pacing and it is not desirable to limit the amount of bandwidth used, the OUTPACING and INPACING parameters in the mode description may need to be increased.

Transmission Priority

Transmission priority determines the criteria for being selected for transmission to the adjacent system by allowing different priority levels to be assigned to session traffic. Three user-defined priorities are defined: high, medium and low. Network priority is reserved for APPN and SNA control traffic. Interactive traffic is typically assigned high priority, and batch traffic is typically assigned medium or low priority.

The following transmission priority fields are defined:

tpQNRE
: Specifies the number of request units that entered the transmission priority queue.

tpQLRE
: Specifies the cumulative length of data that entered the transmission priority queue.

tpQNRL
: Specifies the number of request units leaving the transmission priority queue to be sent to data link control for transmission to the adjacent system.

tpQLRL
: Specifies the cumulative length of data leaving the transmission priority queue to be sent to data link control for transmission to the adjacent system.

tpQTRR
: Specifies the cumulative amount of time that request units waited in the transmission priority queue.

The following information can be derived from the transmission priority fields:

- The average length of a request unit entering the transmission priority queue is: tpQLRE/tpQNRE.
- The average length of a request unit leaving the transmission priority queue is: tpQLRL/tpQNRL.
- The average amount of time a request unit waited in a transmission priority queue is: tpQTRR/tpQNRL.

Excessive waiting in a transmission priority queue may occur if:

- The data is preempted by higher priority data
- The line is a slow speed line
- Frequent retransmissions are required due to an error-prone line

Note: The average wait time for higher priority data should typically be less than lower priority data.

Line Transmission

Performance data is collected to quantify the amount of time required to successfully transmit data to the adjacent system. This measurement period begins after the data leaves the transmission priority queue and ends when the data is successfully delivered to the adjacent system.

The following line transmission fields are defined:

tpNRUD
: Specifies the number of request units delivered to the adjacent system.

tpLRUD
: Specifies the cumulative length of data delivered to the adjacent system.

tpTRUD
: Specifies the cumulative amount of time in milliseconds to deliver data to the adjacent system.

The following information can be derived from the line transmission fields:

- The average length of a delivered request unit is: tpLRUD/tpNRUD.
- The average amount of time to deliver a request unit is: tpTRUD/tpNRUD.

Note: This data does not provide an accurate measurement of line utilization because only a portion of the data being transmitted on the line is measured.

Receiving Data

Performance data is collected to record the number of request units and cumulative length of data that is received.

The following fields are defined:

tpNRUR
: Specifies the number of request units received from the adjacent system.

tpLRUR
Specifies the cumulative length of request units received from the adjacent system.

The following information can be derived:

- The average length of a received request unit is: tpLRUR/tpNRUR.

Intermediate Session Traffic Work Load

The work load caused by intermediate session traffic can be estimated because a separate set of session traffic fields is defined for intermediate and end point session traffic. The values from the corresponding intermediate session field for each priority level can be added together to determine the overall system work load. For example, INNRUR+IHNRUR+IMNRUR+ILNRUR is the total number of request units received on all intermediate sessions.

The intermediate session work load can be reduced by decreasing the maximum intermediate sessions parameter in the network attributes, or decreasing the pacing counts configured on the end point systems. The iSeries server configures the pacing counts on the OUTPACING and INPACING parameters on the mode description.

Control Traffic Work Load

The work load caused by control traffic can be estimated by examining the network priority session traffic fields. Network priority is reserved for control traffic. High, medium and low priority are used by user traffic. APPN control traffic uses end point sessions only. Operations that change the number of sessions and alert control traffic may use both end point and intermediate sessions.

Comparing Different Priority Levels

The SNA performance measurements allow the proportion of network, high, medium and low priority traffic to be analyzed. High priority is typically reserved for interactive jobs that require good response time and medium and low priority is assigned to batch jobs.

The priority level is configured in the Transmission priority parameter on the class-of-service description.

APPN Control Point Performance Measurements

The primary purpose of the APPN control point is to allow applications on one system to dynamically establish sessions with applications on another system. Because of the dynamics involved in APPN, there are many work activities that an APPN network node or end node needs to perform to maintain the information required to establish sessions. You can find the APPN information under the Networking topic in the iSeries Information Center.

The APPN performance measurements provide a granular breakdown of these work activities. The file QAPMAPPN does not contain any data regarding processing unit utilization or disk unit accesses. Information regarding processing unit utilization and disk unit accesses for the tasks that perform APPN functions can be found in the QAPMJOBS file (performance monitor) or the QAPMJOBL file (Collection Services). A performance analyst can then determine the activities that APPN was performing (to better understand the resource utilization found in the

QAPMJOBS file or QAPMJOBL file). Use the QAPMAPPN file with the QAPMJOBS file or the QAPMJOBL file to determine the effect of APPN functions on a system's performance.

The QAPMAPPN file does not contain any information regarding session traffic. APPN session traffic data is maintained in the file QAPMSNA. There is a set of measurements for each active controller description on the system. The QAPMSNA file data provides performance measurements to give a breakdown of intermediate routing and session endpoint traffic. The session traffic data provides a breakdown based on the different transmission priorities that can be used. Refer to "Session Traffic Fields" on page 214 for more information on session traffic.

APPN Work Activities

The following are the various APPN work activities:

- Topology maintenance
- Directory services registration and deletion requests
- Configuration changes
- Control point session activation and deactivation
- Control point presentation services
- Session setup activities

Topology Maintenance

These work activities maintain the APPN topology database. The APPN topology database allows routes through the APPN network to be calculated, based on a class-of-service selected by the user initiating a session. You can display how often the topology database is viewed using the Display APPN information (DSPAPPNINF) command.

Topology maintenance can account for a large amount of processing unit and disk unit accesses. In general, the amount of resource required for topology maintenance grows as networks become larger and as the APPN network becomes unstable. The instability of a network is caused by frequently activating and deactivating transmission groups or by having line failures and systems failures in the network. Following are some key terms regarding topology maintenance and a short explanation of how these work activities affect performance:

Transmission group (TG) update

A TG update occurs when a controller description on the local system has a status change (for example, it changes from *inactive* to *active*). When the TG defines a connection between two network nodes, this causes the local system to send a topology database update.

Topology database update (TDU)

A TDU is the device used to broadcast a status change of a resource in the intermediate routing portion of an APPN network. A server sends TDUs for several different reasons. A TDU is a general data stream (GDS) variable that can block information about multiple resources into a single entity. Thus, if the topology routing services (TRS) component receives multiple TG updates, it can block these together into a single TDU. TDUs are distributed to every network node in the APPN network that is connected to the remaining systems in the network using control point sessions.

Node congestion updates

These occur when a network node has a status change in its capacity for performing intermediate routing. On the iSeries server, node congestion is based simply on the number of intermediate sessions that are currently active. Node congestion updates cause the local system to send TDUs.

Received TDUs

APPN network nodes receive TDUs as well as send them. If TDUs are received frequently, this can degrade system performance. The counts maintained for received TDUs provide a breakdown between new and old resources.

One count tracks the number of times the most frequently used node was included in received TDUs during an interval. When many TDUs are received and the same node is always listed in the APPN performance data, this could indicate a configuration problem where the listed node has updates sent continuously. This situation can have a serious effect on performance.

Initial topology exchange

An initial topology exchange is an examination of the resources in the intermediate routing portion of the topology database that occurs any time control point sessions are established between two network nodes. Any of the resources that have changed status or for which a TDU has been received are sent to the partner network node in a TDU. If one of the systems has refreshed its topology database or if this is the first initial topology exchange with the partner network node since performing a system IPL, the entire intermediate routing portion of the APPN topology database is sent.

Obsolete Topology Entry Removal

Once every 24 hours the topology database is examined to determine if any entries in the local system have not been updated in the past 15 days. The entries that have not been updated are deleted. If the local system is a network node, the system sends a TDU once every five days (so other nodes do not delete the local system from their topology database).

Display APPN information (DSPAPPNINF)

Each time the Display APPN Information (DSPAPPNINF) command is run with *TOPOLOGY specified for the information type (INFTYPE) parameter, every entry in the APPN topology database is examined. In networks with a large amount of topology, this can account for a significant number of read operations from disk units.

Note: This does not directly affect topology maintenance.

Directory Services Registration and Deletion Requests

APPN end nodes register and delete their local location names with their network node server. For end nodes, these configuration change requests are tracked because configuration changes cause an end node to send the registration and deletion requests.

These measurements are maintained on a network node to show the effort involved in processing received location registration and deletion requests from attached end nodes. Various conditions cause an end node to send in registration and deletion requests (for example, the activation of a control point session, or a configuration change). The conditions that cause an end node to send these requests can be found in the configuration and control point session performance measurements. Multiple locations can be included in a single registration request (such as when an end node is registering all of its locations following control point session activation).

In general, registration and deletion requests should not cause a performance burden on a network node because this type of information is not distributed to every network node in the network.

Configuration Changes

These work activities cause the APPN control point to update configuration information and can at times cause an update to be sent to one or more systems. The activities included in this section are:

- Change network attributes processing
- Local location list updates
- Remote location list updates
- Mode description updates
- Class-of-service description

Change network attributes (CHGNETA)
All of the APPN tasks are involved in processing a Change Network Attributes (CHGNETA) command so local information can be updated. The topology routing services task sends out a TDU if the local system is a network node and the route addition resistance (RAR) is changed. Changing the local system node type, local network ID, or local control point name can cause the APPN topology and APPN directory databases to be deleted. This can indirectly affect performance (because additional processing is required to reconstruct these databases).

APPN local location list updates
These cause a local location to be added to or deleted from the APPN directory database. If the local system is an end node with a CP-CP session established to a network node server, these cause a registration or deletion request to be sent to the server.

APPN remote location list updates
These cause a remote location to be added to or deleted from the APPN directory database.

Mode updates
These cause the control point manager (CPMGR) task to update its mode tables to reflect the addition, deletion, or update of a mode description.

Class-of-service updates
These cause the control point manager (CPMGR) and topology routing services (TRS) tasks to update their class-of-service tables to reflect the addition, deletion, or update of a class-of-service description.

Control Point Session Activation and Deactivation

These work activities track the number of control point sessions that are started and ended. These counts are classified as the locally controlled (contention winner) CP-CP sessions or the remotely controlled (contention loser) CP-CP sessions.

There are various details associated with the activation and deactivation of control point sessions. Contention winner control point sessions are primarily used for sending data (TDUs, directory searches). Contention loser control point sessions are used to receive control point data from other systems. The activation of a contention winner CP session has many similarities to the activation of a user session. The steps involved with the activation of a session (single hop route requests, activate route requests, device selection) are discussed in “Session Setup Work Activity Details” on page 227.

When the local system is an end node and it activates a control point session to its network node server, all of the local locations are registered with the network node.

The control point session performance measurements also provide counts of the number of control point sessions that are currently active. Variations in these counts can help explain changes in resource utilization over different time intervals. Because the number of active control point sessions can affect the number of systems involved in TDU search procedures, the APPN tasks that provide the majority of the function for control point session activation and deactivation are control point manager (CPMGR) and control point presentation services (CPPS).

Control Point Presentation Services (CPPS)

Control point presentation services handles all of the data transfer that occurs on the CP-CP sessions for the other APPN tasks. Analysis of these counts provides a summary of the types of activities in which the APPN control point is involved over a given set of time intervals. This information is classified into data sent and data received for the various APPN transaction programs. These transaction programs are:

- Control point (CP) capabilities
- Topology database update
- Directory services for search processing
- Registration/deletion

To best utilize the APPN performance measurements, the control point presentation services measurements (CPPS) should be analyzed first. These measurements provide a summary of the data traffic over the control point sessions for the various APPN transaction programs. This summary discusses on the correct APPN work activities and isolates any APPN performance problems. For example, if a time interval shows a high number of directory services transactions and only a limited number of topology database updates, the session setup measurements, instead of the topology maintenance measurements, should be checked.

The control point presentation services measurements provide:

- The number of data received requests (data received from other network locations that are directly connected to each other).
- The amount of data received.
- The number of send data requests (data sent to other network locations that are directly connected to each other).
- The amount of data sent.

This information is provided for all of the different APPN transaction programs. These transaction programs are:

Control point (CP) capabilities

Used to send and receive control point capabilities to adjacent systems immediately after activating control point sessions. In general, running CP capability transaction programs should only slightly affect system performance.

Topology database update

Used to send and receive TDUs. TDUs are sent on contention winner CP sessions and received on contention loser CP sessions. TDUs can significantly affect performance for network nodes. If the CPPS measurements seem abnormally high (compared to other time intervals), check the topology maintenance data to determine the cause of the increase.

Directory services (DS)
Used to send and receive search requests to other nodes in the network. Search processing can significantly affect performance for network nodes, but generally it only slightly affects end nodes. Search requests and responses are sent asynchronously by the APPN directory services task. If the CPPS measurements seem abnormally high (compared to other time intervals), check the session setup performance measurements to determine the cause of the increase.

Registration and deletion
Used to send location registration and deletion requests (from an end node to a network node server). In general, registration and deletion requests should not significantly affect performance. However, if a several requests are causing the CPPS and DS tasks to increase processing unit use, check the directory services registration and deletion requests measurements.

Session Setup Activities

These measurements provide information on the various steps that are taken by the APPN control point to process session initiation requests. Because establishing an APPN session is a highly distributed function, the measurements provide a breakdown of the work activity details based on the role a system plays in establishing a session. For example, a network node performs certain functions to allow local users to establish sessions. However, a network node also performs functions to allow attached end nodes to establish sessions. The performance measurements in each case are separated so you can find where the resources are used.

The activities performed and the resources used vary between APPN end nodes and network nodes. Because APPN session setup is a function distributed between multiple systems, it is necessary to classify session setup work into different work activities.

Each of these work activities causes different types of work to run on the local system. Refer to “Session Setup Work Activities” on page 225 for a description of the session setup work activities. Refer to “Session Setup Work Activity Details” on page 227 for a description of measurable work details associated with session setup. Many of these details are common between the different work activities. The sample data for session setup keeps separate counts and cumulative elapsed times for the different work activities being performed.

Following is some terminology used to describe various work activities performed by APPN. The definitions of these terms are based on the context of this discussion.

Bind command
The request unit sent by a node to set up the LU-LU session.

Broadcast search
A search sent by a network node and eventually forwarded to every network node in the network (connected by one or more CP-CP sessions).

Directed search
A directory search sent by one network node to a single network node. A network node sends this search if it has information in its directory

database that indicates the destination network node was the previous owner or network node server of the end node that owns the location. A directed search may flow through multiple network nodes along the way (these are intermediate nodes on a directed search). Only the destination of the directed search performs additional search logic.

Domain broadcast
A search sent by a network node to its adjacent end nodes that specified they want these searches. Currently, the only time a server sends these to other servers is in a multiple network environment.

NNS(OLU)
A network node serving an end node that is initiating a session setup request.

NNS(DLU)
A network node serving an end node that is the destination of a session setup request.

One hop search
A search sent from an end node to a network node or from a network node to an end node. This search is only sent to a single node.

Session Setup Work Activities

Following is a list of the session setup work activities. Each work activity has various detailed measurements associated with it. For each work activity, there is a cumulative elapsed time measurement and a count of the number of times a given work activity was successful. The start time and end time measured (accounting for the cumulative elapsed time measurements) and the criteria for counting a given work activity successful are listed with the work activity.

1. **Locally started sessions (source)**

   Description: Sessions that are started on the local system, including explicit session initiation requests by a user as well as internal session initiation requests (for example, sessions started for session limit negotiation or alert traffic).

   Start: The system determines the APPC device description to use for session initiation request.

   End: The system provides information regarding the APPC device description request. The information is either a list of devices or an error code.

   Success: One or more device descriptions are returned to the operating system.

2. **Receiver of search requests (local system = EN)**

   Description: The local system, an end node, receives a search request from its network node server.

   Start: The directory services task receives a locate request from the CPPS task.

   End: Directory services (DS) returns the locate search response to the CPPS task or the CP session when the system that sent the search fails.

   Success: Directory services returns a positive response to the search request it had received.

3. **Search processing on for attached EN (local system = NN)**

   Description: The local system, a network node, has received a search request from a served end node that is initiating a session. The local system is responsible for searching for the target system and then calculating a route to the destination control point.

Start: The DS task receives a request from CPPS and determines it is a search request from a served end node.

End: DS returns the locate search response to CPPS or the CP session with the end node that sent the message indicating that the search had failed.

Success: DS sends a positive response to the locate search request, and routing information is supplied to the end node.

4. **Intermediate node on a directed search**

   Description: The local system, a network node, has received a directed search request from another network node. The only functions that need to be performed in this case are forwarding the search to the next hop of the route, and also forwarding the search response to the system that had sent the search to the local system.

   Start: DS receives a directed search request from CPPS and realizes the local system is not the destination network node.

   End: DS returns the locate search response to the system it received the search from or the CP session ends between the local system and either the system that sent the search to the local system or the system that the local system forwarded the search to.

   Success: DS successfully sends the directed search, receives a positive response, and successfully returns the directed search response to the system that had originally sent the search request.

5. **Destination NN on a directed search - NNS(DLU)**

   Description: The local system, a network node, has received a directed search request from another network node. In this case, the local system is the target of the directed search because the location being searched for had at one time resided on the local system or on an end node that was being served by the local system.

   Start: DS receives a directed search request from CPPS and realizes the local system is the destination network node.

   End: DS returns a positive response to the system that had sent the search to the local system or the CP session ends with that system.

   Success: The response given by DS to the system that had sent the search to the local system is positive.

6. **Broadcast search received**

   Description: Broadcast searches are processed only by network nodes. When the local system receives a broadcast search, it sends the search to all of its adjacent network node partners and it also determines if the location being searched for resides on the local system or on a served end node. Broadcast searches are the most costly search types from a performance standpoint because of the number of systems that are involved.

   Start: DS receives a broadcast search request from CPPS.

   End: DS has forwarded the search response to the system that sent the broadcast search to the local system and it has processed all search responses from systems to which the local system forwarded the broadcast search.

   Success: The response sent back to the system that sent the search to the local system is positive.

7. **NN processing a received search** from a node in a non-iSeries network

   Description: This work activity tracks the number of searches processed that are started by systems in a different APPN network (based on network identifier). Only searches received from network nodes in another network are counted. Note that only the systems on the boundaries of the network will maintain these measurements.

Start: DS receives a search request from CPPS and determines it is from a node in another network.

End: DS returns the locate search response to CPPS or the CP session with the non-iSeries node that sent the message indicating that the search had failed.

Success: DS sends a positive response to the non-iSeries node that sent the search request to the local system.

8. **Network node processing a received bind** from a node in the iSeries (local) network without routing information

   Description: The local system, a network node, is responsible for determining the control point that the target system resides on, calculating a route to the destination control point, and forwarding the bind on to the next hop of the route.

   Start: The control point receives a bind request from the session connector manager (the part responsible for establishing intermediate sessions) and determines that the request was received from a node in the iSeries network and that routing information does not exist.

   End: The control point returns a response to the session connector manager task.

   Success: The request for the intermediate session initiation is returned with a positive response (which means the link for the next hop of the route has been located and is active).

   Note: Work activities **9**, **10**, and **11** have the same start, end, and success definitions as work activity **8**. Work activities **10** and **11** do not require any search processing or route computation processing.

9. **NN processing a received bind** from a node in a non-iSeries network without routing information
10. **NN processing a received bind** from a node in the iSeries network with routing information
11. **NN processing a received bind** from a node in a non-iSeries network with routing information

Session Setup Work Activity Details

For APPN, session setup involves details such as:

- Initial screening to determine if existing sessions may be used
- Directory search processing to determine which system in the network owns the destination location desired
- Route selection to determine the optimal route based on class of service through the network
- Switched link activation
- Device selection and/or creation of a new device

These detailed measurements are stored separately for each distinct work activity in which the measurement can occur. For example, the system can issue a directed search as a result of several different work activities (in this case work activities **1**, **3**, **7**, **8**, and **9**). Therefore, five different sets of detailed measurements for directed searches are there so that the person analyzing the data can determine which activities are causing the directed searches to run.

Following are explanations of some of the key terms of the work activity details:

Initial screening
These measurements are functions performed by the location manager and the control point manager tasks. These measurements indicate how many new sessions need to be started (which require full control point services to complete the request) and session requests satisfied by using existing bound sessions. There are also measurements to count session initiation requests that get pended by the control point. The pending of session initiation requests improves performance because the directory search, route selection, and switched link activation phases need only be done once for multiple session initiation requests received.

Directory search processing
This step involves determining the control point that owns the target system of a session initiation request. The APPN parts that are most affected by directory search processing are DS and CPPS. The effect of search processing on performance is greater on a network node than on an end node because of the various roles that a network node can have in search processing. Because a network node processes the first positive response it receives on a search request and sends this to the search originator, a network node can still process a search request after the work activity that started the request has completed. Even though the bind for a session may have already been sent, a network node may still be processing subsequent search responses received from other nodes. The directory search processing phase can be an asynchronous process if searches are sent to other systems, which can account for increased values in various cumulative elapsed time measurements.

Route selection
Route selection is carried out by the TRS task. There are different types of routes that TRS calculates. A single hop route is done by an end node (when an end node has not received routing information from a network node server). A single hop route is also done for establishing a control point session. Request route processing is done by network nodes for establishing end-to-end routes based on a particular class-of-service.

Switched link activation
This processing is primarily carried out by the machine services control point (MSCP) task. MSCP receives activate route requests to start switched link activation sequences. There are many reasons for delays in this step (such as waiting for operator intervention to answer a message or dial a switched connection). This step can also cause a controller description to be automatically created by the operating system (which can also cause a delay).

Device selection
This processing measures the number of times that the T2 station IOM task is requested to select a device description. This step can lead to the automatic creation and/or vary on of device descriptions. The measurements for automatic creation and/or vary on of device descriptions can be found in the QAPMSNA file.

APPC Protocol

For APPC, there are two types of transactions for which the Performance Tools collect sample data: inbound and outbound.

An outbound transaction begins when the request is issued and ends when the complete response is received. An inbound transaction begins when a request is received and ends when a response is sent.

The transaction timings provide a picture of how much time is spent in processing a transaction on the local and remote systems.

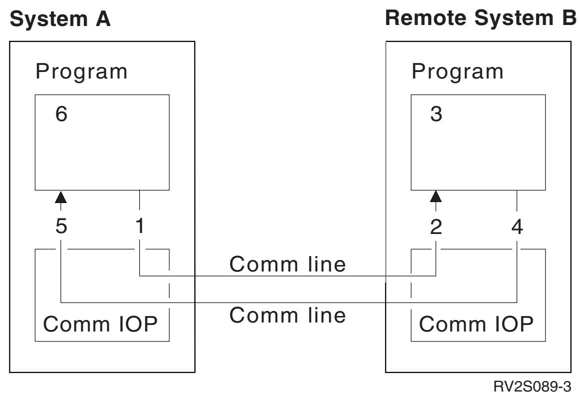


Figure 102. Using APPC Protocol Communications

From System A's Perspective

System A is sending data to system B and is expecting a response from system B. Figure 102 shows the steps in system A's outbound transaction.

1. System A **puts**, or transmits, data
2. System B **gets**, or receives, the data from system A
3. A program on system B processes the data and produces new data in response
4. System B puts the new data, which is its response to system A
5. System A receives the data, which is the response from system B
6. The program on system A processes data, determines the next request, and returns to step **1**

The following ratios of fields found in the QAPMJOBS file (performance monitor) or the QAPMJOBL file (Collection Services) are effective performance indicators:

JBPUTA/JBPUTN
: The average number of bytes per put operation. Larger values indicate greater efficiency because fewer put operations are necessary.

JBPUTA/JBRTI
: The average number of bytes buffered per transmit (request). Put operations made by system A go into a communications buffer. The system transmits the contents of the buffer when it fills up with operations requiring data to flow to the remote system. The higher this number is, the better the buffer is utilized. When the buffer is used more efficiently, the lower communications layers are called less often and the result is better performance.

From System B's Perspective

System B is receiving information from system A and will be sending a response to system A. In Figure 102, steps **2**, **3**, and **4** make up system B's inbound transaction. This is a subset of system A's outbound transaction.

2. System B gets, or receives, the data from system A

3. A program on system B processes the data and produces new data in response
4. System B puts the new data, which is its response to system A

Conversely, steps **4**, **5**, **6**, **1**, and **2** can be considered system B's outbound transaction. Steps **5**, **6**, and **1** make up system A's inbound transaction, which is a subset of system B's outbound transaction.

The following ratios of fields found in the QAPMJOBS file or QAPMJOBL file are effective performance indicators:

JBGETA/JBGETN
The average number of bytes per get operation. Larger values indicate greater efficiency because fewer get operations are necessary.

JBGETA/JBRRI
The average number of bytes made available to the program in a buffer. The receiving system buffers data received until the buffer fills up or until an operation (on the transmitting system) requires the immediate delivery of data to the receiving program.

Notes:

1. A series of multiple put operations can be created by system A. At the end of these put operations, system A effectively passes control to system B through a change direction (CD) operation. System B can complete its first get operation when a buffer of data arrives from system A. It can process subsequent put operations from system A as it receives them. However, it cannot send any data back to system A until it receives the change direction (CD) indication.
2. System A's put operations can overlap system B's get operations.

APPC Performance Notes

A complete end-to-end analysis of APPC performance includes the following elements:

- Communications time
- IOP time on system A (outgoing and incoming)
- Line time (from system A to system B, and from system B to system A)
- IOP time on system B (incoming and outgoing)
- Processing time on system B

Knowledge of the application design, along with performance data from both system A and system B, allows you to analyze the application's performance. Using the outbound time (in the JBPGIL field in the QAPMJOBS file or QAPMJOBL file) on the local system and the inbound time (in the JBGGIL field in the QAPMJOBS file or QAPMJOBL file) on the remote system, the amount of time the local system spent waiting for the remote system to respond to its request can be determined. With the addition of information such as the number of input and output operations plus the amount of data sent and received, average transaction times can be determined. The line speed can be used to determine how much the line slows processing and the effect of changing this. The processing unit in the application can be used on a per transaction basis (where communications activity is continuous) to determine the effects of model upgrades.

The iSeries Information Center contains complete information on all the APPC information collected by Collection Services.

Performance Measurement and SNADS

In general, SNADS sample data does not provide any direct performance tuning capabilities. There are no distribution parameters that can be adjusted to affect SNADS performance (with a minor exception for distribution queue attributes and SNADS senders). However, the customer can do normal system job tuning and measure the results in distribution throughput using the sample data.

Performance tuning for SNADS jobs may involve adjusting the job priority or other attributes contained in the job class or job description. A description of each job and the characteristics important for performance analysis and tuning is provided in *Work Management*. Unless otherwise noted in the detailed sections, SNADS jobs have the following common characteristics:

- All are submitted using the QSNADS job description.
- A separate routing entry exists in the QSNADS subsystem for each type of SNADS job. This allows the customer to identify different job classes (priority) for each. The default is class QSNADS, which has a run priority of 40.
- All run under the QSNADS or QGATE user profile.
- All internal distribution objects (those not visible to the user) created by SNADS are owned by the QSNADS user profile. This identifies how much system storage is being used by distribution activities.

SNADS Transaction

A SNADS transaction and a distribution within a SNADS job generally have a one-to-one relationship. A **SNADS transaction** is the processing done by a SNADS job as it handles a distribution. Each distribution processed is considered a transaction, including both distributions processed successfully and distributions processed with errors.

The following functions in a SNADS transaction are described in this section:

- Router
- Receiver
- Sender
- Gateway senders

Notes:

1. Distribution processing that ends with errors may result in another attempt of the same distribution. Thus, a single distribution may cause the transaction count to be incremented multiple times. For example, the line drops during a transmission. Each send attempt counts as a transaction even though the same distribution is being processed each time. Each transaction (ending with an error) accounts for resources expended in the distribution attempt.
2. The number of transactions ending with errors is included in the error count provided in the sample data.

Table 18. SNADS Transaction Types

Transaction Type	SNADS Function
’01’	SNADS Router
’02’	SNADS Receiver
’03’	SNADS Sender
’04’	SystemView Distribution Services (SVDS) Receiver

Table 18. SNADS Transaction Types (continued)

Transaction Type	SNADS Function
’05’	SVDS Sender
SNADS Gateway Senders	
’08’	SNADS DLS Gate (Document Library Services)
’09’	SNADS Gate (VM/MVS Bridge, SMTP, X.400)

SNADS Router

The QSNADS router function is the heart of SNADS. All distributions that flow through SNADS are processed by the router. It uses the system directory and distribution services configuration to determine what queue or queues to put the distribution on.

A distribution with multiple destinations may have a distribution copy placed on a local delivery queue and multiple distribution queues. This is called **fan-out**. Some destinations may be routed successfully while others result in router errors.

A router transaction begins when the router finds a distribution on its queue. The transactions ends when the distribution has been placed on all applicable queues and removed from the router queue.

The SNADS router function has the following characteristics:

- The SNADS router function is a job that runs in the QSNADS subsystem and is started by the SNADS startup job (QZDSTART).
- The job name is QROUTER.
- The job’s user profile and job description are QSNADS.
- The subsystem routing entry compare value is ’QROUTER’.
- The router job should remain active as long as the QSNADS subsystem is active. If the router ends or is canceled, the subsystem must be stopped and restarted to start the router.
- The router function can support only one router job.

SNADS Receiver

The SNADS receiver function is a job that runs in response to a SNADS remote sender opening a session and doing an APPC evoke operation. The SNADS receiver manages the receive side communications protocol for the SNADS conversation.

A receiver transaction begins when the receiver receives distribution data from the sender. The distribution data is separated and stored in an internal control block. A file server object is created if the distribution carried one. The distribution is put on an internal queue for the SNADS router to process. The receiver then logs and sends confirmation to the sender function. The transaction ends when the confirmation request is complete or the job ends for any reason (for example, a communications error).

A SNADS receiver job has the following characteristics:

- It runs in the subsystem configured for the communications device that was started by a remote sender. The default is QCMN subsystem.
- The job name is the same as the communications device name.

- The job's user profile, job description, and so on are determined by the subsystem's communications entry and routing entries. These normally default to the QSNADS user profile, QSNADS job description, and PGMEVOKE subsystem routing entry.
- A receiver job runs until one of the following occurs:
  – The evoking sender no longer has data to send.
  – An error is detected by either the sender or receiver.
  – The session ends abnormally (for example, the line fails).
- A receiver may be started repetitively over time by a job on the sending system (probably the same sender job).
- SNADS imposes no limits on the number of receiver jobs that can be active at the same time. Multiple receivers can be active for the same device.
- The QSNADS subsystem does not have to be active. Receivers can queue distributions for the router job regardless of the state of the router or QSNADS subsystem.

SNADS Sender

The SNADS sender function manages the send side communications protocol for the SNADS conversation. It starts the remote receiver and sends any available distributions (queued on its distribution queue) to the remote system. SNADS senders service *SNADS type distribution queues.

The sender is sensitive to the following:
- The state (held or waiting) of the distribution queue.
- The state (held or waiting) of the queue entries.
- The send conditions configured for the queue.

The sender does not establish a communications session or send any distribution unless its distribution-queue conditions or states allow it.

When send conditions are met or they end, a certain amount of overhead is required to establish or end communications. This is not included in the sender transaction (resource use time); it is, however, included in the overall job statistics. If errors occur during this activity, the sample data error count is incremented along with the active transition count but no other transaction data or counts will change.

A sender transaction begins when the sender dequeues the next distribution to be sent (send conditions were previously met and a session is active). Distribution data is put into code and sent to the receiver. If a file server object is present, that data is read and sent with the distribution. The sender waits for the receiver to confirm the distribution, at which time it is logged and removed from the distribution queue. This ends the transaction. The transaction can also be ended by any error that is detected during processing.

The SNADS sender function has the following characteristics:
- The SNADS sender function is a job that runs in the QSNADS subsystem and is started by the SNADS startup job (QZDSTART). One job is started for each distribution queue (type *SNADS) configured. Sender jobs may also be started by configuration (CFGDSTSRV) as distribution queues are added, and by operations (WRKDSTQ) if the operator starts a send operation.
- The job name is the same as the remote location name configured with the distribution queue.

- The job's user profile and job description are QSNADS. The subsystem routing entry compare value is 'QSENDER'.
- The sender job should remain active as long as the QSNADS subsystem is active, if no errors are detected. Sender jobs for queues with no time or depth specified end as soon as the queue is empty. If the sender is detecting errors and the retry count configured for the queue is exceeded, the sender job ends. The sender can be restarted by selecting the *Send queue* option on the WRKDSTQ display or issuing the SNDDSTQ command.
- There can be as many sender jobs as there are distribution queues.
- The sender function can support only one sender job per distribution queue. (Multiple sender jobs may sometimes be started for a particular queue but they will eventually cancel each other until only one is left.)
- SNADS senders can be started (evoked as an APPC application) by remote SNADS receivers. Although this function is supported by iSeries senders, there is no known SNADS implementation where a receiver will start a sender.

SVDS Receiver

The SVDS receiver function is a job that runs in response to an SVDS remote sender opening a session and doing an APPC evoke operation. The SVDS receiver manages the receive side communications protocol for the SVDS conversation.

A receiver transaction begins when the receiver receives distribution data from the sender. The distribution data is separated and stored in an internal control block. A file server object is created if the distribution carried one. The distribution is put on an internal queue for the SNADS router to process. The receiver puts a completion report message unit on a queue. This ends the transaction. The transaction can also be ended by an error detected during processing. The receiver will send the completion report message unit to the sender after the sender sends a change direction (CD) indication. The receiver processes any other transactions from the sender. After the sender sends a CD indication, the receiver sends the completion report message unit.

An SVDS receiver job has the following characteristics:

- It runs in the subsystem configured for the communications device that was started by a remote sender. The default is QCMN subsystem.
- The job name is the same as the communications device name.
- The job's user profile, job description, and so on are determined by the subsystem's communications entry and routing entries. These normally default to the QGATE user profile, QSNADS job description, and PGMEVOKE subsystem routing entry.
- A receiver job runs until one of the following occurs:
  - The evoking sender no longer has data to send.
  - An error is detected by either the sender or receiver.
  - The session ends abnormally (for example, the line fails).
- A receiver may be started repetitively over time by a job on the sending system (probably the same sender job).
- There can be only one receiver job active per connection.
- The QSNADS subsystem does not have to be active. Receivers can queue distributions for the router job regardless of the state of the router or QSNADS subsystem.

SVDS Sender

The SVDS sender function manages the send side communications protocol for the SVDS conversation. It starts the remote receiver and sends any available distributions (queued on its distribution queue) to the remote system. SVDS senders service *SVDS type distribution queues.

The sender is sensitive to the following:

- The state (held or ready) of the distribution queue.
- The state (held, ready, pending, or suspended) of the queue entries.
- The send conditions configured for the queue.

The sender does not establish a communications session or send any distribution unless its distribution-queue conditions or states allow it.

When send conditions are met or they end, a certain amount of overhead is required to establish or end communications. This is not included in the sender transaction (resource use time); it is, however, included in the overall job statistics. If errors occur during this activity, the sample data error count is increased along with the active transition count. No other transaction data or counts will change.

A sender transaction begins when the sender dequeues the next distribution to be sent (send conditions were previously met and a session is active). Distribution data is put into code and sent to the receiver. If a file server object is present, that data is read and sent with the distribution.

The SVDS sender function has the following characteristics:

- The SVDS sender function is a job that runs in the QSNADS subsystem and is started by the SNADS startup job (QZDSTART). One job is started for each distribution queue (type *SVDS) configured. Sender jobs may also be started by configuration (CFGDSTSRV) as distribution queues are added, and by operations (WRKDSTQ) if the operator starts a send operation.
- The job name is the same as the remote location name configured with the distribution queue.
- The job's user profile is QGATE. The job description is QSNADS. The subsystem routing entry compare value is 'QSVDSSND'.
- The sender job should remain active as long as the QSNADS subsystem is active, if no errors are detected. Sender jobs for queues with no time or depth specified end as soon as the queue is empty. If the sender is detecting errors and the retry count configured for the queue is exceeded, the sender job is suspended. The sender can be restarted by selecting the *Send queue* option on the WRKDSTQ display or issuing the SNDDSTQ command.
- There can be as many sender jobs as there are distribution queues.
- The sender function can support only one sender job per distribution queue. (Multiple sender jobs may sometimes be started for a particular queue but they will eventually cancel each other until only one is left.)
- SVDS senders can be started (evoked as an APPC application) by remote SVDS receivers. Although this function is supported by iSeries senders, there is no known SNADS implementation where a receiver will start a sender.

SNADS Gateway Senders (DLS Gate and VM/MVS Bridge)

Gateway senders are not a function of SNADS architecture. OS/400 SNADS support provides distribution queuing and scheduling support for other distribution functions. This support is provided through distribution queues (queue types *DLS and *RPDS) and the SNADS gateway sender function.

Gateway senders are similar in every respect to SNADS senders except that SNADS does not handle any communications nor does it matter if the distribution ever leaves the local system. Based on the same queuing controls as SNADS senders, distributions are handed over to the appropriate bridge function. When the bridge function confirms that it has successfully received (or processed) the distribution, the distribution is removed from the SNADS queue.

The transaction begins when it is time to send and a distribution is found on the queue. The distribution data is put into code for the bridge function along with any file server object. The gate sender waits for a response from the bridge indicating the distribution was sent; then the distribution is logged and removed from the queue. This ends the transaction. Any error detected by the gateway sender or an error response from the bridge would also end the transaction.

Gateway senders have the same characteristics as the SNADS senders except:
- The job's user profile is QGATE.
- The subsystem routing entry compare value is 'QGATEWAY'.
- The bridge function may or may not completely process the distribution under the gateway sender job. All current implementations process the distribution in other jobs. Therefore, the sample data only reflects the resource required to hand over the distribution. One possible exception is the resource use time. This may reflect total time, depending on when the bridge function acknowledges receipt of the distribution.

Table 19. Sample Data for Each SNADS Function

Data Field Description	Field Name	SNADS Router	SNADS or SVDS Receiver	SNADS or SVDS Sender	SNADS DLS Gate	SNADS RPDS Gate
Transaction count	SNNTR	X	X	X	X	X
Resource use time	SNRUT	X	X	X	X	X
FSO count	SNFSO	X	X	X	X	X
FSO byte count	SNFSOB	X	X	X	X	X
Transaction time	SNTRT	X	X	X	X	X
Error count	SNERR	X	X	X	X	X
Active transitions count	SNATN	X	X	X	X	X
Recipient count	SNNRC	X	X	X	X	X
Fan-out count	SNFOC	X	–	–	–	–
Local distribution count	SNLDC	X	–	–	–	–

SNADS Sample Data

This section describes the sample data provided by SNADS. The data collected is the same for all SNADS jobs (that is, the sample data format does not change). However, not all entries apply to every SNADS function (sample data subtype). Data that does not apply to a function will be zero when the data is written.

Table 19 summarizes the sample data supported for each SNADS function.

Sample Data Interpretation

The primary purpose of the SNADS specific sample data is performance planning. This data provides statistics on what SNADS activity is taking place over time. It indicates the amount, size, and location of the distribution load on the system.

This sample data does not include resources used for local distribution (from a local user to a local user). SNADS involvement is limited to asynchronous remote distribution. This includes remote systems sending mail to the local system, the local system's role as an intermediate node, and local distribution to a remote system.

The following are various SNADS jobs described by transaction type:

- The router job (type X'01') indicates the total amount of mail being handled by the system. This reflects distributions from receivers, distributions originated locally, distributions arriving from one of the SNADS bridge interfaces, as well as DSNX-PC activity. Assuming there is not substantial bridge activity, the number of distributions originating locally is the difference between the distributions routed and the distributions received.
- SNADS receiver jobs (type X'02') and SVDS receiver jobs (type X'04') indicate the amount of mail arriving on the local system from remote SNADS sources. Specific receiver jobs indicate the amount arriving from the associated location. Receiver jobs must be processed in an aggregate because the sending system evokes a receiver job whenever it has something to send. This causes receiver jobs to start and stop often.
- SNADS sender jobs (type X'03'), SNADS gateway sender jobs (types X'08' and X'09'), and SVDS sender jobs (type X'05') represent distributions leaving the system. These may originate from all the same sources as described above for the router. Because there may be multiple paths off a system (connections to multiple destinations), a single distribution processed by the router may be copied to multiple distribution queues and therefore represent a sender transaction in multiple sender jobs.

For SNADS receivers, routers, and senders, the job data reflects the real processing time, and for receivers and senders it also reflects the APPN/APPC resources used. Gateway senders are a little different in that the data is only handed over to a bridge function; there may be additional processing in other jobs. No communications take place in a gateway sender.

Note: Although SVDS senders are defined with user profile QGATE, they do use communications.

SNADS Sample Data Field Descriptions

Transaction count (SNNTR): Under normal conditions, the transaction count indicates how many distributions have been processed by the respective jobs. In the case of the router, it also indicates how many SNADS distributions are flowing through the system.

Transaction count is not an absolute distribution count:

- A router error indicates one or more recipients failed. If no recipients were routed successfully, the distribution goes no further. If at least one recipient was valid, the distribution is placed on one or more queues.
- Receiver and sender errors usually represent distribution attempts that failed rather than distributions that failed (for example, when the line goes down); at some future time, the distribution will be successful. Therefore, when this type

of error has occurred, the transaction count is incremented once when the distribution attempt is successful and one or more times when it fails. Note, however, that certain irrecoverable errors can occur and result in the deletion of the distribution.

- Distributions can be deleted from queues by operator action. This can occur during distribution or between distribution attempts.
- Transaction count is not updated when an error occurs prior to the start of the transaction—even though the error count may be updated.

Resource Use Time (SNRUT): This indicates how long it took the job to process the transaction. It is a function of system loading, relative job priorities, and communications line speed (receivers/senders). Another important cause is the size of the distribution. Distributions that carry large amounts of data (see **FSO count**) take longer to send and receive.

Longer resource use times (especially for senders) also mean longer transaction times for subsequent queued distributions.

Size (FSO) (SNTRT): Some distributions are very small (for example, messages) and do not require much communications resource to transfer. Other distributions can carry data objects or documents. In addition to the obvious effect on communications, these distributions require added resource and processing time to be stored on or copied from the local system (only one copy is made).

The amount of data being carried increases all resources and measurements associated with the job.

The **FSO count** (SNFSO) provides a comparison between the number of transactions with and without file server objects. Message distributions do not file server objects associated with them. The **FSO byte count** (SNFSOB) also indicates how much data is being moved by the distributions carrying FSOs.

Errors: The error count should normally be very low or 0. Some router errors may be expected and reflect an user ID that is not valid or a system that was not entered in the routing table. Some sender errors may be expected if the remote system is down or there is a line problem.

In this case, the **error count** (SNERR) and **active transitions count** (SNATN) increase without affecting other transaction counts and data.

If line performance is a problem, error rates for senders and receivers may indicate that the line is not staying up long enough to complete sending of a distribution, causing distributions to be sent multiple times.

Recipients: The **recipient count** (SNNRC) indicates how many users are in the destination list of the distribution. These may be individual users or names of distribution lists that expand at the destination systems. The number of recipients has a major effect on the router but little effect on senders and receivers.

Distributions with multiple recipients may go to multiple destination systems through different distribution queues as well as to the local system. One distribution copy is placed on each queue regardless of how many recipients belong to that queue. The router **fan-out count** (SNFOC) and **local distribution count** (SNLDC) indicate where distributions are going (remote/local) and to how many different queues.

Transitions and Queuing Time: The active transitions count indicates how often the job was waiting for a distribution to process (provided other controls did not prevent activity) or how often a sequence of one or more distributions was processed. Queuing time is a measure of distribution delay. Queuing time is the difference between transaction time and resource use time.

- For the router, job transitions are not expensive. A high transition rate indicates that the router is moving distributions quickly. A low transition rate combined with longer queuing times may indicate that the router's job priority is too low for the distribution rate.
- Senders do not send unless queue conditions are met. These include: queue is ready, time is within from/to time, queue depth is reached, and distributions are in the queue. When the conditions are met, the sender does the following:
  - Passes to an active state (queue state changes from *Waiting* to *Sending*).
  - Tries to establish a session.
  - Tries to start the remote receiver.

  Because this is substantial additional distribution overhead (and the most error prone), the active transitions count was provided.

  If the transition count represents a high percentage of sender transactions, and performance is vital, an increase to the queue depth should be considered. Queuing time can be used to balance the distribution delay on the send queue as opposed to the number of transitions.

  A high sender transition rate accompanied by high error counts might also indicate that the sender is experiencing difficulty establishing communications and is in a wait-retry recovery loop.
- On a target system, a receiver job is started every time the sender job makes an active transition. This is additional overhead that is also reduced by reducing the remote sender transitions as described above.

  The transition count for receiver jobs parallels the transition count for the associated remote sender. A high transition count relative to the number of distributions received from a remote location may indicate a need to make some remote sender adjustments or consider using prestart jobs for SNADS receivers.

SNADS Performance Notes

1. The run priority of SNADS jobs can be changed by changing the class of the corresponding subsystem routing entry.
   - The router's priority can be raised to increase throughput when there are periods of heavy interactive activity using SNADS. System performance may be satisfactory even if the router has a priority higher than interactive. However, if a system problem occurs (for example, a loop), the router could take over the system.
   - The receiver's priority can be raised by adding a routing entry with a compare value of 'QZDRCVR' at position 37 of the routing data.
2. When distributions continually arrive on a sender queue, but at a rate slower than required to send, system resource will be wasted, constantly starting and stopping sessions on both local and remote systems as well as starting jobs on the remote system.
   - The queue depth can be used to allow some number of distributions into the queue before sending begins. This also has the benefit of allowing additional distributions to arrive on the queue while the queue is being emptied.

However, the distribution is delayed until enough distributions accumulate to satisfy the send conditions. Distribution rates, queuing times, and queue active (send) transitions are available in the sample data to measure this.
- Prestart jobs can be used on the remote system to reduce receiver job startup overhead.
3. Activity to or from a particular remote location can be determined by looking at the data for the senders and/or receivers associated with that remote location. The job name is used to select these jobs.

   Each sender is named by the remote location name specified in the SNADS configuration and the corresponding device. Each receiver job name is the same as the device carrying the conversation. If device names are the same as the remote location name (usually true), all send and receive activity to a particular remote location can be observed using the remote location as the job name.

OS/400 File Server

Transaction information is collected for two types of file server shared folders transactions. Both transaction types are handled within the Licensed Internal Code. The transaction types are the following:
- Requests from personal computers; the transaction type is *TNS (Transaction).
- Replies sent to the personal computer through T2; the transaction type is *QUEUE (Measuring queuing times).

For the first transaction type (request from a personal computer), both the time the request is received and the time the request is finished are logged. For the Licensed Internal Code requests, the times should be very short. Locks/Unlocks typically are only one or two milliseconds. Reads/Writes depend on how much input/output needs to be done. Change End of File, Force Buffers, and Resets of files are also handled.

The OS/400 program handles the following requests:
- Create
- Delete
- Open
- Close
- Directory (List file attributes)
- Make directory
- Remove directory

These requests are not logged for transaction data.

Personal computer functions like the copy or type function are classified into multiple requests (usually list file attributes, open file, read/write, and close). Only the times for read and write requests are logged.

The second transaction type described (replies sent to the personal computer) logs the amount of time it takes for T2 to respond to the file server stating that the reply (from the file server to the personal computer) has been sent. This is done for commands handled by both the OS/400 program and the Licensed Internal code. Also, a single command from the personal computer, like a read request, could result in multiple queuing operations. These times should also be short. Figure 103 on page 241 shows this transaction type.

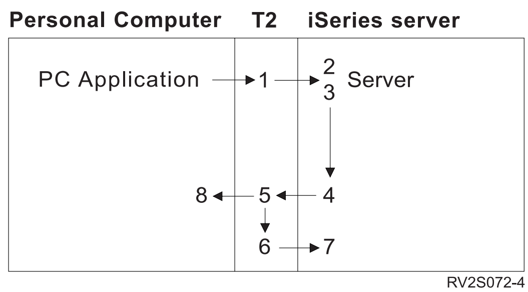


Figure 103. T2 transaction type

1. PC application sends request to T2
2. T2 sends the request to Licensed Internal Code server
3. Server logs the following
   a. Start of transaction
   b. End of transaction
   c. Start of queue transaction
4. Licensed Internal Code server sends reply to T2
5. T2 sends the reply to PC application
6. T2 sends acknowledgment to Licensed Internal Code server
7. Licensed Internal Code server logs the end-of-queue transaction
8. PC application receives a reply

The transaction times start after the server gets the request and end before a reply is sent.

The total transaction time (in seconds) is stored in the JBRSP field in the QAPMJOBS file (performance monitor) or QAPMJOBL file (Collection Services). The number of transactions (5250 only) is stored in the JBNTR field in the QAPMJOBS file or QAPMJOBL file. These fields are also updated by display I/O transactions and by pass-through transactions.

OS/400 file server jobs run in the QSERVER subsystem.

Pass-Through Transactions

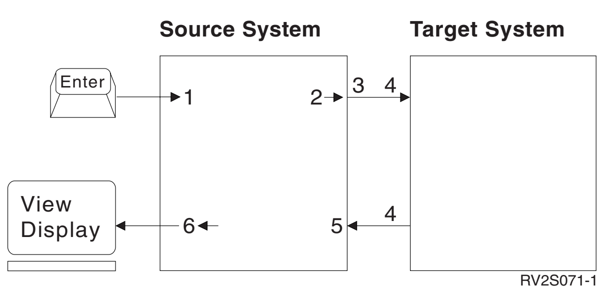


Figure 104. Source Pass-through Transaction Path

Figure 104 shows the flow of data for a pass-through transaction. The following occurs:

1 A user presses Enter, sending a request for data.

2	The request for data is then sent to the target system.
3	The transaction data leaves the source system.
4	The transaction data is on the network.
5	The transaction data is sent from the target system to the source system.
6	Data appears on the display.
1→2	Data is in the source system Pass-through is processing data
2→3	Service time
3→5	Display wait time
5→6	Data is in the source system
1→6	Transaction

Pass-Through Performance Notes

The target program on a session time includes only trace points (no sample data). Here are some useful formulas:

Display wait time
(**3→5**) The time from when the source system sends a request to when it receives the data from the target system.

Service time
(**2→3**) The time from when the source system sends a request for data to the target system until the requests are on the network.

Transaction time
(**1→6**) The time from when a user presses Enter until a new display appears.

The total transaction time (in seconds) is stored in the JBRSP field in the QAPMJOBS file or the QAPMJOBL file. The number of transactions (5250 only) is stored in the JBNTR field in the QAPMJOBS file or the QAPMJOBL file. These fields are also updated by display I/O transactions and by Client Access shared folders transactions.

Data Queue Transactions

Data queues provide a means for one job to start a work activity in another server job. A data queue transaction identifies and provides a means of measurement for this server work activity with the following boundaries:

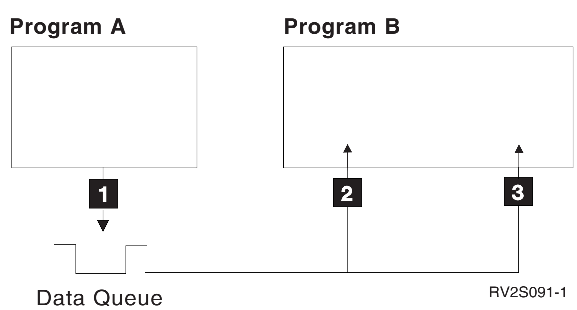


Figure 105. Data Queue Transaction

1. Program A sends data to the data queue. This is the start of the application input queuing time.

2. Program B dequeues the data. This ends the application input queuing time.

   The total application queuing time (in hundredths of a second) is stored in the JBAIQT field in the QAPMJOBS file or the QAPMJOBL file. The number of application queuing transactions is stored in the JBNAIQ field in the QAPMJOBS file or the QAPMJOBL file. These fields are also updated by display I/O transactions. This also starts the resource utilization time.
3. Program B dequeues the next data. This ends the resource utilization time.

   The total resource usage time (in seconds) is stored in the JBRUT field in the QAPMJOBS file or the QAPMJOBL file. The number of resource usage transactions is stored in the JBNRU field in the QAPMJOBS file or the QAPMJOBL file. These fields are also updated by display I/O transactions.

Chapter 9. Performance Graphics

This chapter describes the functions that allow you to work with performance data in a graphical format. The performance data is collected by Collection Services. The graphs can be displayed interactively, printed, plotted, or saved to a graphics data format (GDF) file for use by other utilities, such as the Business Graphics Utility (BGU).

Notes:

1. This chapter does not refer to Capacity Planning graphics. For information about using the graphics feature of the capacity planner, see the *BEST/1 Capacity Planning Tool* book.
2. To generate the graphs, you must install option 14 (GDDM) of the operating system.

Summary—Manager Feature

Two distinct types of graphs can be displayed: performance graphs and historical graphs. Performance graphs use the performance data that is collected in a single member of the performance database files. Performance graphs are useful for identifying jobs that are performing poorly or evaluating the activities performed by a user or class of users on the system during a specified period.

Historical graphs use performance data collected in several members of the performance database files. Historical data is the summary of the performance data generated by Collection Services. The Create Historical Data (CRTHSTDTA) command is used to summarize the performance data for use by the historical graphs. Historical graphs are used to show how the performance of a system has changed over time, for example, as historical trends.

Use the following steps to display a performance graph:

1. Create a graph format using the Create Graph Format (CRTGPHFMT) command. (Graph formats are reusable.)
2. Collect performance data with Collection Services.
3. Display the graph using the Display Performance Graph (DSPPFRGPH) command.

Use the following steps to display a historical graph:

1. Create a graph format using the CRTGPHFMT command. (Graph formats are reusable.)
2. Collect performance data with Collection Services.
3. Create the historical data using the CRTHSTDTA command.
4. Display the graph using the Display Historical Graph (DSPHSTGPH) command.

When you select option 9 (Performance graphics) on the IBM Performance Tools menu, the Performance Tools Graphics menu appears.

```
PERFORMG                 Performance Tools Graphics
                                                           System:   ABSYSTEM
Select one of the following:

     1. Work with graph formats and packages
     2. Work with historical data
     3. Display graphs and packages

    70. Related commands











Selection or command
===> __________________________________________________________________
__________________________________________________________________________
F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F16=System main menu
```

You can also reach this menu by typing the Start Performance Graphics (STRPFRG) command on the command line of any display. From this menu, you can work with performance data in a graphical format.

Work with Graph Formats and Packages—Manager Feature

Graph formats are templates or outlines used by the DSPPFRGPH and the DSPHSTGPH commands to display graphs in a user-defined format. Table 20 shows the 15 predefined graph formats included in QPFRDATA, the IBM-supplied performance library.

Table 20. QPFRDATA Graph Formats

Graph Format Name	Description
QIBMASYNC	Asynchronous disk I/O per second against time
QIBMCMNIOP	Communications IOP use against time
QIBMCMNLIN	Maximum communications line use against time
QIBMCPUPTY	Processor unit use of jobs with priorities 0-19, 20-39, 40-59, 60-79, and 80-99 against time
QIBMCPUTYP	Processor unit use of batch, interactive, and system jobs against time
QIBMDSKARM	Disk arm use against time
QIBMDSKIOP	Disk IOP use against time
QIBMLWSIOP	Local work station IOP use against time
QIBMMFCIOP	Multifunction communications IOP use against time
QIBMMFDIOP	Multifunction disk IOP use against time
QIBMDSKOCC	Percentage of disk occupied against time
QIBMRSP	Interactive response time against time
QIBMTOTDSK	Total disk I/O per second against time
QIBMTNS	Transactions per hour against time
QIBMSYNC	Synchronous disk I/O per second against time

Graph packages allow you to group several graph formats into a single entity. This is useful for printing, displaying, or plotting a number of graphs at once. Instead of having to issue several DSPPFRGPH or DSPHSTGPH commands to print several graphs, you can use the package name (one command) to print all of the graphs in the graph package. Also included in QPFRDATA is a predefined graph package, QIBMPKG, which contains the 15 IBM standard graph formats.

If you select option 1 (Work with graph formats and packages) on the Performance Tools Graphics menu, the Work with Graph Formats and Packages display appears.

```
                     Work with Graph Formats and Packages

Library  . . . . . . . . . . .   QPFRDATA

Type options, press Enter.
  1=Create graph format    2=Change          3=Copy   4=Delete
  5=Display sample graph   6=Create package   8=Display package contents

        Format/
Option  Package     Type      Text
  _     __________            _________________________________________
  _     PACKAGE1    PACKAGE   Graph Package containing format w/ func. areas
  _     QIBMPKG     PACKAGE   IBM Graph Package
  _     FORMAT1     FORMAT    CPU Utilization vs. Time-Functional Areas
  _     NWCTEST     FORMAT
  _     QIBMASYNC   FORMAT    Asynchronous Disk I/O per Second vs. Time
  _     QIBMCMNIOP  FORMAT    Communications IOP Utilization vs. Time
  _     QIBMCPUPTY  FORMAT    CPU Utilization vs. Time (Priority)
  _     QIBMCPUTYP  FORMAT    CPU Utilization vs. Time (Job Type)
  _     QIBMDSKARM  FORMAT    Disk Arm Utilization vs. Time
                                                                 More...

F3=Exit   F5=Refresh   F12=Cancel   F15=Sort by format   F16=Sort by text
```

This display shows you the graph formats and graph packages that exist in the library specified in the *Library* field. The graph format or graph package name, a format or package indicator, and a text description appear on the display. If you cannot find the format or package you want to work with, use the appropriate function key to sort the formats and packages. You can sort them by name, type, or text description. When you find the graph format or package you want to work with, select the function you want to perform by typing the appropriate option in the *Option* field and pressing Enter.

If you are searching for a graph format or graph package located in a library that is different from the one currently listed in the *Library* field at the top of the display, type a new library name in the field and press Enter. A list of the graph formats and graph packages available in the library you specified appears. You can then select one of them to work with.

Create Graph Format—Manager Feature

To create a new graph format, type a 1 (Create graph format), the graph format name, and the description on the first line under the *Option*, *Format/Package*, and *Description* columns, and press Enter. The CRTGPHFMT command prompt appears.

Specify how your graphs are displayed by selecting from the following options:

- Titles
- X-axis data
- Y-axis data

- Data type
- Individual line breakdown
- Graph type

Graph Types—Manager Feature

The graph types available are:

- Line
- Scatter plot
- Surface
- Floating bar
- Composite bar

Line Graphs

Use line graphs to show change occurring over time. Line graphs can represent increases, decreases, trends, and general fluctuations of quality.

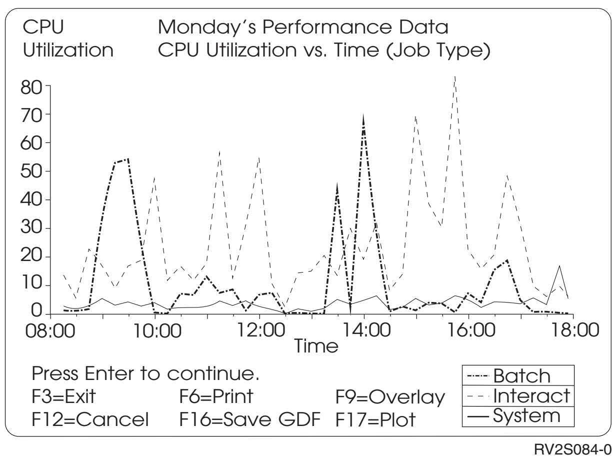


Figure 106. Line Graph: Data Represented as Lines

Each plotted point is shown by a marker; the plotted points are connected to form a continuous line. Each line is assigned a different color. If lines overlap, the color of the last legend entry at that point is displayed.

Scatter Plots

Scatter plots are similar to line graphs, except that the lines that connect the data points are not drawn.

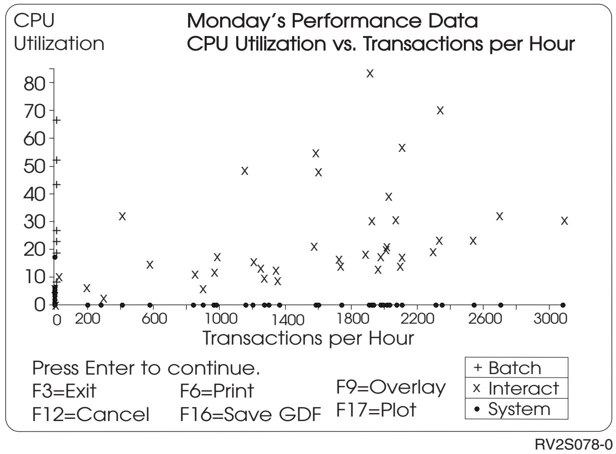


Figure 107. Scatter Plot: Data Represented as Markers

Surface Graphs

Use surface graphs like line graphs to show changes occurring over time. Surface graphs emphasize volume by shading the area between the lines and the X-axis if you specify Y (yes) for the area fill option.

Note: If you do not use the area fill option in your surface graph, your graph will be a cumulative line graph. If there is a legend entry with a value of zero to plot, its line covers the line plotted previously because there is no change to plot. Although shading requires more time to display or plot than simply drawing the lines, the area fill option may show more clearly which legend entries represent the different areas, particularly in cases where a line of one color may cover another.

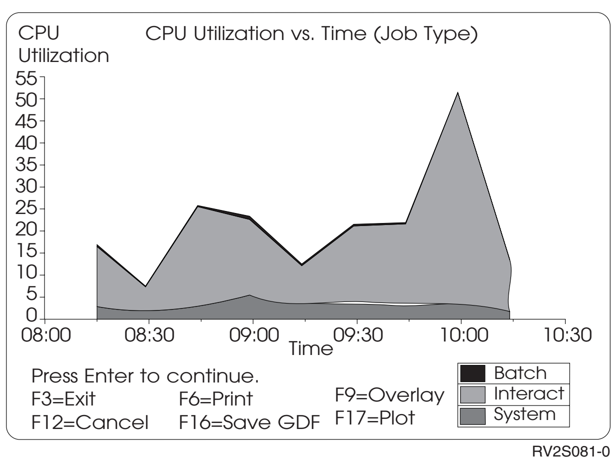


Figure 108. Surface Graph: Data Represented as Shaded Regions

Bar Graphs

Use bar graphs to show changes occurring over time, parts of an entity, relationships between variables, and comparisons.

Use **composite-bar** graphs to show how parts comprise the entity, and how the entity relates to other entities.

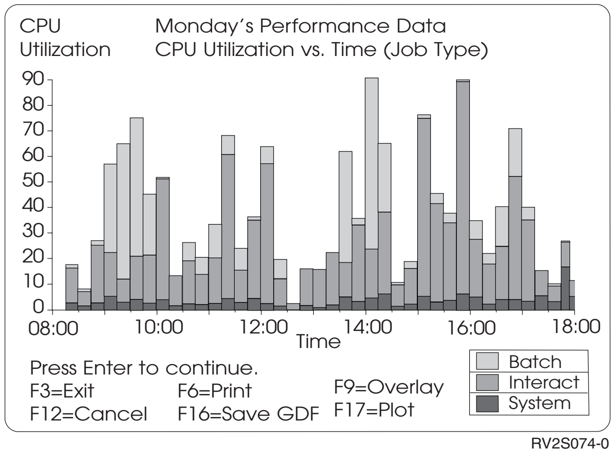


Figure 109. Composite-Bar Graph

Floating-bar graphs are similar to composite-bar graphs, except that the first component is not shown. Use floating-bar graphs to show the lower limits of each entity, in addition to the relationship of the elements that comprise the entity.

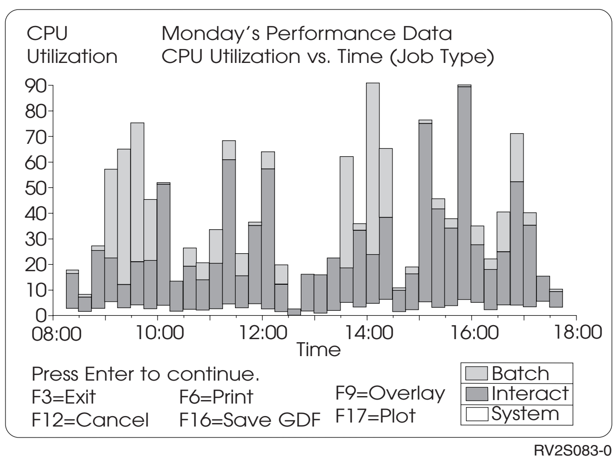


Figure 110. Floating-Bar Graph

Data Types—Manager Feature

Data types control the number of lines displayed in your graph. They are a means of categorizing the information provided in your graph. For example, if you want the graph CPU Over Time and want a separate line plotted for every priority data type, you would specify *PRIORITY as your data type. You would then be presented with a display that would allow you to enter 1 to 16 priority ranges for plotting in this particular graph. Data types, therefore, control the legend entries in your graph.

Data types available for graphing are:

All Jobs
: *ALL (default)

Job Type
: *JOBTYPE

Priority
*PRIORITY

Functional Area
*FCNARA

IOP (input/output processor)
*IOP

Disk *DISK

Communications Lines
*CMNLINE

Valid Data Types for Axis Selections

Table 21 shows the possible combinations for X-axis and Y-axis values based on the data type being graphed. For example, if you want to graph Time against Disk IOP Utilization, specify a data type of *IOP.

Table 21. Valid X-axis and Y-axis Values

	X-Axis										
Y-Axis	**Time**	**CPU Util**	**Trans per Hour**	**Total Nbr of Trans**	**Resp Time**	**Sync Disk I/O per Sec**	**Total Sync I/O**	**Async Disk I/O per Sec**	**Total Async I/O**	**Total Disk I/O per Sec**	**Total Disk I/O**
CPU Util	X[2]	—	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]
Trans per Hour	X[2]	X[1]	—	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]
Total Number of Trans	X[2]	X[1]	X[1]	—	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]
Re-sponse Time	X[2]	X[1]	X[1]	X[1]	—	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]
Sync Disk I/O per Second	X[2]	X[1]	X[1]	X[1]	X[1]	—	X[1]	X[1]	X[1]	X[1]	X[1]
Total Sync Disk I/O	X[2]	X[1]	X[1]	X[1]	X[1]	X[1]	—	X[1]	X[1]	X[1]	X[1]
Async Disk I/O per Second	X[2]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	—	X[1]	X[1]	X[1]
Total Async Disk I/O	X[2]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	—	X[1]	X[1]
Total Disk I/O per Second	X[2]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	—	X[1]

Table 21. Valid X-axis and Y-axis Values (continued)

Y-Axis	X-Axis: Time	CPU Util	Trans per Hour	Total Nbr of Trans	Resp Time	Sync Disk I/O per Sec	Total Sync I/O	Async Disk I/O per Sec	Total Async I/O	Total Disk I/O per Sec	Total Disk I/O
Total Disk I/O	X^2	X^1	X^1	X^1	X^1	X^1	X^1	X^1	X^1	X^1	—
Com IOP Util	X^3	—	—	—	—	—	—	—	—	—	—
Disk IOP Util	X^3	—	—	—	—	—	—	—	—	—	—
Local Work Station IOP Util	X^3	—	—	—	—	—	—	—	—	—	—
Multi-function Com IOP Util	X^3	—	—	—	—	—	—	—	—	—	—
Multi-function Disk IOP Util	X^3	—	—	—	—	—	—	—	—	—	—
Disk Arm Util	X^4	—	—	—	—	—	—	—	—	—	—
Disk Percent Occupied	X^4	—	—	—	—	—	—	—	—	—	—
Com Line Util	X^5	—	—	—	—	—	—	—	—	—	—
Logical database I/O	X^6	X^6	X^6	X^6	X^6	X^6	X^6	X^6	X^6	X^6	X^6

Key:

1. A graph type of *SCATTER and data type of *ALL, *FCNARA, *JOBTYPE, or *PRIORITY are required.
2. A data type of *ALL, *FCNARA, *JOBTYPE, or *PRIORITY is required.
3. A data type of *IOP is required.
4. A data type of *DISK is required.
5. A data type of *CMNLINE is required.
6. A data type of *JOBTYPE and a job type of *DDM are required.

Legends—Manager Feature

The legends displayed in the graph are controlled by the data type specified (for example, *JOBTYPE). The maximum number of legend entries you can specify for each data type is as follows:

Data Type
Maximum Legend Entries

All 1

Job Type
16

Priority
16

Functional Area
16

IOP 2

Disk 2

Communications Line
16

Create Graph Package—Manager Feature

To create a new graph package, type a 6 (Create graph package), the graph package name, and the text description on the first line under the *Option*, *Format/Package*, and *Text* columns, and press Enter. The Create Graph Package display appears.

```
                             Create Graph Package

Graph package . . :   PACKAGE2
  Library . . . . :     QPFRDATA

Type options, press Enter.
  1=Select   5=Display sample graph

Option     Format        Text
  _        FORMAT1       CPU Utilization vs. Time-Functional Areas
  _        FORMAT2       Response Time vs. Time-Functional Areas
  _        QIBMASYNC     Asynchronous Disk I/O per Second vs. Time
  _        QIBMCMNIOP    Communications IOP Utilization vs. Time
  _        QIBMCPUPTY    CPU Utilization vs. Time (Priority)
  _        QIBMCPUTYP    CPU Utilization vs. Time (Job Type)
  _        QIBMDSKARM    Disk Arm Utilization vs. Time
  _        QIBMDSKIOP    Disk IOP Utilization vs. Time
  _        QIBMDSKOCC    Percentage of Disk Occupied vs. Time
  _        QIBMLWSIOP    Local Workstation IOP Utilization vs. Time
  _        QIBMMFCIOP    Multifunction IOP (Comm) Util vs. Time
                                                                 More...

F3=Exit   F5=Refresh   F12=Cancel   F16=Sort by text
```

On this display, type a 1 (Select) by any graph formats that you want to include in the graph package. If you are unsure about including a graph format in the package, type a 5 (Display sample graph) by the format in question. This displays a sample graph using the format selected. When you have made all of your selections and there are only 1's in the *Option* column, press Enter to create the graph package.

Change Graph Formats and Packages—Manager Feature

To change an existing graph format or graph package, type a 2 (Change) next to the format or package name on the Work with Graph Formats and Packages display, and press Enter. If you are changing a graph format, the Change Graph Format (CHGGPHFMT) command prompt appears. Make your changes and press Enter. If you are changing a graph package, the Change Graph Package display appears.

```
                             Change Graph Package

Graph package . . :   PACKAGE1
  Library . . . . :     QPFRDATA
  Text  . . . . . :   Text for package 1

Type options, press Enter.
  1=Select   5=Display sample graph

Option     Format         Text
  1        FORMAT1        CPU Utilization vs. Time-Functional Areas
  1        FORMAT2        Response Time vs. Time-Functional Areas
  1        QIBMASYNC      Asynchronous Disk I/O per Second vs. Time
  _        QIBMCMNIOP     Communications IOP Utilization vs. Time
  _        QIBMCPUPTY     CPU Utilization vs. Time (Priority)
  _        QIBMCPUTYP     CPU Utilization vs. Time (Job Type)
  _        QIBMDSKARM     Disk Arm Utilization vs. Time
  _        QIBMDSKIOP     Disk IOP Utilization vs. Time
  _        QIBMDSKOCC     Percentage of Disk Occupied vs. Time
  _        QIBMLWSIOP     Local Workstation IOP Utilization vs. Time
                                                                   More...
F3=Exit   F5=Refresh   F10=Restore list   F12=Cancel
F15=Sort by format     F16=Sort by text
```

On this display, 1's appear next to the graph formats that are already included in the graph package. To eliminate a graph format from the package, replace the 1 with a blank. To add additional graph formats to the package, type a 1 (Select) next to the graph formats you want to include. To display a sample of a graph format, type a 5 (Display sample graph) next to the graph format and press Enter. A sample graph using the graph format is displayed.

Note: You cannot change the IBM standard graph formats and graph package (QIBMxxxxxx).

Copy Graph Formats and Packages—Manager Feature

To copy a graph format or graph package, type a 3 (Copy) next to the format or package name on the Work with Graph Formats and Packages display and press Enter.

```
                     Work with Graph Formats and Packages

Library  . . . . . . . . . . .   QPFRDATA

Type options, press Enter.
  1=Create graph format    2=Change           3=Copy   4=Delete
  5=Display sample graph   6=Create package   8=Display package contents
```

Either the Copy Graph Format (CPYGPHFMT) or Copy Graph Package (CPYGPHPKG) command prompt appears. You can copy a graph format or package to another library or into the same library under a different name. A graph format or package that is created in a library cannot have the same name as a graph format or graph package that already exists in the library.

Copying graph formats and packages is useful for changing a base format or package, such as the IBM standard graph formats and package (QIBMxxxxxx).

Delete Graph Formats and Packages—Manager Feature

To delete graph formats and graph packages, type a 4 (Delete) next to the format and package names on the Work with Graph Formats and Packages display, and press Enter.

If a graph format you selected to delete is contained in any graph packages, a warning message displays telling you that the format is in a package. If you delete the graph format, the format is also removed from the graph package. If all the graph formats in a graph package are deleted, the package is also deleted.

Note: You cannot delete the IBM standard graph formats and graph package (QIBMxxxxxx).

Display Sample Graph

To display a sample of a graph format, type a 5 (Display sample graph) next to the graph format name on the Work with Graph Formats and Packages display, and press Enter. A sample graph using the graph format is displayed.

Note: This option is not valid for graph packages.

Display Package Contents—Manager Feature

To display the contents of a graph package, type an 8 (Display package contents) next to the graph package name on the Work with Graph Formats and Packages display, and press Enter. The Display Package Contents display appears.

Note: Option 8 (Display package contents) cannot be specified for graph formats.

```
                           Display Package Contents

Graph package . . :   PACKAGE1
  Library . . . . :     QPFRDATA

Type options, press Enter.
  5=Display sample graph

Option     Format         Text
  _        FORMAT1        CPU Utilization vs. Time-Functional Areas
  _        QIBMASYNC      Asynchronous Disk I/O per Second vs. Time
  _        QIBMCMNIOP     Communications IOP Utilization vs. Time









                                                                      Bottom

F3=Exit   F5=Refresh   F12=Cancel   F16=Sort by text
```

On this display, type a 5 (Display sample graph) to see a sample graph displayed using the graph format.

Work with Historical Data—Manager Feature

The Display Historical Graph (DSPHSTGPH) command uses historical data to show the changes in resource utilization on your system over time. Historical data is a summary of the performance data generated by Collection Services.

Notes:

1. Files are created to contain the historical data. For each performance member with historical data, there is a single value for each type of information that can be graphed for each day of the member's performance collection period. Thus, the amount of data is reduced and summarized into the historical files. Once you have historical data for a member, you may choose to delete the performance data (DLTPFRDTA) created through the initial performance data collection to free file storage space.
2. If you want to display a historical graph, specify a start/stop date range that contains less than 400 summarized performance data members.
3. Any time a collection extends beyond midnight, each day counts as one member.

Because historical graphs can help show trends in your system's performance, it is recommended that you create historical data in a given library for members that are collected at the same time. (For example, you might want to compare data that was all collected on Wednesdays from 8:00 a.m. to 12:00 p.m., whereas you probably would not want a historical graph with one member collected on Wednesday from 8:00 a.m. to 12:00 p.m. and the other on Saturday from 1:00 to 5:00 p.m.)

If you select option 2 (Work with historical data) on the Performance Tools Graphics menu, the Work with Historical Data display appears.

```
                        Work with Historical Data

Library . . . . . .   QPFRDATA

Type options, press Enter.
  1=Create historical data   4=Delete historical data

        Member      Historical
Option  Name           Data     Date      Time
  _     Q003180843      NO      11/14/00  08:43:15
  _     Q003171050      NO      11/13/00  10:51:00
  _     SATDATA         YES     11/11/00  10:42:48
  _     TESTDATA        YES     11/11/00  10:26:12
  _     NOV111995       NO      11/11/00  09:57:27
  _     Q003150955      NO      11/11/00  09:55:41
  _     FRIDAY          YES     11/10/00  11:17:03
  _     Q003132332      YES     11/09/00  23:32:19
  _     Q003121407      YES     11/08/00  14:07:11
  _     Q003121142      NO      11/08/00  11:42:30
  _     Q003111538      NO      11/07/00  15:39:02
                                                                    More...
F3=Exit   F5=Refresh   F11=Display text   F12=Cancel
F15=Sort by member     F16=Sort by text
```

The member name, a historical data indicator, and the date and time you collected each set of performance data appear on this display. To display the member text description, press F11 (Display text). If you cannot find the data you want to work with, use the appropriate function key to sort the sets of performance and historical data. You can sort them by member name, text description, or by the date and time the member was created. When you find the data you want to work with, indicate the function you want to perform by typing the appropriate option.

If you are searching for performance or historical data located in a library that is different from the one currently listed in the *Library* field at the top of the display, type a new library name in the *Library* field and press Enter. A list of performance and historical data members available in the library you specified appears. You can then select one of them to work with.

Note: All of the members in the historical data must have unique names. If you create a member that has the same name as a historical data member, you may want to change the name by using the Copy Performance Data (CPYPFRDTA) command to use the new member for historical purposes.

Create Historical Data

To create historical data for performance members, type a 1 (Create) by the members, and press Enter. The Confirm Create of Historical Data display appears.

```
                      Confirm Create of Historical Data

 Library . . . . . :   QPFRDATA

 Press Enter to confirm your choices for 1=Create.
 Press F12=Cancel to return to change your choices.

         Member      Historical
 Option  Name           data     Date      Time
   1     Q003180843      NO      11/14/00  08:43:15
   1     Q003171050      NO      11/13/00  10:51:00
   1     SATDATA         YES     11/11/00  10:42:48

                                                                      Bottom
 F11=Display text   F12=Cancel
```

On this display, press Enter to create historical data for the members. Once historical data has been created for a member, you can delete the original performance data using the Delete Performance Data (DLTPFRDTA) command if the data is not needed for performance analysis, capacity planning, or performance graphing.

Delete Historical Data

To delete the historical data created by the Create Historical Data command, type a 4 (Delete) by members that contain historical data, and press Enter. This does not delete the original performance data.

Note: If the performance data for a member no longer exists, you cannot re-create historical data for that member after the historical data has been deleted.

Display Graphs and Packages—Manager Feature

You can view, print, or plot graphs from your display. You can also store a graph in a GDF file for use by other utilities, such as the BGU. This is done on the Specify Graph Options display.

If you select option 3 (Display Graphs and Packages) on the Performance Tools Graphics menu, the Display Graphs and Packages display appears.

```
                         Display Graphs and Packages

Select one of the following:

     1. Display performance data graphs
     2. Display historical data graphs















Selection or command
===> __________________________________________________________________
_______________________________________________________________________
F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel
```

Two distinct types of graphs can be displayed: performance graphs and historical graphs. Performance graphs use the performance data that is collected in a single member of the performance database files. Performance graphs are useful for identifying jobs that are performing poorly or evaluating the activities performed by a user or class of users on the system during a specified period.

Historical graphs use performance data collected in several members of the performance database files. Historical data is the summary of the performance data generated by Collection Services. The Create Historical Data (CRTHSTDTA) command is used to summarize the performance data for use by the historical graphs. Historical graphs are used to show how the performance of a system has changed over time, for example, as historical trends.

Note: It is best to collect the performance data used for historical graphs over the same period of time. For example, if your normal working day is from 8:00 a.m. to 5:00 p.m., you would not want to create a historical graph to evaluate system performance during working hours using system performance data collected from 5:00 p.m. to 8:00 a.m.

Display Performance Graphs—Manager Feature

If you select option 1 (Display performance data graphs) on the Display Graphs and Packages display, the Select Graph Formats and Packages display appears.

```
                         Select Graph Formats and Packages

Library  . . . . . . . . . . .   QPFRDATA

Type options, press Enter.
  1=Select   5=Display sample graph   8=Display package contents

        Format/
Option  Package     Type      Text
  _     NEWPACKAGE  PACKAGE   Graph Package for Job Types
  _     PACKAGE1    PACKAGE   Graph Package containing IOP formats
  _     QIBMPKG     PACKAGE   IBM Graph Package
  _     FORMAT1     FORMAT    CPU Utilization vs. Time-Functional Areas
  _     FORMAT2     FORMAT    Response Time vs. Time-Functional Areas
  _     QIBMASYNC   FORMAT    Asynchronous Disk I/O per Second vs. Time
  _     QIBMCMNIOP  FORMAT    Communications IOP Utilization vs. Time
  _     QIBMCPUPTY  FORMAT    CPU Utilization vs. Time (Priority)
  _     QIBMCPUTYP  FORMAT    CPU Utilization vs. Time (Job Type)
  _     QIBMDSKARM  FORMAT    Disk Arm Utilization vs. Time


                                                                       More...
F3=Exit   F5=Refresh   F12=Cancel   F14=Sort by format   F15=Sort by text
```

This display shows you the graph formats and graph packages that exist in the library you specified. The graph format or graph package name, a format or package indicator, and a text description appear on the display. If you cannot find the format or package you want to use in your performance graph, use the appropriate function key to sort the formats and packages. You can sort them by name, type, or text description. When you find the graph format or package you want to use in your performance graph, type a 1 in the corresponding *Option* field.

If you are searching for a graph format or graph package located in a library that is different from the one currently listed in the *Library* field at the top of the display, type a new library name in the *Library* field, and press Enter. A list of graph formats and graph packages available in the library you specified appears. You can then select one of them to use in your performance graph.

Note: If you want to display a performance graph, select a performance data member that contains less than 400 intervals, or (if the member has more than 400 intervals) specify the start and stop date and time to reduce the number of intervals displayed in the graph.

Display Sample Graph—Manager Feature

To display a sample of a graph format, type a 5 (Display sample graph) next to the graph format, and press Enter. A sample graph using the graph format appears.

Note: This option is not valid for graph packages.

Display Graph Package—Manager Feature

To display the contents of a graph package, type an 8 (Display package contents) next to the graph package, and press Enter. A list of the graph formats contained in the graph package appears.

Note: This option is not valid for graph formats.

Select Performance Data Member—Manager Feature

After you select a graph format or graph package to use in your performance graph, the Select Performance Data Member display appears.

```
                        Select Performance Data Member

Library . . . . . .   QPFRDATA

Type options, press Enter.
  1=Select

        Member
Option  Name        Text                                  Date      Time
  _     Q003180843                                        11/14/00  08:43:15
  _     Q003171050                                        11/13/00  10:51:00
  _     SATDATA3    Saturday Data-third run               11/11/00  10:42:48
  _     SATDATA2    Saturday Data-second run              11/11/00  10:26:12
  _     SATDATA1    Saturday Data-first run               11/11/00  09:57:27
  _     Q003150955                                        11/11/00  09:55:41





                                                                       More...
F3=Exit   F5=Refresh      F12=Cancel   F15=Sort by member
F16=Sort by text
```

The member name, a text description, and the date and time you collected each set of performance data appear on this display. If you cannot find the data you want to display, use the appropriate function keys to sort the sets of performance data. You can sort the data by member name, text description, or by the date and time the member was created. When you find the performance data you want to use in your performance graph, type a 1 in the corresponding *Option* field.

If you are searching for a member located in a library that is different from the one currently listed in the *Library* field at the top of the display, type a new library name in the *Library* field and press Enter. A list of the performance members available in the specified library appears. You can then select a member to display.

Select Categories for Performance Graphs—Manager Feature

If the graph format or graph package you previously selected does not graph only IOP, disk, or communications line data, the Select Categories for Performance Graphs display appears.

```
                  Select Categories for Performance Graphs

Member  . . . . . :   MONDAYDATA
  Library . . . . :     QPFRDATA

Type options, press Enter.  Press F6 to include all data in the graph.
  1=Select

Option     Category
  _        Job
  _        User ID
  _        Subsystem
  _        Pool
  _        Communications line
  _        Control unit
  _        Functional area

                                                                     Bottom
F3=Exit   F6=Include all data in the graph   F12=Cancel
```

Type a 1 in the *Option* column next to the categories of information from which you want performance data. Press Enter.

Note: Normally, you include all categories of information in your graph. To do this, do not type a 1 in any category. Instead, simply press F6.

If you choose to display the graph with only certain categories of information, a display appears that allows you to enter selection criteria for each category. This is the same as selecting categories of information to include in performance reports. See Chapter 7. Performance Reports—Manager Feature, for more information on selecting and omitting.

Specify Graph Options—Manager Feature

When you have chosen the information you want to appear on your performance graph, or if you selected a graph format with IOP, disk, or communications line data type, the Specify Graph Options display appears.

```
                              Specify Graph Options

Type choices, press Enter.

  Graph title  . . .   *MBRTEXT

  Graph subtitle . .   CPU Utilization vs. Time

  X-axis range:
    First  . . . . .   *AUTO___                 *SAME, *AUTO, Number
    Last . . . . . .   ________                 Number

  Y-axis range:
    First  . . . . .   *AUTO___                 *SAME, *AUTO, Number
    Last . . . . . .   ________                 Number

  Area fill  . . . .   *NO                      *SAME, *YES, *NO

  Start:
    Day  . . . . . .   *FIRST                   *FIRST, MM/DD/YY
    Time . . . . . .   *FIRST                   *FIRST, HH:MM:SS
                                                                        More...
F3=Exit   F12=Cancel
```

Figure 111. Specify Graph Options

Page down to view the rest of the graph options.

```
                              Specify Graph Options

Type choices, press Enter.

  Stop:
    Day  . . . . . .   *LAST                    *LAST, MM/DD/YY
    Time . . . . . .   *LAST                    *LAST, HH:MM:SS

  Output . . . . . .   *_______                 *, *PRINT, *PLOT, *OUTFILE











                                                                       Bottom
F3=Exit   F12=Cancel
```

On this display you can specify a new title, subtitle, axis ranges, area fill value, start time and date, stop time and date, and output value for your performance graph. If you selected a graph format for your performance graph, the values for the title, subtitle, axis ranges, and area fill defined in the graph format appear. Changing any of the values on the Specify Graph Options display only changes the format for the graph created. The graph format does not change. If you selected a graph package for your performance graph, *SAME appears for the title, subtitle, and axis ranges. *SAME means to leave these values as they are defined in the individual graph formats in the package. If you specify any new values, the new values appear on all of the graphs in the package.

For example, if you type `New Graph Title` for the graph title and the graph package contained three graph formats, the resulting three graphs would have "New Graph Title" as their title.

The area fill option allows you to override the area fill option on the graph format to display a graph more quickly. Filling in (or shading) an area is accomplished by drawing several lines. Densely shaded patterns require more lines. Each line that is drawn takes time. Consequently, the graph displays faster if area fill is not used. If the *area* fill option on the graph format is *YES, then selecting *NO for the *area fill* option causes the area not to be filled.

You may specify the start and stop date and time for the performance data to be shown in the graph. If you do not specify the start and stop date and time, the graph includes data from the first (or only) date that data was collected to the last (or only) date that data was collected.

The output option specifies how the graphs are to be displayed.

Press Enter to display your graph or graphs.

Display Historical Graphs—Manager Feature

Historical graphs allow you to graphically see how your system performed during many runs of Collection Services. Historical graphs use the summarized data obtained from the members of the performance database files generated for each collection. This shows you how the performance of your system has changed over time. For example, it can show how processing unit utilization increased or fluctuated.

If you select option 2 (Display historical data graphs) on the Display Graphs and Packages display, the Select Graph Formats and Packages display appears. This is the same display that is shown for displaying performance graphs. (See "Display Performance Graphs—Manager Feature" on page 258 for more information.) After you select a graph format or graph package from the Select Graph Formats and Packages display, the Specify Graph Options display appears.

```
                              Specify Graph Options

Type choices, press Enter.

  Graph title  . . .   *BLANK___________________________________________

  Graph subtitle . .   *BLANK___________________________________________

  X-axis range:
    First  . . . . .   *AUTO___                 *SAME, *AUTO, Number
    Last . . . . . .   ________                 Number

  Y-axis range:
    First  . . . . .   *AUTO___                 *SAME, *AUTO, Number
    Last . . . . . .   ________                 Number

  Area fill  . . . .   *NO                      *SAME, *YES, *NO

  Data library . . .   QPFRDATA__               Name


                                                                More...
F3=Exit   F12=Cancel
```

Page down to view the rest of the graph options.

```
                            Specify Graph Options

Type choices, press Enter.

  Start:
    Day . . . . . . . .   *FIRST__          *FIRST, *SELECT, MM/DD/YY

  Stop:
    Day . . . . . . . .   *LAST___          *LAST, MM/DD/YY

  Create historical
  data . . . . . . . . .  *NO_              *YES, *NO

  Output . . . . . . . .  *_______          *, *PRINT, *PLOT, *OUTFILE






                                                                       Bottom
F3=Exit   F12=Cancel
```

Display Graph Overlay—Manager Feature

Once you have a performance graph or historical graph displayed, you can define one overlay by pressing F9 (Overlay). An overlay is a graph that is placed on top of another graph so that you can see both graphs at the same time. Overlays can help you compare one graph to another as shown below.

You must select a graph format with the same X-axis specified.

If you want to overlay a historical graph, you cannot display a graph format with functional area data type.

Note that when you overlay a graph, there is a maximum of 16 legend entries between the two graphs. Therefore, if you are currently displaying a graph with two legend entries, your overlaid graph may have only a maximum of 14 legend entries (if allowed for the data type in the graph format). See "Legends—Manager Feature" on page 252 for the maximum number of legend entries for the individual data types. If you are currently displaying a graph with 16 legend entries, you cannot overlay a second graph.

Press F9 (Overlay), and the Select Graph Format display appears. Select the graph format that you want to overlay above the graph that is currently displayed.

```
                             Select Graph Format

Library . . . . . .   QPFRDATA


Type option, press Enter.
  1=Select

Option     Format         Text
  _        QIBMASYNC      Asynchronous Disk I/O per Second vs. Time
  _        QIBMCMNIOP     Communications IOP Utilization vs. Time
  _        QIBMCPUPTY     CPU Utilization vs. Time (Priority)
  _        QIBMCPUTYP     CPU Utilization vs. Time (Job Type)
  _        QIBMDSKARM     Disk Arm Utilization vs. Time
  _        QIBMDSKIOP     Disk IOP Utilization vs. Time
  _        QIBMDSKOCC     Percentage of Disk Occupied vs. Time
  _        QIBMLWSIOP     Local Workstation IOP Utilization vs. Time
  _        QIBMMFCIOP     Multifunction IOP (Comm) Util vs. Time
  _        QIBMMFDIOP     Multifunction IOP (Disk) Util vs. Time
  _        QIBMRSP        Interactive Response Time vs. Time
                                                                More...

F3=Exit   F5=Refresh      F12=Cancel   F16=Sort by text
```

Select a graph format and press Enter, and the Specify Graph Overlay Options display appears.

```
                        Specify Graph Overlay Options

Type choices, press Enter.

  New graph title      *BLANK________________________________________

  New graph subtitle   *BLANK________________________________________

  Y-axis range:
    First  . . . . .   *AUTO_____              *SAME, *AUTO, Number
    Last . . . . . .   __________              Number

  Area fill  . . . .   *NO_                    *YES, *NO







F3=Exit   F12=Cancel
```

Specify a title and subtitle for your new, overlaid graph on this display. If you do not specify a new title and subtitle, your new graph title and subtitle are left blank.

The Y-axis range value defaults to the value that was specified in the graph format. Here, again, you have the chance to change it. You may choose to have the same range as defined in the graph format (*SAME), you may choose to have it automatically fit the range of values (*AUTO), or you may specify the range yourself by typing in the numbers.

You also select whether to have area fill in the overlaid graph.

After you press Enter, your two graphs should be displayed. You can use the function keys on the display to print or plot the overlay or send the overlay format to a GDF file. Figure 112 shows an example of an overlay graph.

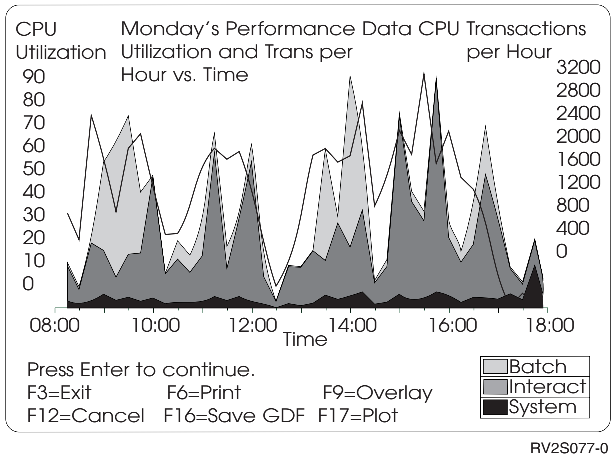


Figure 112. Overlay Graph Example

Chapter 10. Performance Utilities—Manager Feature

This chapter describes the commands that you access with option 5 (Performance utilities) on the IBM Performance Tools menu. When you choose option 5, the Performance Utilities display appears.

```
                            Performance Utilities

Select one of the following:

     1. Work with job traces
     2. Work with Performance Explorer
     3. Select file and access group utilities
     4. Start performance trace
     5. End performance trace
```

The utilities shown on the Performance Utilities display provide you with support for the detailed performance analysis of applications when you are working to understand or improve the performance of those applications.

See "Summary of Data Collection and Report Commands—Manager Feature" on page 12 for an overview of the commands you use with Performance Tools, their data collection requirements, and their intended uses. For a description of the performance explorer function (option 2) see Chapter 11. Performance Explorer.

Job Traces

If you select option 1 (Work with job traces) on the Performance Utilities display, the Work with Job Traces display appears.

```
                            Work with Job Traces

 Select one of the following:

     1. Start job trace
     2. Stop job trace
     3. Print job trace reports
```

On this display you can choose to start or stop a job trace. After you collect the trace data, you can print job trace reports that show information about input/output (I/O) operations, file use, transaction timing, job flow, and so on.

The options in the Job Trace display and the corresponding commands are as follows:

Job Traces
    Corresponding Command

Start Job Trace
    STRJOBTRC

Stop Job Trace
ENDJOBTRC

Print Job Trace Reports
PRTJOBTRC

For more information on job traces, see "Analyzing Job Flow and Transaction Performance" on page 269.

File and Process Access Group (PAG) Utilities

If you choose option 3 (Select file and access group utilities) on the Performance Utilities menu, the Select File and Access Group Utilities display appears.

```
                Select File and Access Group Utilities

Select one of the following:

     1. Analyze program/file use
     2. Analyze physical/logical file relationships
     3. Analyze file key structure
     4. Collect/display access group data
     5. Analyze access group data
```

On this display you can choose to create reports that show the program-to-file use, the physical-to-logical file relationships, the file key structure, or access group data. You can also use this display to determine if the application programs use shared display and database files, if the files are ordered by their frequency of use, if the files remain open but have no activity, or if programs free their static storage or keep it active.

Notes:

1. Before you use option 3, be sure that the processing for option 2 has completed. The output from option 2 is used as input for this function.
2. Option 5 is dependent on data collected by option 4. So you must take option 4 first.

The options in the Select File and Access Group Utilities display and the corresponding commands are as follows:

Table 22. Options in the Select File and Access Group Utilities display

File and Access Group Utilities	Corresponding Command
Analyze program and file use	ANZPGM
Analyze Physical and logical file relationships	ANZDBF
Analyze file key structure	ANZBDFKEY
Collect or Display access group data[1]	DSPACCGRP
Analyze access group data[1]	ANZACCGRP

Note:

[1] You should not use these commands because the Licensed Internal Code no longer uses process access groups for caching data that is used by a job. Because of this implementation, this value will always be 0 for current releases.

For more information on file and PAG utilities, see "Analyzing the Relationship of Programs and Database Files" on page 276.

Analyzing Job Flow and Transaction Performance

Use the job trace commands to collect trace information about a job. You can do this while the job runs in the normal production environment, or you can set up a special test for a job or program and trace how it runs. Once you collect the trace information, print the reports (there are two summary reports and one detail report). The summary reports allow you to determine the overall performance of the job without analyzing the detail report. Use the summary reports to guide you through the detail report.

Do not produce the detailed job analysis until you define which program or job you want to analyze.

Job trace analysis enhances the operating system's standard trace job (TRCJOB command) reports and provides a summary of job operation and transaction processing. The primary use for job trace analysis is to determine how a job processes. You can determine what parts of a job use the most resources, and measure the effect of program changes relative to previous trace data. Do not use job trace analysis to determine accurate job or transaction processing times.

Start Job Trace (STRJOBTRC) Command

Use the STRJOBTRC command to start the job trace function. The End Job Trace (ENDJOBTRC) and Print Job Trace (PRTJOBTRC) commands provide summary and detail reports of the job trace data.

Consider the following points when you use STRJOBTRC:

- The job trace function usually changes the paging characteristics of a job. Therefore, the trace reports may not show representative times for program operation.
- To cancel the job trace without saving any of the collected data, use the TRCJOB SET(*END) command.
- The job trace function issues a Start Service Job (STRSRVJOB) command if a job other than the current job is specified on the STRJOBTRC command.

End Job Trace (ENDJOBTRC) Command

Use the ENDJOBTRC command to do the following:

- Stop the job trace and direct the trace data into a user-defined database file member.
- You may start the PRTJOBTRC command to print the reports that analyze the trace data. These analysis reports provide an estimate of the response and processing times. They also show the number of database reads, nondatabase reads, and write I/O operations.

The database file QAPTTRCJ is created as output when you use the ENDJOBTRC command. Table 23 shows the names and descriptions of the fields in the QAPTTRCJ file.

Table 23. QAPTTRCJ File

Field Name	Description
SCFUNC	Type of function

Table 23. QAPTTRCJ File (continued)

Field Name	Description
SCSTYP	Subtype of function
SCFLD1	Column heading 1
SCFLD2	Column heading 2
SCFLD3	Column heading 3
SCTIME	Time of trace record
SCSEQ	Record sequence number
SCENT	Entry machine interface (MI) instruction number
SCEXT	Exit machine interface (MI) instruction number
SCINV	Call level
SCCPU	CPU time used
SCDB	Database reads
SCNDB	Nondatabase reads
SCPAG	Pages written
SCWAIT	Number of waits
SCRCEN	Century. 0 indicates the twentieth century. 1 indicates the twenty-first century.
SCRDAT	Date
SCRTIM	Time
SCSYNM	System name
SCDATE	Date of trace record
SCMODU	Module name
SCMODL	Module library name
SCPROC	Procedure name
SCEST1	Entry statement one
SCEST2	Entry statement two
SCEST3	Entry statement three
SCXST1	Exit statement one
SCXST2	Exit statement two
SCXST3	Exit statement three
SCLPRO	Longer procedure name
SCTHRD	Thread

The printer file created by this command is the same as that created by the PRTJOBTRC command, as described in Print Job Trace (PRTJOBTRC) Command.

Print Job Trace (PRTJOBTRC) Command

Use the PRTJOBTRC command to print a report of all, or a selected part, of the job trace data. The job trace data that prints comes from the database file member that was created when you ran the ENDJOBTRC command.

Note: There may be gaps in the sequence numbers on the report. These are caused by undefined trace records that may contain unprintable characters. To view these records, use the TRCJOB report, which gives you a hexadecimal display of these fields.

The following printer files are the output when you use the PTRJOBTRC command:

File **Description**

QPPTTRC1
First part of the summary report (Trace Analysis Summary)

QPPTTRC2
Second part of the summary report (Trace Analysis I/O Summary)

QPPTTRCD
Trace record detail report (Trace Job Information)

Both the Trace Analysis Summary Report and the Trace Analysis I/O Summary Report show the job trace data detail by transaction. On these reports, two lines for each transaction show all the trace records for that transaction. A transaction boundary is determined by consecutive trace records with these characteristics:

- The first trace record indicates a call to the program specified by the end of transaction (ENDTNS) parameter.
- The second trace record indicates a return to the program specified by the start of transaction (STRTNS) parameter.

The default ENDTNS and STRTNS parameters cause the trace records to be shown by work station transactions on these reports. A transaction begins when a user presses the Enter key, or otherwise responds to a program prompt, and ends when the program next requests input from the work station. You can change these parameters in order to summarize other types of transactions, such as record processing (useful when tracing a batch job), or communications I/O.

The summary reports show you the number and types of I/O operations that occurred for each transaction, the number of full and shared file opens and closes, the number of subfile operations, and the number of messages that occurred in the transaction. Messages may be the result of normal operation or they may be due to program actions that you can avoid (full open/close, duplicate keys in a file, or incorrect subfile processing).

The summary reports also contain a reference to the detail report. Every detail record has a sequence number in it. The summaries show the starting and ending detail report sequence numbers for each transaction summarized. The detail report program can be limited to a range of sequence numbers. This feature allows you to run the summaries, then print only the detail you are interested in.

The collection of trace data takes a certain amount of processing time, the amount of which can vary depending on such factors as system load and model. This overhead time is included in the trace data on which the PRTJOBTRC command reports. The command attempts to subtract the overhead time from the reported figures, leaving only the time used for program processing. Due to the variability of the overhead time, this adjustment may not be accurate. This adjustment is an estimate only. Therefore, do not use reported processing times as an absolute measure of the response time of a program or set of programs.

Figure 113 shows an example of the Trace Analysis Summary Report.

```
   Title                                           TRACE ANALYSIS SUMMARY                            12/01/01
    FILE-QAPTTRCJ   LIBRARY-QPFRDATA   MBR-QAJOBTRC                             JOB- BYSINN    .VLLXR239  .003368
                                                  P H Y S I C A L   I / O
          SECONDS    CPU SECONDS     DB READS  NON-DB RDS      WRITES  WAITS  SEQUENCE
WAIT-ACT      4.852           .009                                                  16
ACTIVE        1.425           .788                      33          5      1       108
WAIT-ACT      4.093           .017                       3                         112
ACTIVE         .247           .110                       7          5      1       119
WAIT-ACT      3.736           .009                                                 123
ACTIVE         .658           .572                       8          5      1       180
WAIT-ACT      1.793           .005                                                 184
ACTIVE         .512           .193                      19          3      2       206
WAIT-ACT      4.195           .009                                                 210
AVERAGE        .711           .426                      18          5      1         4
TOTAL         2.842          1.703                      70         18      5
```

Figure 113. Trace Analysis Summary Report

The header of the Trace Analysis Summary Report shows the following values:

Title The title specified on the command.

FILE The name of the database file containing the trace data.

LIBRARY
The library the database file is in.

MBR The database file member containing the trace data.

JOB The name of the job that was traced.

The columns in the detailed section of the Trace Analysis Summary Report are as follows:

ACTIVE or WAIT-ACT
The time between the ENDTNS and STRTNS programs is labeled Wait-Act. If you were tracing an interactive job and used the default STRTNS and ENDTNS parameters, this value is the time taken to process the transaction.

SECONDS
The approximate time the job was waiting or active.

CPU SECONDS
The approximate processing unit time used for the transaction. If the value is zero (or blank), you may have chosen the wrong value for the model parameter.

DB READS
The number of physical database reads that occurred.

NON-DB RDS
The number of physical nondatabase reads that occurred.

WRITES
The number of physical writes that occurred.

WAITS
The number of waits that occurred.

SEQUENCE
The job trace sequence number in the detail report that this summary line refers to.

AVERAGE and TOTAL
: Averages and totals for the fields described above. The entry on the Average line in the Sequence column shows the number of STRTNS and ENDTNS pairs encountered. For an interactive job, this is the number of transactions entered while the trace was on if the default STRTNS and ENDTNS values were used.

Figure 114 shows an example of the Trace Analysis I/O Summary Report.

```
   Title                                           TRACE ANALYSIS I/O SUMMARY                      12/01/01
    FILE-QAPTTRCJ   LIBRARY-QPFRDATA   MBR-QAJOBTRC                                JOB- BYSINN    .VLLXR239  .003368
                               P R O G R A M     *******  PROGRAM DATA BASE  I/O *******   FULL    SHARE    SUBFILE
             SECONDS  SEQNCE NAME     CALL INIT GETDR GETSQ GETKY  GETM   PUT  PUTM    UDR OPN CLS OPN CLS READS WRITES  MSGS
WAIT-ACT       4.852      16
ACTIVE         1.425     108  QPTPAGD0    1                                                           1             11
WAIT-ACT       4.093     112
ACTIVE          .247     119
WAIT-ACT       3.736     123
ACTIVE          .658     180                                                                                        11
WAIT-ACT       1.793     184
ACTIVE          .512     206                                                                      1
WAIT-ACT       4.195     210
AVERAGE         .711       4                                                                                         6
TOTAL          2.842                      1                                                       1   1             22
```

Figure 114. Trace Analysis I/O Summary Report

The columns in the Trace Analysis I/O Summary Report are as follows:

Title The title specified on the command.

FILE The name of the database file containing the trace data.

LIBRARY
: The library the database file is in.

MBR The database file member containing the trace data.

JOB The name of the job that was traced.

WAIT-ACT
: The time that the job was inactive, probably due to typing or think time by the user.

ACTIVE
: The time the job was processing.

SECONDS
: The time the job was waiting or active.

SEQNCE
: The job trace sequence number in the detail computer printout that this summary line refers to.

PROGRAM NAME
: The name of the last program called that was not in the library QSYS before the end of a transaction.

PROGRAM CALL
: The number of non-QSYS library programs called during the step. This is not the number of times that the program named in the PROGRAM NAME field was called.

PROGRAM INIT
: The number of times that the IBM-supplied initialization program was called during the transaction. For RPG programs this is QRGXINIT, for

COBOL it is QCRMAIN. Each time the user program ends with LR (RPG) or END (COBOL), the IBM-supplied program is also called. This is not the number of times the program named in the *Program Name* field was initialized. QCRMAIN is used for functions other than program initialization (for example, blocked record I/O, some data conversions).

PROGRAM DATABASE I/O
The number of times the IBM-supplied database modules were used during the transaction. The database module names have had the QDB prefix removed (PUT instead of QDBPUT). The type of logical I/O operation performed by each is as follows:

GETDR
Get direct

GETSQ
Get sequential

GETKY
Get by key

GETM
Get multiple

PUT, PUTM
Add a record

UDR Update, delete, or release a record

The values for OPENS and CLOSES in the programs are as follows:

FULL OPN
The number of full opens for all types of files.

FULL CLS
The number of full closes for all types of files.

SHARE OPN
The number of shared opens for all types of files.

SHARE CLS
The number of shared closes for all types of files.

The valid values for *Subfile I/O* are as follows:

SUBFILE READS
The number of subfile reads.

SUBFILE WRITES
The number of subfile writes.

MSGS
The number of messages sent to the job during each transaction.

The Trace Job Information Report, shown in Figure 115 on page 275, has essentially the same format as the system-supplied trace job output.

```
Sample Job Trace Report                              TRACE JOB INFORMATION                                      PAGE     1
FILE-QAPTTRCJ   LIBRARY-QPFRDATA   MBR-QAJOBTRC        JOB- BYSINN    .VLLXR239  .003368
TIME            SEQNBR  FUNCTION  PROGRAM     LIBRARY    ENTRY EXIT  INV       CPU      DB      NON-DB    WRITTEN     WAITS
15 04 26 225
        .       000001  RETURN    QPTTRCJ1    QPFR       0077  00CF  03       .012                  1
15 04 26 262
        .       000002  CALL      QCLRTNE     QSYS       0001  002D  04                             1
15 04 26 296
        .       000003  XCTL      QCLCLNUP    QSYS       0001  0048  04       .012
15 04 26 307
        .       000004  RETURN    QPTTRCJ1    QPFR       00D0  00D0  03       .008
15 04 26 316
        .       000005  RETURN    QCMD        QSYS       016C  0153  02       .012
15 04 26 330
        .       000006  CALL      QMHRCMSS    QSYS       0001  037E  03       .012                  1
15 04 26 363
        .       000007  CALL      QMHGSD      QSYS       0001  00F5  04       .012
15 04 26 372
        .       000008  CALL      QMHRTMSS    QSYS       0001  0136  05       .008
15 04 26 383
        .       000009  RETURN    QMHGSD      QSYS       00F6  0397  04       .016
15 04 26 397
        .       000010  CALL      QWSPUT      QSYS       0001  08A6  05       .028
15 04 26 429
        .       000011  XCTL      QWSGET      QSYS       0001  027E  05       .012
15 04 26 440
        .       000012  CALL      QT3REQIO    QSYS       0001  0055  06       .061                  5          3         1
15 04 26.445    000013   T3-ENTRY
15 04 26.447    000014   T3REQIO-REQIO
15 04 31.285    000015   T3DEQ-DEQ
```

Figure 115. Trace Job Information Report

The columns in the Trace Job Information Report are as follows:

TIME The time of day for the trace entry. The time is sequentially given in hours, minutes, seconds, and fractions of a second.

SEQNBR
The number of the trace entry.

FUNCTION
This causes the trace entry to be recorded. The possible trace entries are as follows:

Trace Entry
Description

Call Call external.

Data A data trace.

Event Event handler.

EXTXHINV
External exception handler.

EXTXHRET
Call termination because of a return from an exception.

INTXHINV
Internal exception handler.

INTXHRET
Return from an exception.

INVEXIT
Call because of a call exit routine.

ITERM
Intervening call termination.

ITRMXRSG
Call termination because of a resignaling exception.

PTRMTPP
Process termination.

PTRMUNHX
Termination because of an unhandled exception.

Return
Return external.

RSMTRC
Trace resumed.

SSPTRC
Trace suspended.

XCTL Transfer control.

PROGRAM
The name of the program for the entry.

LIBRARY
The library name that contains the program associated with the trace entry.

ENTRY
The instruction in the program where the program was given control. This is true when a program is nonobservant and observant.

EXIT The instruction number in the program where the program gave up control.

INV The call level of the program.

CPU The approximation of the CPU used on this trace entry. This is a calculated value based on the time used and the CPU model being run.

DB The number of physical database reads that occurred for the entry.

NON-DB
The number of physical nondatabase reads that occurred for the entry.

WRITTEN
The number of physical writes that occurred for the entry.

WAITS
The number of waits that occurred for the entry.

The read and write counts do not include any asynchronous I/O operations. The counts indicate the number of I/O requests (either single or multiple page) sent to the device, and describe the request queuing at the device.

Analyzing the Relationship of Programs and Database Files

Use the Analyze Program (ANZPGM) command and the Analyze Database File (ANZDBF) command to print an overview of the programs and files used in an application. The commands provide reports showing program-to-file use and physical and logical file relationships in the libraries.

Use the Analyze Database File Keys (ANZDBFKEY) command to print an overview of the key structure of logical files in an application.

These commands provide you with a file and program use overview and key definition detail. It may be that your files or programs have changed since they were first written and the file use has changed. For example, there may now be more logical files over your physical files than the application currently needs. This situation can cause performance degradation, especially if many key field changes or record adds occur. Remove any unneeded logical views.

Although you may use these commands infrequently, it is recommended that you use them periodically to get a good understanding of the program-to-file relationships and of the logical file structure used in the applications.

Analyze Program (ANZPGM) Command

Use the ANZPGM command to produce reports showing program-to-file and file-to-program relationships.

When you use the ANZPGM command, the following printer files are created as output:

File **Description**

QPPTANZP
The program-to-file relationship report (Program-to-File Cross-Reference)

QPPTANZP
The file-to-program relationship report (File-to-Program Cross-Reference)

Figure 116 shows an example of the Program-to-File Cross-Reference Report.

```
12/01/95 13:37:09                            Program to File Cross-Reference                                          Page    1
                                                                                                                      File Usage
                                                                                                        Record        1=In 2=Out
Library      Program      Program Text Description                               Object       Library      Format        4=Upd 8=?
----------   ----------   --------------------------------------------------     -----------  -----------  ----------    ----------
QPFR         OLDPTCHGJR                                                          QAPMDMPT     *LIBL                              1
                                                                                 QDPTJTYP     QPFR         SFL                   3
                                                                                 QDPTJTYP     QPFR         SFLCTL                3
                                                                                 QDPTJTYP     QPFR         QDPTF1                3
                                                                                 QDPTJTYP     QPFR         QDPTF2                3
                                                                                 QDPTJTYP     QPFR         QDPTF3                3
                                                                                 QDPTJTYP     QPFR         HELP1                 3
                                                                                 QTRIDX       QPFRDATA     IDXREC                6
                                                                                 QJTYP1       QPFRTEMP     IDXREC                1
                                                                                 QJTYP2       QPFRTEMP     IDXREC                6
             OLDPTTNSRP                                                          *FILE                                           8
                                                                                 QAPMJOBS                                        8
                                                                                 QSYSPRT                                         8
                                                                                 QTRIDX                                          8
                                                                                 QTRINTD                                         8
                                                                                 QTRINTU                                         8
                                                                                 QTRJOBI                                         8
                                                                                 QTRJOBO                                         8
                                                                                 QAPMDMPT     &LIB                               8
                                                                                 QAPMJOBS     &LIB                               8
                                                                                 QTRIDX       &LIB                               8
                                                                                 QTRJSUM      &LIB                               8
                                                                                 QTRTSUM      &LIB                               8
                                                                                 QDDSSRC      *LIBL                              1
                                                                                 QPTMPLST     *LIBL
                                                                                 QPTTRIDX     *LIBL
                                                                                 QDDSSRC      QPFR                               1
                                                                                 &TRCJOBS     QTEMP                              8
```

Figure 116. ANZPGM Program-to-File Cross-Reference Report

The ANZPGM Program-to-File Cross-Reference Report shows the following columns:

Library and Program
The name of the program that uses the file shown.

Program Text Description
The program's text description, if it was provided at program creation.

Object and Library
The name of the object that the program refers to, and the name of the library the object is in.

Record Format
The name of the formats in the file used by the program in the file being referred to.

File Usage
The manner in which the file is used by the program (1—input, 2—output, 4—update, 8—unknown, or any of the OR'd combinations of these, such as 3—input-output, 6—output-update). For more information and other values for the Display Database Relations (DSPDBR) command and the Display Program References (DSPPGMREF) command, see the iSeries Information Center.

Figure 117 shows an example of the ANZPGM File-to-Program Cross-Reference Report.

```
12/01/95 13:37:15                    File to Program Cross Reference                              Page    1
                                                                                                 File Usage
                          Record                                                                 1=In 2=Out
Library      Object       Format      Library     Program     Program Text Description          4=Upd 8=?
-----------  -----------  ----------  ----------  ----------  --------------------------------------------------  ----------
                                                  QMNADDTO
                                                  QMNGOMNU
                                                  QMNMAIN
                                                  QPTBATCH
                                                  QPTCPTRP
                                                  QPTCPTSL
                                                  QPTCPTWK
                                                  QPTLCKQ
                                                  QPTPGMX2
                                                  QPTSLECT
                                                  QPTSYSRP
                                                  QPTSYSSL
                                                  QPTSYSWK
                                                  QPTTRCJ1    STRJOBTRC CPP                                           2
                                                  QPTTRIDX
                                                  QPTTST1
                                                  QPTSYSRP
             *FILE                    QPFR        OLDPTTNSRP                                                          8
             *FILE                                QPTTNSRB                                                            8
             *FILE                                QPTTNSRP                                                            8
             *FILE                    QPFRTEMP                                                                        8
             *NONE                    QPFR        QPTTRCJ0    ENDJOBTRC CPP
             *NONE                                QPTTRCJ1    STRJOBTRC CPP
             QAJOBTRC                             QPTTRCRP    ENDJOBTRC CPP                                           8
             QAPMDMPT                             QPTCHGJT                                                            8
```

Figure 117. ANZPGM File-to-Program Cross-Reference Report

The ANZPGM File-to-Program Cross-Reference Report shows the following columns:

Library and Object
The name and library the file is in.

Record Format
The names of the record formats in the file.

Library and Program
The names and library of the programs that use the file.

Program Text Description
The program text description.

File Usage
The manner in which the file is used (1—input, 2—output, 4—update, 8—unknown, and OR'd combinations of these values).

Analyze Database File (ANZDBF) Command

Use the ANZDBF command to print reports detailing physical and logical file relationships.

When you use the ANZDBF command, the following files are created as output:

File **Description**

QPPTANZD
The printer file that has the physical-to-logical database file relationships report (Database Relation Cross-Reference).

QPPTANZD
The printer file that has the logical-to-physical database file relationships report (Logical File Listing).

QAPTAZDR
The database file that serves as input to the ANZDBFKEY command.

Figure 118 on page 280 shows an example of the ANZDBF Database Relation Cross-Reference Report.

```
12/01/95 14:29:31      Database Relation Cross Reference             Page    1
Type                                                         Depncy
P=Phy                        Depnd  Dependent   Dependent    Type
L=Lgl   File        Library     Count  File        Library      D/A
-----   ----------  ----------  -----  ----------  ----------   ------
  L     QANSCRAL    QSMU
        QANSCRA1
        QANSCRA2
        QANSCRA3
        QANSCRCL
        QANSCRL
        QANSCRML
        QANSCRM1
        QANSCRM2
        QANSCRM3
        QANSCRNL
        QANSCRN1
        QANSCR1
        QASVNUP
  P     QANSCRAC                    4  QANSCRAL    QSMU           D
                                    4  QANSCRA1    QSMU           D
                                    4  QANSCRA2    QSMU           D
                                    4  QANSCRA3    QSMU           D
        QANSCRAN                    2  QANSCRNL    QSMU           D
                                    2  QANSCRN1    QSMU           D
        QANSCRCN                    2  QANSCRCL    QSMU           D
                                    2  QANSCRC1    QSMU           D
        QANSCRCR                    2  QANSCRL     QSMU           D
                                    2  QANSCR1     QSMU           D
        QANSCRMS                    4  QANSCRML    QSMU           D
                                    4  QANSCRM1    QSMU           D
                                    4  QANSCRM2    QSMU           D
                                    4  QANSCRM3    QSMU           D
        QANSSRC
        QANSSRI
        QASVNUPP                    1  QASVNUP     QSMU           D
           32 records processed
```

Figure 118. ANZDBF Database Relation Cross-Reference Report

The ANZDBF Database Relation Cross-Reference Report has the following columns:

Type The file type (P-Physical, L-Logical).

File The name of the file.

Library
The library containing the file.

Depnd Count
The number of logical files dependent on this file.

Dependent File
The names of each dependent logical file.

Dependent Library
The library the dependent logical files are in.

Depncy Type D/A
D—Data share dependency. A—Access share dependency.

The entries in the *Type*, *File*, and *Library* columns are left blank if they are the same as the previous line.

Figure 119 shows an example of the ANZDBF Logical File Report.

```
12/01/95 14:29:34            Logical File Listing                        Page    1
                        Depncy                                  Type
Dependent   Dependent   Type                                    P=Phy
File        Library     D/A      File        Library            L=Lgl
----------  ----------  ------   ----------  ----------         -----
QANSCRAL    QSMU          D      QANSCRAC    QSMU                 P
QANSCRA1    QSMU          D
QANSCRA2    QSMU          D
QANSCRA3    QSMU          D
QANSCRNL    QSMU          D      QANSCRAN    QSMU                 P
QANSCRN1    QSMU          D
QANSCRCL    QSMU          D      QANSCRCN    QSMU                 P
QANSCRC1    QSMU          D
QANSCRL     QSMU          D      QANSCRCR    QSMU                 P
QANSCR1     QSMU          D
QANSCRML    QSMU          D      QANSCRMS    QSMU                 P
QANSCRM1    QSMU          D
QANSCRM2    QSMU          D
QANSCRM3    QSMU          D
QASVNUP     QSMU          D      QASVNUPP    QSMU                 P
          15 records processed
```

Figure 119. ANZDBF Logical File Report

The ANZDBF Logical File Report shows the following:

Dependent File
The names of each dependent logical file.

Dependent Library
The library the dependent logical files are in.

Depncy Type D/A
D—Data share dependency. A—Access share dependency.

File The name of the physical file.

Library
The library containing the physical file.

Type The physical file type.

Analyze Database File Keys (ANZDBFKEY) Command

Use the ANZDBFKEY command to print a report showing the key structure of logical files.

When you use the ANZDBFKEY command, the following input file is used:

File Description

QAPTAZDR
Database file that is the output from the ANZDBF command.

Note: Because the ANZDBFKEY command uses the output from the ANZDBF command as its input, be sure the ANZDBF command is finished before you use the ANZDBFKEY command. The ANZDBFKEY command tests the existence of the ANZDBF output file and, if the file does not exist, the program ends.

When you use the ANZDBFKEY command, the following files are created as output:

File **Description**

QPPTANZK
Printer file for the access path and record selection report (Key Fields and Select/Omit Listing).

QPPTANKM
Printer file for the logical file key report (Analysis of Keys for Database Files).

The information provided in these reports may suggest ways of combining logical files, for physical files with a number of logical files over them. This process of combining reduces the total number of logical files the system must maintain.

For example, consider an application that uses these two logical views of the same physical file:

- Logical file FILEA with key FIELD1
- Logical file FILEB with keys FIELD1 and FIELD2

In this case, it is likely that you could delete FILEA and use FILEB instead.

Reducing the number of logical views an application uses can help the performance of the application and of the system.

Figure 120 gives an example of the ANZDBFKEY Key Fields and Select/Omit Listing.

This report lists the access path and selection (logical files only) values based on the output produced by the Display File Description (DSPFD) command with a single line for each key field or selection rule.

```
12/01/95 14:35:02      Key Fields and Select/Omit Listing              Page    1
    File       Library         Order  Path Type Unique Maintenance
PHY QAOFCP     QOFCFLS         FIFO   KEYED       N    *IMMED
        Based on          Format      Key Field  Seq   Sign  Zone  Alt
                                       NAME
                                       JDATE           SIGN
                                       STIME           SIGN
                                       SEQ             SIGN
                                       EXT             SIGN
                                       GMTGNO          SIGN
    File       Library         Order  Path Type Unique Maintenance
LGL QAOFCALL   QOFCFLS         FIFO   KEYED       N    *IMMED
        Based on          Format      Key Field  Seq   Sign  Zone  Alt
    QAOFCP     QOFCFLS    CALRC1       MJDATE          SIGN
                                       MTIME           SIGN
                                       NAME
    **Record Selection**  Format      Field     S/O Comp Values
                          CALRC1      MJDATE     S   GT   +0
                                      MTIME      A   GT   +0
                                      EXT        A   LE   +2
                                                 O   AL
```

Figure 120. ANZDBFKEY Key Fields and Select/Omit Listing

In the ANZDBFKEY Key Fields and Select/Omit Listing Report, the first output line shows the following:

File The file name and, to the left of the name, the file type—physical (PHY) or logical (LGL).

Library
The name of the library in which the file is contained.

Order Ascending or descending sequence for the keys (LIFO, FIFO).

Path Type
The type of access path (ARRIVAL, KEYED, or SHARED).

Unique
Whether unique keys are used (Y or N).

Maintenance
*IMMED, *RBLD, or *DLY.

The second output line shows the following:

Based On
The physical file name.

Format
The format name in the logical file.

Key Field
The name of the key field (can be one or more lines).

Seq The key sequence (blank is ascending, DES is descending).

Sign The key sign (blank, SIGN, or ABSV).

Zone The zone/digit specified (blank, ZONE, or DIGIT).

Alt The alternative collating sequence (YES or blank).

If record selection is used, the third output line shows the following:

Format
The logical file format name.

Field The select/omit field name.

S/O Whether to select (S) or omit (O).

Comp The compare relation such as EQ, GT, LT, and AL (all).

Values
The values to compare against.

Printer File QPPTANKM lists the file names, and for logical files, the key fields for each format in descending order from major key to minor key.

You can use this list to find ways to combine logical files, when physical files have many logical files over them. By combining files, you can reduce the number of logical views an application requires and the total number of logical files the system must maintain. Having fewer files to maintain can improve the performance of the application and of the system.

Figure 121 on page 284 shows an example of the ANZDBFKEY Analysis of Keys for Database Files Report.

```
12/01/95 14:35:02                           Analysis of Keys for Database Files                                   Page 1
   Physical File QAOFCP      Library QOFCFLS
                   Logical  Maint                                                                              No.
File       Library    Format       ******* Key Fields Major to Minor *******                                   Keys S/O
QAOFCP     QOFCFLS               I NAME       JDATE      STIME      SEQ        EXT        GMTGNO                 6
QAOFCALL   QOFCFLS    CALRC1     I MJDATE     MTIME      NAME                                                    3  YES
QAOFCL     QOFCFLS    MTGREC     I GMTGNO     NAME       JDATE      STIME      SEQ        EXT                    6
```

Figure 121. ANZDBFKEY Analysis of Keys for Database Files Report

The columns in the ANZDBFKEY Analysis of Keys for Database Files Report are as follows:

Physical File
The name of the physical file.

Library
The physical file library.

File The logical files over the physical file.

Library
The library the file is in.

Logical Format
The logical file format name.

Maint Maintenance. Specify I (immediate), R (rebuild), or D (delay).

Key Fields Major to Minor
Up to seven key fields.

No. Keys
The number of key fields in the file.

S/O Whether select/omit is specified for key. YES indicates it is specified.

Chapter 11. Performance Explorer

Performance explorer is a data collection tool that helps the user identify the causes of performance problems that cannot be identified by collecting data using Collection Services or by doing general trend analysis. Two reasons to use performance explorer include:

- Isolating performance problems
- Modeling the performance of applications

The collection functions and related commands of performance explorer are part of the OS/400 operating system. The reporting function and its associated commands are part of the Performance Tools for iSeries licensed product, the Manager feature. The *AS/400 Performance Explorer Tips and Techniques*, SG24-4781, provides additional examples of the performance explorer functions and examples of the enhanced performance explorer trace support.

Do I Need Performance Explorer?

Performance explorer is a tool that helps find the causes of performance problems that cannot be identified by using tools that do general performance monitoring. As your computer environment grows both in size and in complexity, it is reasonable for your performance analysis to gain in complexity as well. The performance explorer addresses this growth in complexity by gathering data on complex performance problems.

This tool is designed for application developers who are interested in understanding or improving the performance of their programs. It is also useful for users knowledgeable in performance management to help identify and isolate complex performance problems.

Note: If you are familiar with the Sampled Address Monitor (SAM) function or the TPST PRPQ, your transition to the performance explorer should be smooth.

When You Need Performance Explorer

When you find that the performance advisor is not telling you enough, you should consider the performance explorer. In short, performance explorer is the tool you need to use after you have tried the other tools. It gathers specific forms of data that can more easily isolate the factors involved in a performance problem.

Comparison of Explorer to Other Performance Tools

A good way to understand performance explorer is to see it compared and contrasted to other tools in the Performance Tools licensed program or in the OS/400 operating system.

Performance Explorer and Advisor Functions

The performance advisor and the performance explorer are quite different functions. The explorer's main purpose is collecting specific data. To do this, it has its own collecting facility. The advisor's role is assessing performance data that you collected. It produces, after its analysis, a list of conclusions and recommendations on ways you can improve your performance. The explorer does not do any analysis for you.

If you are using the advisor, you are probably doing routine performance maintenance. If you are using the explorer, you know that you have a performance problem, and you are having a hard time identifying its cause.

Performance Explorer and Collection Services

In a sense, the performance explorer is much like Collection Services because they both collect data. The main difference is that performance explorer provides a much greater level of detail. Also, unlike Collection Services, the performance explorer allows you to specify particular areas of interest, and it allows you to focus the collection. The performance explorer collection can be tuned to include very specific data. It is the ability to tune, or specify, the data to be collected that makes the performance explorer effective in helping isolate performance problems.

Note: You can run both collections of data at the same time. However, you should keep this to a minimum because the system is significantly affected when both collections are active.

For example, Collection Services can tell you that you have a high disk percentage. You can use performance explorer to isolate the factors behind a problem that you have identified. Performance explorer can identify what programs and objects are causing your system to have a high disk percentage.

Benefits of Performance Explorer

Performance explorer has advantages for people who need detailed performance analysis on an iSeries server. Using performance explorer you can:

- Do a detailed analysis on one job without affecting the performance of other operations on the system.
- Analyze data on a system other than the one on which it was collected. For example, if you collect data on a managed system in your network, you can send it to the central site system for analysis.
- Map performance information to code

  Using performance explorer, you can map performance information back to source lines of code to correlate the performance data generated with the code that caused the data to be generated.
- Collect performance information on user-developed software. See “Enabling Collections of User-Written Code” on page 291 for additional information.

How Performance Explorer Works

1. You set up a performance explorer data collection using a definition.
2. You start performance explorer and it collects the data based on the definition.
3. You can create reports from the databases.
4. You can print those reports, if you want to.

You can access the commands associated with the performance explorer tool using one of the following:

- The command interface. Type the commands from the command line. All the commands are part of the OS/400 operating system, except the PRTPEXRPT command.
- The Performance Tools menu options. Select option 5 (Performance utilities) from the IBM Performance Tools menu, then option 2 (Work with Performance Explorer).

```
                        Work with Performance Explorer

Select one of the following:

     1. Add Performance Explorer Definition (ADDPEXDFN)
     2. Change Performance Explorer Definition (CHGPEXDFN)
     3. Remove Performance Explorer Definition (RMVPEXDFN)
     4. Start the Performance Explorer (STRPEX)
     5. End the Performance Explorer (ENDPEX)
     6. Print Performance Explorer Reports (PRTPEXRPT)
     7. Delete Performance Explorer Data (DLTPEXDTA)









Selection or command
===>

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel
```

General Flow of the Performance Explorer

The following sections should help you become familiar with the normal path through the performance explorer. Figure 122 shows a basic work cycle.

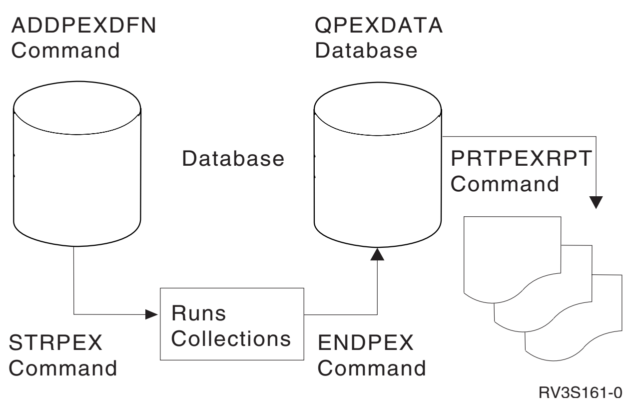


Figure 122. Performance Explorer Basic Flow

The work cycle is made up of these activities:

- The first task in this cycle is to create a session definition that informs the iSeries server about what processes you want to collect performance data. On the Add Performance Explorer Definition (ADDPEXDFN) command, specify the collection type and a name for the definition. This definition is stored as a database member by that name in the QAPEXDFN file in library QUSRSYS. The name that you specify is used on the STRPEX command.
- The second task is to start collecting data (STRPEX command), which in turn creates a data file containing the specified performance data.

- The third task is to stop collecting the data and save it to database files for analysis. Use the End Performance Explorer (ENDPEX) command to stop the collection.
- The fourth task is to analyze the performance data. The PRTPEXRPT command provides unique reports for each type of data (statistical, profile, or trace).

  The other option for analysis is to write your own queries over the set of database files. See "Performance Data—Performance Explorer" on page 311 for a list of those database files.

Creating a Performance Explorer Definition

The first task is to define what data is to be collected using the Add Performance Explorer Definition (ADDPEXDFN) command. After the definition is completed and saved, you are ready to continue to the second task in the cycle of work.

The performance explorer provides the following types of data collection:

- Statistical
- Profile
- Trace

Before creating a new definition, consider what kinds of information you want and the amount of detail you need. In general, the three main types of collections have the following characteristics:

- **Statistics type definitions**. Identifies applications and IBM programs or modules that consume excessive CPU use or that perform a high number of disk I/O operations. Typically, you use the statistical type to identify programs that should be investigated further as potential performance bottlenecks.
  - Using this definition results in collecting the same basic information as the TPST tool.
  - Good for first order analysis of OS/400 original program model (OPM) programs, procedures, and MI complex instructions.
    - Gives number of invocations
    - Gives both inline and cumulative CPU usage in microseconds
    - Gives both inline and cumulative number of synchronous and asynchronous I/O
    - Gives number of calls made
  - Works well for short or long runs
  - Size of the collected data is fairly small and constant for all runs
  - Run time collection overhead of ILE procedures may be a problem due to the frequency of calls. Although run time is degraded, performance explorer removes most of the collection overhead from the data.
  - Uses combined or separated data areas. The MRGJOB parameter on the Add Performance Explorer Definition (ADDPEXDFN) command specifies whether all program statistics are accumulated in one data area, or kept separate (for example, one data area for each job).

  The statistics can be structured in either a hierarchical or flattened manner.
  - A hierarchical structure organizes the statistics into a call tree form in which each node in the tree represents a program procedure run by the job or task.
  - A flattened structure organizes the statistics into a simple list of programs or procedures, each with its own set of statistics.

- **Profile type definitions**. Identifies high-level language (HLL) programs that consume excessive CPU utilization based on source program statement numbers. You can also identify a program that is constantly branching between the start of the program and subroutines at the end of the program. If the program is large enough, this constant jumping back and forth can cause excessive page fault rates on a system with limited main storage. In the case of the trace profile (TPROF), all the programs and tasks in the collection are profiled.
  - Profile (specify *PROFILE for TYPE parameter on ADDPEXDFN command)
    - Gives detailed breakdown of where you are spending time within a program or procedure
    - Size of collection is fairly small and constant regardless of length of run
    - Can narrow the scope of data collected to just a few programs of interest
    - Limit of 16 MI programs means that you should use this as a second order analysis tool.
    - Can vary overhead by changing sample interval. An interval of 2 milliseconds seems a good first choice for benchmarks.
    - No restrictions on pane size due to the number of programs specified or the size of the programs specified.
  - Trace Profile (specify the following on the ADDPEXDFN command: *TRACE for TYPE parameter, an interval, and *PFRDTA for TRCTYPE)
    - Gives detailed breakdown of where you are spending time in the jobs or tasks of the collection
    - Size of collection is relatively small but not constant. The size increases as the length of the run increases.
    - Can narrow the scope of data collected to just a few jobs or tasks of interest
    - Profiles all jobs in the collection
    - Can vary overhead by changing sample interval. An interval of 2 milliseconds seems a good first choice for benchmarks.
- **Trace type definitions**. Gathers a historical trace of performance activity generated by one or more jobs on the system. The trace type gathers very specific information about when and in what order events occurred. The trace type collects detailed program, Licensed Internal Code (LIC) task, OS/400 job, and object reference information.
  - Storage management and flow trace definitions
  - Good for watching storage management activity on the system. Also shows MI complex instructions.
  - Longer runs collect more data

Starting the Performance Explorer

To start the performance explorer, use the Start Performance Explorer (STRPEX) command. You can specify to start a new performance explorer session or resume an already active session.

Note: When you start a session, a job can be in only one collection at a time. Performance explorer does not start a collection if this situation occurs.

Ending the Performance Explorer

To end the performance explorer session, use the End Performance Explorer (ENDPEX) command. The ENDPEX command performs the following actions on the collected data:

- Places the collected data in files QAYPExxx in the library that you specify.

  Use OPTION(*END) and DTAOPT(*LIB) to do this. The database member name for all the QAYPExxx files uses the session name as the default unless you specify a name for the DTAMBR parameter.

  You can specify RPLDTA(*NO) to erase data that was collected using this session name or RPLDTA(*YES) to add the collected data to the existing data. Unless you are a very sophisticated user, use RPLDTA(*NO).
- Places the collected data into a single IBM-defined file.

  Use OPTION(*END) and DTAOPT(*FILE) to do this. Typically, you would use *FILE only under the direction of an IBM service representative. Specifying the *FILE value on the DTAOPT parameter saves the collection information into a binary file. The binary file option should be used only if the data is going to be shipped to IBM. The performance tools can analyze only the database files.
- Discards the collected data.

  Use OPTION(*END) and DTAOPT(*DLT) to delete any collected data. You do this when you determine the collected data cannot be used. For example, one of the suspected jobs did not start as expected. If you choose the *DLT option, the collected performance data for the session is never saved.
- Saves the collected data.

  Use OPTION(*END) and DTAOPT(*LIB) to save the collection into a database file. Use these values if you are sending data to a manager site.
- Suspends the collection session but does not end it.

  Use OPTION(*SUSPEND) to do this. You can later start the data collection again by issuing the STRPEX command with OPTION(*RESUME) for the specific session ID.

  Note: If you forget the active collection session name, use the ENDPEX SSNID(*SELECT) command.

Deleting Performance Explorer Data

To delete performance explorer data, use the Delete Performance Explorer Data (DLTPEXDTA) command. The DLTPEXDTA command discards performance data from a set of database files.

Creating and Printing Performance Explorer Reports

You create and print performance explorer reports by using the Print Performance Explorer Report (PRTPEXRPT) command.

Use the OUTFILE parameter when you want to customize your Trace Report. The performance explorer stores its collected data in the QAVPETRCI file, which is located in the QPFR library. Type the following command to view the contents for a single record:

```
DSPFFD FILE(QPFR/QAVPETRCI)
```

Finding Your Performance Explorer Active Sessions

The SELECT parameter on the ENDPEX command provides a list of all sessions that were started with the STRPEX command and for which the ENDPEX OPTION(END) command has not completed yet. This parameter shows the Select Performance Explorer Session display.

```
                    Select Performance Explorer Session

Type option, press Enter.
  1=Select


                                                                    Event
Option    Session       User          Type          State               Count

          TPROF         JENNEY        *TRACE        ACTIVE               40000
```

Enabling Collections of User-Written Code

To collect certain types of performance information on user-developed software, performance collection must be enabled when the program is created. In general, all user-developed software is created with performance collection enabled.

Note: The Profile definition does not need to be enabled.

For more information on how to enable or disable performance collection, refer to the specific compiler documentation and refer to the Enable performance collection (ENBPFRCOL) parameter on the Create Bound C Program (CRTBNDC) command.

Programs can also be enabled or disabled using the ENBPFRCOL parameter on the Change Program (CHGPGM) command.

Note: The default for all ILE languages is to have the pre-defined trace points at the program-level enabled. However, some languages provide a compiler option (ENBPFRCOL parameter) that allows you to turn the enabling off. Those languages that do not provide the option will have the pre-defined collection points enabled.

The significance of the collection mechanism is that:
- It is controlled by pre-defined collection points that are compiler generated.
- The pre-defined collection points are scalable.
- The system and all IBM code are shipped with these pre-defined trace points.
- The default for all compilers is to have these pre-defined collection points enabled.

Types of Performance Explorer Reports

Table 24 on page 292 identifies the sections that are available for the individual performance explorer reports. Some sections are common to all reports; some reports have unique sections. The information that follows the table shows examples of each section.

Table 24. Sections that are available for the performance explorer reports

Section	Statistics Report	Profile Report	Trace Report	Base Report
Definition	X	X	X	X
Run	X	X	X	X
Task	X	X	X	X
CPU Summary	X	X		
Library	X	X		
Main	X	X	X	

Common Report Sections

The following series of report examples show the sections that are common to the performance explorer reports. Each section also contains the field descriptions for each report.

Definition Information

You define what kind of data to collect with the ADDPEXDFN command. The Definition Information report reflects the definition that was used in collecting the data. This heading appears only once in any type of report.

Figure 123 shows an *STATS collection type as an example.

```
                                                    Performance Explorer Report
                                                      Definition Information                                              Page    1
Library . . : QPEXDATA
Member. . . : STATSF
Description :  BLANK
Type . . . . . . . . . . . . : STATISTICS
Definition Name. . . . . . . : SFSTATSF
Defined By . . . . . . . . . : JENNEY
Definition Description . . . : stats job(*) task(*none) dtaorg(*flat)
Data Organization. . . . . . : FLAT
Overhead Subtraction . . . . : YES
Merge Jobs . . . . . . . . . : YES
Include Dependent Jobs . . . : YES
Selected Jobs:
    Name       User       Number
    *
Selected Task Names:
    *NONE
Selected MI Complex Instructions:
    *ALL
```

*Figure 123. Example for *STATS Definition Information*

The Definition Information shows the following values:

Library
: The library that contains the collected data.

Member
: The name of the member that contains the collected data.

Description
: The description of the data that was saved.

Type
: The method for collecting performance data.

Definition Name
: The name of the performance explorer definition.

Defined By
: The user ID that created the definition

Definition Description
: The description given to the definition

Include Dependent Jobs
: The tasks or jobs that are created on behalf of a task or job that is currently part of the collection are part of the collection.

Selected Jobs
: The jobs that are included in the performance explorer data collection session. The "*" means the current job when the STRPEX command is issued.

  Name The name of the job to include in the performance explorer data collection session. You can specify up to 10 qualified jobs.

  User The name of the job associated with a specific user. When you specify a user name, you further qualify the job.

  Number
  : The number of the job. When you specify a job number, you further qualify the job.

Selected Task Names
: The name of the Licensed Internal Code (LIC) low-level task to be part of the collection.

  Note: By default all task names are included in each collection.

Selected MI Complex Instructions
: The machine interface (MI) complex instructions that are part of the collection. The MI complex instructions represent all the high-level machine interface instructions used by OS/400 support. MI complex instructions include functions like finding the pointer to an object, writing records sequentially to a file, or creating a duplicate object.

  Note: By default all MI instructions are included in each collection.

Sample Interval (ms)
: The rate, in milliseconds, that **profile mode** collections sample the location for the currently running programs.

Selected Programs
: The programs listed as part of a **profile type definition**.

  Pane Size
  : The pane size is the number of consecutive program instruction addresses assigned to each counter. Pane size can range from 4 bytes to 4096 bytes. The default pane size is 4 bytes. Valid values are 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, and 4096. The smaller the pane size, the more detailed the program profile information will be.

    For example, a pane size of 4 means one instruction. A pane size of 2048 means 512 instructions.

  Library
  : The library the program is in.

  Program
  : The program whose performance profile data will be collected.

Type The type of program specified, either a program (*PGM) object or a service program (*SRVPGM) object.

Module
The specific module within the program or service program that is to be profiled.

Procedure
The specific procedure within the specified module that is to be profiled.

Run Information

This report provides general information about when the data was collected, the state of the machine from which the data was collected, details about the length of collection, and who ran the collection. This heading appears only once in any type of report.

Figure 124 shows an example of the Run Information section. The Run Information section provides the same information for each of the main reports, which is general system and session information.

```
                                        Performance Explorer Report
                                             Run Information                                                Page    2
Library . . : QPEXDATA
Member. . . : STATSF
Description :  BLANK
Sessions since IPL. . . . . . . . . . . . . :                          1
Session name. . . . . . . . . . . . . . . . : JENNEY
Start time. . . . . . . . . . . . . . . . . : 2001-11-06-10.40.02.745080
Stop time . . . . . . . . . . . . . . . . . : 2001-11-06-10.40.51.567576
Total time  DD-HH.MM.ss.uuuuuu. . . . . . . :         00-00.00.48.822496
Suspend time (us) . . . . . . . . . . . . . :                 13,549,392
Duration of trace . . . . . . . . . . . . . :                   35273104
Total DB CPU (us) . . . . . . . . . . . . . :                          0
Number of events. . . . . . . . . . . . . . :                      2,332
Trace wrap count. . . . . . . . . . . . . . :                          0
Missed events due to buffering. . . . . . . :                          0
Missed events while recording . . . . . . . :                          0
Job creating session. . . . . . . . . . . . : QPADEV0029JENNEY    101029
Started by user . . . . . . . . . . . . . . : JENNEY
Target system . . . . . . . . . . . . . . . : ABSYSTEM
Serial number . . . . . . . . . . . . . . . : 10-1803D
Logical partition ID. . . . . . . . . . . . : 01
System type . . . . . . . . . . . . . . . . : 9406
System model. . . . . . . . . . . . . . . . : 500
   Processor feature. . . . . . . . . . . . : 2403
   Interactive feature. . . . . . . . . . . : 1535
Total pages memory. . . . . . . . . . . . . :                     32,768
OS/400 level. . . . . . . . . . . . . . . . : 370
Version . . . . . . . . . . . . . . . . . . : V5R1M0
Logical DASDs . . . . . . . . . . . . . . . :                          4
Jobs/tasks in session . . . . . . . . . . . :                          1
Jobs in session . . . . . . . . . . . . . . :                          1
Configured ASPs . . . . . . . . . . . . . . :                          1
Independent ASP ID and name . . . . . . . . :                1 MYASP67890
```

*Figure 124. *STATS Run Information Report*

The Run Information section shows the start, stop,and total run times of the collection. You also see that the job ran the collection on system ABSYSTEM.

The Run Information shows the following values:

Library
The library the database file is in.

Member
The database file member containing the data.

Description
The description of the data that was saved.

Sessions since IPL
: The number of times that the performance explorer collected data since the last IPL

Session name
: The name of the session.

Start time
: The time that the session was started

Stop time
: The time that the session was stopped.

Total time
: The total elapsed time that data was being collected, including suspended time.

Suspend time (us)
: The amount of time, in microseconds, that the session was in a suspended state. It's possible for this field to show a number other than zero even if you have not suspended the session.

Duration of trace (us)
: The total active runtime minus the total suspended time.

| **Total DB CPU**
| : The database CPU time in microseconds.

Number of events
: The total number of events encountered during a session.

Trace wrap count
: The trace wraps to the beginning when the trace file is full. The oldest trace records are written over by new ones as they are collected. This is the number of times the trace wrapped.

Notes:

1. Trace wrap count applies only to trace type session.
2. Specify the *STOPTRC value on the TRCFULL parameter of the ADDPEXDFN command to avoid this wrapping.

Missed events due to buffering
: The number of events that were not collected during the session.

Missed events due to recording
: The number of events that were not collected during the session.

Job creating session
: The name of the job that issued the STRPEX command

Started by user
: The user ID that issued the STRPEX command

Target system
: The name of the system the data was collected on

Serial number
: The serial number of the system the data was collected on

| **Logical partition ID**
| : The partition ID in which the collection was run.

System type
: The type of system the data was collected on

System model
: The model of system on which the data was collected. This includes the processor feature and the interactive feature.

Total pages memory
: The number of 4-K memory pages on the system on which the data was collected. 98,304 means 384MB of main storage.

```
1. 98,304 / 1024(1K) = 96
2. 96 * 4 = 384
```

OS/400 level
: The OS/400 driver level of the system on which data was collected The OS/400 level relates to the latest level of cumulative package that is installed on your system.

Version
: The OS/400 release level of the system on which data was collected

Logical DASDs
: The physical number of disk drives attached to the system, if mirroring is not used. If your system has mirrored protection active, the mirrored disk pair count as one logical DASD.

Data areas
: The number of performance explorer internal data areas the collection was partitioned into. If you specify MRGJOB(*YES), the performance explorer stores the collected data for all jobs in a combined data area.

Jobs/tasks in session
: The total number of tasks and jobs that were included in the session.

Jobs in session
: The total number of jobs that were included in the session. In this example, this number is equal to *Jobs/tasks in session* minus *Jobs in session*. There is no correlation between jobs and LIC tasks. The collections always contain all the LIC tasks of the system.

Configured ASPs
: The number of ASPs on the system on which data was collected

Independent ASP ID and name
: The number of independent ASPs on the system on which data was collected. There is one record per independent ASP. The record contains the ID (number) and the name.

Task Information

This report shows the jobs and task from which data was collected.

Figure 125 on page 297 shows an example of the Task Information section. The Task Information section provides the same information for each of the main reports. If the task or job did meaningful work during the collection time period, the values under the CPU (us) and CPU Percent are a number other than 0.

```
                                                  Performance Explorer Report
                                                       Task Information                                                    Page    5
Library . . : QPEXDATA
Member. . . : STATSF
Description :  BLANK
Task ID    Job/Task Name                 Pool Priority Existence    Elapsed Time (us)             CPU (us)  CPU %  DB CPU %
                                                       Start/End
-----------------------------------------------------------------------------------------------------------------------------------
      6739 QPADEV0029 WATTS      101029     4      163   Y    Y             41897112               822096   20.97         0
         1 CFINT01                          0        0   Y    Y             42570008              3098472   79.03         0
-----------------------------------------------------------------------------------------------------------------------------------
```

Figure 125. Task Information Report

The Task Information Report shows the following values:

Library
The library the database file is in.

Member
The database file member containing the data.

Description
The description of the data that was collected.

Task ID
The system identifier for the task

Job/Task Name
The name of the task or job under which the data was run.

Pool The system pool that the job or task in on the system.

Priority
The relative LIC priority that the job or task runs at on the system.

Note: The priority column here is not the same as the job priority that is shown on the Work with Active Jobs display. You can subtract 140 from the non-SLIC tasks to find the RUNPTY value used on AS/400.

Existence Start
Indicates if the job or task existed at the start of the collection (Y/N)

Existence End
Indicates if the job or task existed at the end of the collection (Y/N)

Elapsed Time (us)
The elapsed time (in microseconds) that the job or task existed during the collection

CPU (us)
The total amount of CPU time used (in microseconds) by the job or task during the collection.

CPU %
The percentage of CPU used by this job or task as compared to the total CPU used by all the jobs or tasks in the collection.

| **DB CPU %**
| The percentage of database CPU used by this job or task as compared to
| the total database CPU used by all the jobs or tasks in the collection.

The **Priority** values that are shown do not correspond to the Run priority (RUNPTY) parameter value. However, for OS/400 jobs with priority values of 1-99, you can subtract 140 to correspond to the RUNPTY value.

RUNPTY(15) is a typical priority for spooled writer jobs (class QSPL).

For Licensed Internal Code (LIC) tasks, the user cannot change them. In most cases LIC task priorities are higher than OS/400 jobs. However, some LIC tasks run at the same priority as the user job for which they are performing a function.

The disk drive tasks that start with prefix DBI or DBL typically run under the RUNPTY value of the OS/400 job for which they are performing the function.

Report-Specific Sections

This section shows examples of the main reports and also report sections that are specific to certain reports.

Summary Information

Summary information provides a subset of the information shown in the main reports. The Profile Report and the Statistics Report have their own Summary Information. The Trace Report does not include a Summary Information Report.

```
                                                      Performance Explorer Report                                 1/21/xx 13:39:10
                                                    Profile CPU Summary Information                                     Page
                                                                                                                           3
Library . . . . :  COOL
Member. . . . . :  RBPROF2PGM
Description . . :  RBPROF-CMDCSTPEXH (CLCSTPEXHI, CSTPEX)
Total CPU . . . :       8480864
Job CPU . . . . :       8256856    97.4 %
Task CPU. . . . :        224008     2.6 %
                   -----------------------
Total Samples . :          7664
Total Hits. . . :          1108    14.5 %
```

*Figure 126. Example for *PROFILE CPU Summary Information*

The Profile CPU Summary Information Report shows the following values:

Library
: The library the database file is in.

Member
: The database file member containing the data.

Description
: The description the user associated with the collected data

Total CPU
: The total amount of CPU used by the tasks and jobs that were collected on (not the whole system CPU).

Job CPU
: The total amount of CPU used by the jobs that were collected on.

Task CPU
: The total amount of CPU used by the tasks that were collected on.

Total Samples
: The total number of samples collected during a session.

Total Hits
: The total number of samples that occurred within the programs the user specified.

```
                                            Performance Explorer Report                              11/07/xx  9:54:47
                                           Stats CPU Summary Information                                   Page    3
Library . . . . . :  QPEXDATA
Member. . . . . . :  STATSF
Job name. . . . . :  ALL JOBS/TASKS IN SESSION
Description . . . :   BLANK
Total Raw CPU . . :       3920568
Overhead Removed. :        112381
Total CPU . . . . :       3808187
Task CPU. . . . . :       3098472    81.4 %
Job CPU . . . . . :        709715    18.6 %
Total DB CPU. . . :         70971     1.8 %
                     -----------------------
   Pgm/Mod CPU. . :        310419     8.2 %
   Unknown CPU. . :        399296    10.5 %
```

*Figure 127. *STATS CPU Summary Information*

The Statistics Summary shows the same fields as the Profile Summary with the addition of the following values:

Job name
: The job name, user ID, and job number. ALL JOBS/TASKS IN SESSION is a special value.

Total Raw CPU
: The total amount of CPU used by tasks and jobs that was collected on (including any collector overhead).

Overhead Removed
: The difference between the total raw CPU and total CPU (in other words, adjusted CPU).

Total CPU
: The total amount of CPU used by tasks and jobs that were collected on (less any collection overhead that could be removed).

Pgm/Mod CPU
: The total CPU of the programs and modules that were collected on and reported on in the STATS INFORMATION section of the report.

Unknown CPU
: The difference between the Job CPU and the Pgm/Mod CPU.

Total DB CPU
: The total amount of database CPU used by tasks and jobs that was collected on.

Library Information

Library information - shows collection information for each library. Also provides data on call and complex MI counts, CPU utilization, and disk I/O operations. This section is available for the statistical report only.

The library section identifies the libraries that contained the programs or modules that were active during the collection period. All CPU usage and disk I/O operation statistics for all the programs or modules in a specific library are totaled for that library. It is common to have a cumulative CPU percent total that is higher than 99.9%. In those cases, you see a CPU percent value of ****. The **** value is considered normal in most cases. Figure 128 on page 300 shows a Library Section that summarizes the CPU and disk I/O activity at the library level.

```
                                                Performance Explorer Report                                 11/07/xx  9:54:47
                                                  Statistics Information                                           Page    3
                                                     Library Section
Library . . : QPEXDATA
Member. . . : STATSF
Job name. . : ALL JOBS/TASKS IN SESSION
Description :  BLANK
                                 +----------------- Inline Stats ------------++-------------- Cumulative Stats -----------+
             Times   Calls MI CPLX            CPU         DB    DB   NDB   NDB            CPU         DB    DB   NDB   NDB  Call
Name        Called    Made  Issued         (us) /   %    SIO   AIO   SIO   AIO         (us) /   %    SIO   AIO   SIO   AIO Level
-----------------------------------------------------------------------------------------------------------------------------------
**LIC Task       0       0       0    3,098,472 81.4      0     0     0     0    3,098,472 81.4      0     0     0     0     0
**Unknown        0       0       0      399,295 10.5      0     0     0     0      399,295 10.5      0     0     0     0     0
```

*Figure 128. *STATS Information Library Section*

One area of interest is the **Unknown category. You can start and stop a collection at any time. You receive resource usage data, but depending on what the programs in a job are doing, you may not see it accounted for accurately. When this happens, the results end up in the **Unknown category and not in the program that you thought was using all the resources.

The shorter the time period that you run a collection, the greater the percentage allocated to **Unknown may be. This occurs because performance explorer collects data from the entry to a program and from the exit from a program. If the program is already entered when you start the collection, the data that is collected is not allocated to that specific program. Instead, the data gets counted and put into a counter called **Unknown.

The Statistics Report, at the library level, shows the following values:

Library
The library the database file is in.

Member
The database file member containing the data.

Description
The description of the data that was saved.

Name The Name of the library for which the statistics are being shown.

Times Called
The number of times programs in that library were called.

Calls Made
The number of calls programs in the library made

MI CPLX Issued
The number of MI complex instructions that were called by a program or procedure. MI complex instructions are the architected MI instructions of iSeries server. They are identified in the report with a single "*" in front of the instruction name.

Inline Stats
The statistics that were incurred directly by programs in the library.

CPU (us)
The amount of CPU in microseconds used by programs in the library

% The percentage of CPU used as compared to the Total CPU found in the summary section.

DB SIO
: The number of database synchronous I/O operations performed by programs in the library.

DB AIO
: The number of database asynchronous I/O operations performed by programs in the library.

NDB SIO
: The number of non-database synchronous I/O operations performed by programs in the library.

NDB AIO
: The number of non-database asynchronous I/O operations performed by programs in the library.

Cumulative Stats
: The statistics that were incurred both directly and indirectly by programs in the library. This can occur through calls to other programs in the other libraries in this list.

Note: At the library level, cumulative statistics can be greater than 100%. In this example, the **** means that the percent is greater than 100%.

CPU (us)
: The cumulative amount of CPU in microseconds that is used by programs in the library and other programs they called.

%
: The percentage of cumulative CPU that is used as compared to the Total CPU that is found in the summary section.

DB SIO
: The cumulative number of database synchronous I/O operations that are performed by programs in the library and other programs they called.

DB AIO
: The cumulative number of database asynchronous I/O operations performed by programs in the library and other programs they called.

NDB SIO
: The cumulative number of non-database synchronous I/O operations that are performed by programs in the library and other programs they called.

NDB AIO
: The cumulative number of non-database asynchronous I/O operations performed by programs in the library and other programs they called.

Call Level
: Shows the invocation call level in a hierarchical statistics collection. Specify DATAORG(*HIER) on the ADDPEXDFN command to show the data in a hierarchical format.

Figure 129 on page 302 shows a sample Library section from the Profile Information Report.

```
                                            Performance Explorer Report                                            6/01/xx 10:34:15
                                              Profile Information                                                  Page    3

                                                 Library Section
Library . . : COOK
Member. . . : RBPROF2PGM
Description : RBPROF-CMDCSTPEXH (CLCSTPEXHI, CSTPEX)
                           Histogram     Hit   Hit   Cum   Start            Map    Stmt   Name
                                         Cnt    %     %    Addr             Flag   Nbr
-------------------------------------------------------------------------------------------------------------------------------
************************************     1108 100.0 100.0 22B55B7DFD002360   MP        7  PFREXP
```

*Figure 129. Example for *PROFILE Library Section*

The Profile Information Report shows the following values:

Library
The library the database file is in.

Member
The database file member containing the data.

Description
The description of the data that was saved.

Histogram
The histogram graphically illustrates the number of sample hits against this entry as compared with the total number of sample hits.

Hit Cnt
The number of samples that occurred within this entry

Hit % The percent of hits for this line as compared to the total number of sample hits.

Cum %
The cumulative Hit % of this entry and all preceding entries.

Start Addr
The address of the first instruction. The Start Addr column is only filled in for the Profile Information Report.

Map Flag
The map flag indicates what this entry corresponds to. The possible values for the map flag are:

- DS (distributed statement). This line represents multiple source statements that were optimized into a single instruction.
- SS (single statement). This line represents a single source statement.
- MS (multiple statement). This line represents multiple source statements.
- MP (multiple procedures). This line represents multiple procedures.

Stmt Numb
The MI statement number of the first instruction of this entry.

Notes:

1. To get a detailed Profile Information Report that shows the utilization of your HLL program statements, you should specify TYPE(*PROFILE) on the PRTPEXRPT command and summarize the collected data by PROFILEOPT(*BLANK) or PROFILEOPT(*STATEMENT).
2. For information on how the source code maps to the statement number, see "Mapping OPM High-Level Language (HLL) Statements to Source Code" on page 309.

Name The name of the program, module, and procedure associated with this entry. If the report is summarized at the Module level, then the procedure will be left off. If the report is summarized at the Program level, then the module and the procedure names will be left off.

Statistics Report

The Statistics Report provides general performance statistics to help identify problem areas. In particular, the statistics details show potential **program** performance trouble spots of a job or system.

The report also shows a variety of other use statistics, such as invocations and number of disk I/Os. From the Statistics Report, you should be able to determine how much resource the programs in your application are using. Using this information, you can determine if there is a performance problem that requires further investigation.

If you notice a single library with a high level of CPU utilization or DASD I/O operations, you might want to focus on programs in that library. Libraries that you might see could include the following:

- QSYS, which stores most of the OS/400 modules.
- QTCP, which provides TCP/IP support.
- QIJS, which provides the Job Scheduler for OS/400 support.
- QBRM, which provides the Backup Recovery and Media Services support.

See the “Library Information” on page 299 section for a discussion of the column descriptions.

Performance Explorer Report
Statistics Information Page 6

Library . . : QPEXDATA
Member. . . : STATSF
Job name. . : ALL JOBS/TASKS IN SESSION
Description : BLANK

Name	Times Called	Calls Made	MI CPLX Issued	Inline Stats CPU (us) /	%	DB SIO	DB AIO	NDB SIO	NDB AIO	Cumulative Stats CPU (us) /	%	DB SIO	DB AIO	NDB SIO	NDB AIO	Call Level
**LIC Task	0	0	0	3,098,472	81.4	0	0	0	0	3,098,472	81.4	0	0	0	0	0
**Unknown	0	0	0	399,295	10.5	0	0	0	0	399,295	10.5	0	0	0	0	0
*CRTS	9	0	0	23,365	0.6	0	0	14	0	23,365	0.6	0	0	14	0	0
*DEQWAIT	10	0	0	22,505	0.6	0	0	2	0	22,505	0.6	0	0	2	0	0
*DESS	9	0	0	13,701	0.4	0	0	6	0	13,701	0.4	0	0	6	0	0
*RSLVSP	37	0	0	11,174	0.3	0	0	0	0	11,174	0.3	0	0	0	0	0
*MATPRMSG	68	0	0	9,471	0.2	0	0	0	0	9,471	0.2	0	0	0	0	0
QWSPUT	23	6	26	9,157	0.2	0	0	0	0	15,305	0.4	0	0	0	0	0
QSFPUT	15	1	0	8,151	0.2	0	0	0	0	17,110	0.4	0	0	3	0	0
QMHRCVPM	24	3	115	7,611	0.2	0	0	0	0	71,841	1.9	0	0	3	0	0
QPTPRCSS	1	57	0	7,591	0.2	0	0	0	0	66,043	1.7	0	0	4	0	0
*SETACST	20	0	0	7,517	0.2	0	0	6	2	7,517	0.2	0	0	6	2	0
QYPEENDP	3	20	20	7,428	0.2	0	0	3	0	142,708	3.7	0	2	40	4	0
QMHGSD	6	48	24	7,192	0.2	0	0	0	0	60,865	1.6	0	0	3	0	0
*FNDINXEN	26	0	0	7,174	0.2	0	0	1	0	7,174	0.2	0	0	1	0	0
QWSGET	17	9	17	7,099	0.2	0	0	0	0	34,884	0.9	0	0	2	0	0
*SNDPRMSG	21	0	0	6,886	0.2	0	0	0	0	6,886	0.2	0	0	0	0	0
QUIINMGR	6	12	0	5,717	0.2	0	0	0	0	29,020	0.8	0	0	2	0	0
*MATPTR	101	0	0	5,462	0.1	0	0	0	0	5,462	0.1	0	0	0	0	0
*MODPRMSG	46	0	0	5,251	0.1	0	0	0	0	5,251	0.1	0	0	0	0	0
QCAFLD	17	0	0	4,976	0.1	0	0	0	0	4,976	0.1	0	0	0	0	0
QUIMGFLW	5	33	16	4,928	0.1	0	0	0	0	71,679	1.9	0	0	7	0	0
QLIDLOBJ	2	4	16	4,317	0.1	0	0	5	0	17,039	0.4	0	0	13	0	0
*MODS1	10	0	0	4,127	0.1	0	0	0	0	4,127	0.1	0	0	0	0	0
QUIEXFMT	6	23	3	4,044	0.1	0	0	0	0	50,525	1.3	0	0	3	0	0
*MATINVIF	135	0	0	4,002	0.1	0	0	0	0	4,002	0.1	0	0	0	0	0
QUILIST	26	0	8	3,885	0.1	0	0	0	0	4,449	0.1	0	0	0	0	0
QCMDEXC	4	22	18	3,571	0.1	0	0	0	0	30,858	0.8	0	0	3	0	0
QCADRV2	11	40	1	3,439	0.1	0	0	0	0	16,106	0.4	0	0	0	0	0
QMHSNDPM	10	0	43	3,239	0.1	0	0	1	0	9,701	0.3	0	0	1	0	0
*MATSOBJ	20	0	0	3,066	0.1	0	0	1	0	3,066	0.1	0	0	1	0	0
QUIVPMGR	27	0	0	2,933	0.1	0	0	0	0	2,933	0.1	0	0	0	0	0
QLICKOBJ	4	6	6	2,907	0.1	0	0	0	0	11,398	0.3	0	0	2	0	0
QCAPOS	7	0	0	2,879	0.1	0	0	0	0	2,879	0.1	0	0	0	0	0
*MODADR	2	0	0	2,838	0.1	0	0	0	2	2,838	0.1	0	0	0	2	0
QWSSFLCT	5	0	0	2,829	0.1	0	0	0	0	2,829	0.1	0	0	0	0	0
*REQIO	10	0	0	2,753	0.1	0	0	0	0	2,753	0.1	0	0	0	0	0
QUIOCNV	6	0	0	2,736	0.1	0	0	0	0	2,736	0.1	0	0	0	0	0
QLIINSRT	2	10	28	2,645	0.1	0	0	0	0	27,409	0.7	0	2	3	4	0
*CRTDOBJ	1	0	0	2,605	0.1	0	0	1	0	2,605	0.1	0	0	1	0	0
*LOCK	20	0	0	2,525	0.1	0	0	0	0	2,525	0.1	0	0	0	0	0
QMHRMVPM	14	0	64	2,495	0.1	0	0	0	0	6,229	0.2	0	0	0	0	0
QSZGTPRD	4	6	18	2,484	0.1	0	0	0	0	8,300	0.2	0	0	0	0	0
QPTGTINP	3	12	6	2,226	0.1	0	0	1	0	8,553	0.2	0	0	1	0	0
QT3REQIO	13	0	30	2,035	0.1	0	0	0	0	27,552	0.7	0	0	2	0	0

*Figure 130. *STATS Information*

Profile Report

The Profile Report provides output to show relative CPU time by procedure. This allows the user to identify where to focus efforts to provide overall performance of the application or program.

Note: You can also summarize profile counts at a procedure, module, or program level.

See the “Library Information” on page 299 section for a discussion of the column descriptions.

In this example, you can see that three statements were responsible for 71.75% of the CPU costs. It would not be worthwhile to investigate other statements that reported smaller percentages. In a real application program, the profile information can show a high percentage of CPU cost for a single statement or similar percentages for more than one statement. Look at the program source code to determine if the high CPU cost is due to a single statement or a group of statements. A group of statements can indicate a processing loop.

```
                                                    Performance Explorer Report                                                    1/21/xx 13:39:10
                                                        Profile Information                                                            Page   12
Library . . : COOK
Member. . . : RBPROF2PGM
Description : RBPROF-CMDCSTPEXH (CLCSTPEXHI, CSTPEX)
                           Histogram     Hit   Hit   Cum   Start             Map    Stmt   Name
                                         Cnt    %     %    Addr              Flag   Nbr
------------------------------------------------------------------------------------------------------------------------------------
                         ***********     349  31.5  31.5 22B55B7DFD002E48    MP       45   CSTPEX
                             *******     243  21.9  53.4 22B55B7DFD002DA0    MP       42   CSTPEX
                              ******     202  18.2  71.7 22B55B7DFD003E40    MP      106   CSTPEX
                                  **      82   7.4  79.1 22B55B7DFD002F20    MP       46   CSTPEX
                                  **      81   7.3  86.4 22B55B7DFD002D6C    MP       41   CSTPEX
                                   *      53   4.8  91.2 22B55B7DFD003ECC    MP      107   CSTPEX
                                   *      45   4.1  95.2 22B55B7DFD002E2C    MP       44   CSTPEX
                                          15   1.4  96.6 22B55B7DFD002F90    MP       47   CSTPEX
                                          10   0.9  97.5 22B55B7DFD003E38    MP      105   CSTPEX
                                           7   0.6  98.1 22B55B7DFD002FA0    MP       50   CSTPEX
                                           4   0.4  98.5 22B55B7DFD002360    MP        7   CSTPEX
                                           4   0.4  98.8 22B55B7DFD002500    MP       14   CSTPEX
                                           2   0.2  99.0 22B55B7DFD0023F4    MP       10   CSTPEX
                                           2   0.2  99.2 22B55B7DFD002D48    MP       40   CSTPEX
                                           2   0.2  99.4 22B55B7DFD003100    MP       55   CSTPEX
                                           2   0.2  99.5 22B55B7DFD003288    MP       69   CSTPEX
                                           2   0.2  99.7 22B55B7DFD00454C    MP      128   CSTPEX
                                           1   0.1  99.8 3567AA401D0024B8    MP     5400   CLCSTPEXHI
                                           1   0.1  99.9 22B55B7DFD0024B0    MP       13   CSTPEX
                                           1   0.1 100.0 22B55B7DFD002CC0    MP       38   CSTPEX
```

*Figure 131. Example for *PROFILE Information*

Trace Report

The Trace Report provides a historical trace of performance activity generated by one or more jobs or tasks on the system.

Figure 132 on page 306 shows a sample Trace report.

```
                                                                                        572848
                                            Performance Explorer Report
                                               Trace Information                                          Page    4
Library . . : QPEXDATA
Member. . . : SFCALLRTN
Description : BLANK
Time Stamp. : 15.07.56.083000 Task ID: 000009F5 Name: QPADEV0004 FOLEY      054858 Run Time (us):          484192 Percent: 84.52
P      = Processor Number        M      = Missed Event Indicator  Obj    = Object                  Seg    = Segment
T ST   = Type Subtype            NAGP   = Non Access Group Pages  NPgs   = Number of Pages         Unit   = DASD Unit/Sub Unit
Sector = DASD Sector             PI     = Pool ID                 AI     = ASP ID                  SKP    = DASD Skip Operation
Span   = DASD Sectors Spanned    EXID   = Exception ID            IEID   = IMPI Exception ID       XCH    = DASD Exchange
PTY    = Apparent Task Priority  WODSC  = Wait Obj Description    RS     = Wait Obj Reason
PREFIX = S: Stealable Page       PREFIX = A: PAG Data             PREFIX = D: Data Base Data       PREFIX = M: Mirrored DASD
PREFIX = P: Permanent Segment    PREFIX = T: Temporary Segment    PREFIX = E: E=R Address
                    Address    Offset Object Name          Obj  Seg  PRE       NPgs LIC-Pgm--Offset MI-Pgm-----Offset NAGP PI AI
                                                           T ST T ST FIX            Unit Sector Span SKP XCH          EXID IEID
ss.mmm P M Task ID  Parent-Pgm HLL-No CurrentPgm  RC Delta Run Cycles    Event  PTY               WaitSleep Cycles WODSC RS SNDTSK
------------------------------------------------------------------------------------------------------------------------------------
56.083 7 0 000009F5 QMHSNDPM   00015F *RSLVSP           0          0    MISTR RESOLVE SYSTEM POINTER
56.083 7 0 000009F5 QMHSNDPM   000160 *RSLVSP           0          0    MIEND RESOLVE SYSTEM POINTER
56.083 7 0 000009F5 QMHSNDPM   000164 *RSLVSP           0          0    MISTR RESOLVE SYSTEM POINTER
56.083 7 0 000009F5 QMHSNDPM   000165 *RSLVSP           0          0    MIEND RESOLVE SYSTEM POINTER
56.083 7 0 000009F5 QMHSNDPM   000167 *TESTAU           0          0    MISTR TEST AUTHORITY
56.083 7 0 000009F5 QMHSNDPM   000167 *TESTAU           0          0    MIEND TEST AUTHORITY
56.083 7 0 000009F5 QMHSNDPM   00017E *FNDINXEN         0          0    MISTR FIND INDEPENDENT INDEX ENTRY
56.083 7 0 000009F5 QMHSNDPM   00017F *FNDINXEN         0          0    MIEND FIND INDEPENDENT INDEX ENTRY
56.083 7 0 000009F5 QMHSNDPM   000491 *MATINVIF         0          0    MISTR MATERIALIZE INVOCATION INFO.
56.083 7 0 000009F5 QMHSNDPM   000492 *MATINVIF         0          0    MIEND MATERIALIZE INVOCATION INFO.
56.083 7 0 000009F5 QMHSNDPM   00020F *MATINVIF         0          0    MISTR MATERIALIZE INVOCATION INFO.
56.083 7 0 000009F5 QMHSNDPM   000210 *MATINVIF         0          0    MIEND MATERIALIZE INVOCATION INFO.
56.083 7 0 000009F5 QMHSNDPM   0006AD *SNDPRMSG         0          0    MISTR SEND PROCESS MESSAGE
56.084 7 0 000009F5 QMHSNDPM   0006AE *SNDPRMSG         0          0    MIEND SEND PROCESS MESSAGE
56.084 7 0 000009F5                   QMHSNDPM          0          0    EXIT
56.084 7 0 000009F5                   QYPESTRP          0          0    EXIT  QYPESTRP/_CXX_PEP
56.084 7 0 000009F5 QCMD       000182 *TESTEXCP         0          0    MISTR TEST EXCEPTION
56.084 7 0 000009F5 QCMD       000182 *TESTEXCP         0          0    MIEND TEST EXCEPTION
56.084 7 0 000009F5                   QMHRCVPM          0          0    ENTRY
56.084 7 0 000009F5 QMHRCVPM   0004CC *MATPRMSG         0          0    MISTR MATERIALIZE PROCESS MESSAGE
56.084 7 0 000009F5 QMHRCVPM   0004CD *MATPRMSG         0          0    MIEND MATERIALIZE PROCESS MESSAGE
56.084 7 0 000009F5 QMHRCVPM   0004E3 *MATINVIF         0          0    MISTR MATERIALIZE INVOCATION INFO.
56.084 7 0 000009F5 QMHRCVPM   0004E4 *MATINVIF         0          0    MIEND MATERIALIZE INVOCATION INFO.
56.084 7 0 000009F5 QMHRCVPM   000036 *MATPRMSG         0          0    MISTR MATERIALIZE PROCESS MESSAGE
56.084 7 0 000009F5 QMHRCVPM   000037 *MATPRMSG         0          0    MIEND MATERIALIZE PROCESS MESSAGE
56.084 7 0 000009F5 QMHRCVPM   00044C *MATINVIF         0          0    MISTR MATERIALIZE INVOCATION INFO.
56.084 7 0 000009F5 QMHRCVPM   00044D *MATINVIF         0          0    MIEND MATERIALIZE INVOCATION INFO.
56.084 7 0 000009F5                   QMHGSD            0          0    ENTRY
56.084 7 0 000009F5 QMHGSD     000827 *MATPRMSG         0          0    MISTR MATERIALIZE PROCESS MESSAGE
56.084 7 0 000009F5 QMHGSD     000828 *MATPRMSG         0          0    MIEND MATERIALIZE PROCESS MESSAGE
56.084 7 0 000009F5                   QUIVPMGR          0          0    ENTRY
56.084 7 0 000009F5                   QUIVPMGR          0          0    EXIT
56.084 7 0 000009F5                   QUIVPMGR          0          0    ENTRY
56.084 7 0 000009F5                   QUIVPMGR          0          0    EXIT
56.084 7 0 000009F5                   QUILIST           0          0    ENTRY
56.084 7 0 000009F5                   QUILIST           0          0    EXIT
56.084 7 0 000009F5 QMHGSD     000819 *MATPRMSG         0          0    MISTR MATERIALIZE PROCESS MESSAGE
56.084 7 0 000009F5 QMHGSD     00081A *MATPRMSG         0          0    MIEND MATERIALIZE PROCESS MESSAGE
56.084 7 0 000009F5 QMHGSD     000819 *MATPRMSG         0          0    MISTR MATERIALIZE PROCESS MESSAGE
56.084 7 0 000009F5 QMHGSD     00081A *MATPRMSG         0          0    MIEND MATERIALIZE PROCESS MESSAGE
```

Figure 132. Trace Information Report

The Trace Report shows the following values:

Library
The library the database file is in.

Member
The database file member containing the data.

Description
The description of the data that was saved.

Time stamp
The full time of day delta from the start of the session for the first event on each page of the report.

Task ID
The task ID (in hexadecimal) of the events on each page.

Note: This information appears only when the sort by *TASK value is specified on the PRTPEXRPT command.

Name The name of the task associated with the events on each page.

Note: This information appears only when the sort by *TASK value is specified on the PRTPEXRPT command.

Run Time (us)
The total run time in microseconds of the task associated with the events on each page.

Note: This information appears only when the sort by *TASK value is specified on the PRTPEXRPT command.

Percent
The percent value of the total run time of the task associated with the events on each page.

Note: This information appears only when the sort by *TASK value is specified on the PRTPEXRPT command.

ss.mmm
The number of seconds.milliseconds of the event from the start of the session.

P (Processor Number)
The number of the processor.

M Missed event indicator. Events are missing because of the following:

B The collection mechanism overloaded.

U The collection mechanism is not available.

***** Unknown reasons.

Task ID
The task ID (in hexadecimal) of the task responsible for the event.

Program
The name of the program associated with the event.

HLL-No
The high-level language statement number (in hexadecimal) of the program where the MI complex instruction was issued.

CurrentPgm
The name of the MI complex instruction or program associated with the event.

RC Delta
The difference between the current event run cycle value and the previous event run cycle value.

Run Cycles
The run cycle value for the event. Run cycles are the number of non-idle CPU cycles and are accumulated on a per job or task basis.

Event The 5-character event abbreviation that identifies what event occurred.

In addition to the previous columns that are shown for the Trace Report, you see the following columns when you specify the TRCTYPE parameter.

Address Offset
The hexadecimal representation of an address associated with the event.

Object Name
The name of the object associated with the event.

Obj T ST
The object type and subtype (in hexadecimal) of the object associated with the event.

Seg T ST
The segment type and subtype (in hexadecimal) of the address associated with the event.

PREFIX
Character flags that give more detail of the object associated with the event.

S Stealable page

A PAG data

D Database data

M Mirrored DASD

P Permanent segment

T Temporary segment

E E=R address

NPgs The number of pages requested by the event.

LIC-Pgm--Offset
The Licensed Internal Code (LIC) program identifier and instruction offset associated with the event.

MI-Pgm Offset
The program name and instruction offset associated with the event.

NAGP
The number of non-activation group pages requested by the event.

PI The pool identifier associated with the event.

AI The auxiliary storage pool identifier associated with the event.

Unit The DASD unit number subunit number (in hexadecimal).

Sector The DASD sector address associated with the event.

Span The span of the DASD request associated with the event.

SKP XCH
Y/N columns indicating whether the DASD event was a skip operation or an exchange operation.

EXID Exception identifier column (in hexadecimal).

IEID IMPI Exception identifier column (in hexadecimal).

Trace Event Descriptions

Refer to the Performance Management URL for the trace event descriptions: `http://www.iseries.ibm.com/perfmgmt/resource.htm`

The tables on the Performance Management web page describe each event available when you specify SLTEVT(*YES) on the ADDPEXDFN command. The tables also indicate the relationships between the TRCTYPE parameter and the events that are included in the performance explorer definition.

Basic Report

The Basic Report provides summary information that includes the definition, run, and task information sections for any of the previous types.

Mapping OPM High-Level Language (HLL) Statements to Source Code

Non-ILE compiled original program model (OPM) program HLL statements that appear in the PRTPEXRPT *PROFILE report do not map the code source statements. To do the mapping, these programs need to be compiled with the *LIST generation option.

Note: This mapping only applies to the OPM compilers.

The HLL statements that appear in the report have to be converted to hexadecimal and matched up with the INST column in the Generated Output section of the compile listing. The values under the Break column of the same section map the source statement numbers of the program.

For example, the following CL program results in a partial listing as shown in Figure 133 on page 310:

```
CRTCLPGM PGM(QGPL/CLEXAMPLE)
   SRCFILE(QGPL/QCLSRC) GENOPT(*LIST)
```

To determine the actual source code statement numbers, do the following steps:

1. Compile the original program model (OPM) program with an *LIST generation option. This listing includes the original HLL source statement numbers and the corresponding MI instructions that were generated for this HLL statement. These MI instructions are assigned their own INSTruction number on the listing.
2. Create the performance explorer definition `ADDPEXDFN TYPE(*PROFILE) INTERVAL(1)`
3. Collect data that includes the OPM program with the Start Performance Explorer (STRPEX) command.
4. Print the report by specifying:

   ```
   PRTPEXRPT TYPE(*PROFILE) PROFILEOPT(*SAMPLECOUNT *STATEMENT)
   ```

   You can see the report in Figure 134 on page 311.
5. Use the Nbr column from the Profile Report to scan the MI statement portion of the listing (Generate Output section) to find the matching hexadecimal instruction number under the column heading **INST**. On the right side of that same print line you see the HLL source statement number under the **Break** column heading. Two lines before the matched INST line you see **BRK 'HLL source statement number'**.
6. Find that statement number in your original source portion of the listing.

```
                                     Control Language Source
SEQNBR  *...+... 1 ...+... 2 ...+... 3 ...+... 4 ...+... 5 ...+... 6 ...+... 7 ...+... 8 ...+... 9 ...+.  DATE
   100- /*-------------------------------------------------------------------*/
   200- /* Program : LOOPCL                                                   */                             08/27/95
   300- /*                                                                   */
   400- /*          Example invocation :                                     */
   500- /*                                                                   */
   600- /*             CALL QGPL/LOOPCL                                      */                             08/27/95
   700- /*                                                                   */
   800- /*                                                                   */
   900- /*                                                                   */
  1000- /* Parameters : none                                                 */
  1100- /*-------------------------------------------------------------------*/
  1200-
  1300- PGM:
  1400-         DCL  &LOOPCNT *DEC  LEN(5 0)  VALUE(1000000)                                                08/12/95
  1500-         DCL  &VAR1    *DEC  LEN(5 0)  VALUE(0)                                                      08/27/95
  1600- /*-------------------------------------------------------------------*/
  1700- /* SIMPLE LOOP WITH SOME MATH COMPUTATIONS                           */                             08/27/95
  1800- /*                                                                   */                             08/27/95
  1900- /*-------------------------------------------------------------------*/
  2000- LOOP:                                                                                               07/28/95
  2100-           IF        COND(&LOOPCNT *NE 0) THEN(DO)                                                   08/23/95
  2200-              CHGVAR     VAR(&VAR1) VALUE(&LOOPCNT * &VAR1)                                          08/27/95
  2300-              CHGVAR     VAR(&VAR1) VALUE(&VAR1 / &LOOPCNT)                                          08/27/95
  2400-              CHGVAR     &LOOPCNT  (&LOOPCNT - 1)                                                    07/28/95
  2500-              GOTO LOOP                                                                              07/28/95
  2600-              ENDDO                                                                                  07/28/95
  2700- END:
                              * * * * *   E N D   O F   S O U R C E   * * * * *
```

Figure 133. Mapping Control Language Source to Statement Numbers (Part 1 of 2)

```
5716SS1 V3R6M0 950929                             Generated Output                        08/27/95 11:25:31  Page     3
 SEQ   INST Offset    Generated Code      *... ... 1 ... ... 2 ... ... 3 ... ... 4 ... ... 5 ... ... 6 ... ... 7 ... ... 8   Break
00001                                              ENTRY * EXT                                                   ;
00002  0001 000004  2132 0025 0026                 CPYBWP ?WCLSEPT@,?WWCBSEPT                                    ;
00003  0002 00000A  0132 0021 4027 213A            CPYBWP ?QCLCLNUP,?WWLISEPT(00314)                             ;
00004  0003 000012  0252 0021 004A                 SETIEXIT ?QCLCLNUP,?WCLRARGLST                               ;
00005  0004 000018  0283 4027 213C 004A            CALLX ?WWLISEPT(00316),?WCLRARGLST,*                          ;
                    0000
00006                                              DCL DD ?CLPVARS(00000007) CHAR(1) AUTO                        ;
00007                                              BRK 'PGM       '                                              ;  PGM
00008                                     PGM :                                                                  ;  PGM
00009                                              BRK 'LOOP      '                                              ;  LOOP
00010                                     LOOP :                                                                 ;  LOOP
00011  0005 000022  23EF 001A 0018 2001            MODEXCPD ?FCEXCMON,?EMEMONAT,X'01'                            ;  LOOP
00012                                              BRK '2100  '                                                  ;  2100
00013                                     ?RCLBL00001:                                                           ;  2100
00014  0006 00002A  3042 0031 2001                 CPYNV ?WCLCSREI ,00001                                        ;  2100
00015  0007 000030  1846 C000 0013 0006            CMPNV(I) &LOOPCNT,P'+0'/NEQ(?4TEMP0001);                      ;  2100
                    0016                                                                                            2100
00016  0008 00003A  1CC2 C000 0016 20F1            CMPBLA(B) ?4TEMP0001 ,C'1'/NEQ(?FL00001)                      ;  2100
                    0010                                                                                            2100
00017                                              BRK '2200  '                                                  ;  2200
00018                                     ?RCLBL00002:                                                           ;  2200
00019  0009 000044  3042 0031 2002                 CPYNV ?WCLCSREI ,00002                                        ;  2200
00020  000A 00004A  104B 0017 0013 0014            MULT ?4TEMP0002,&LOOPCNT,&VAR1                                ;  2200
00021  000B 000052  1042 0014 0017                 CPYNV &VAR1 ,?4TEMP0002                                       ;  2200
00022                                     ?ICLBL00002:                                                           ;  2200
00023                                              BRK '2300  '                                                  ;  2300
00024                                     ?RCLBL00003:                                                           ;  2300
00025  000C 000058  3042 0031 2003                 CPYNV ?WCLCSREI ,00003                                        ;  2300
00026  000D 00005E  104F 0017 0014 0013            DIV ?4TEMP0002,&VAR1,&LOOPCNT                                 ;  2300
00027  000E 000066  1042 0014 0017                 CPYNV &VAR1 ,?4TEMP0002                                       ;  2300
00028                                     ?ICLBL00003:                                                           ;  2300
00029                                              BRK '2400  '                                                  ;  2400
00030                                     ?RCLBL00004:                                                           ;  2400
00031  000F 00006C  3042 0031 2004                 CPYNV ?WCLCSREI ,00004                                        ;  2400
00032  0010 000072  1047 0017 0013 000C            SUBN ?4TEMP0002,&LOOPCNT,P'+1';                               ;  2400
00033  0011 00007A  1042 0013 0017                 CPYNV &LOOPCNT ,?4TEMP0002                                    ;  2400
00034                                     ?ICLBL00004:                                                           ;  2400
00035                                              BRK '2500  '                                                  ;  2500
00036  0012 000080  3011 0004                      B LOOP                                                        ;  2500
00037                                              BRK '2600  '                                                  ;  2600
00038                                              BRK 'END       '                                              ;  END
00039                                     END :                                                                  ;  END
00040                                              BRK '2700  '                                                  ;  2700
00041                                     ?ICLBL00001:                                                           ;  2700
```

Figure 133. Mapping Control Language Source to Statement Numbers (Part 2 of 2)

```
                        Performance Explorer Report
                            Profile Information

 Histogram     Hit   Hit   Cum   Start              Map    Stmt   Name
               Cnt    %     %    Addr               Flag   Nbr

    ******      70   17.4  17.4 1F048B9A4D0019E8   MP    00000D  LOOPCL
     *****      61   15.2  32.6 1F048B9A4D0018A4   MP    00000A  LOOPCL
     *****      60   14.9  47.5 1F048B9A4D001BD8   MP    000011  LOOPCL
      ****      52   12.9  60.4 1F048B9A4D001AAC   MP    00000E  LOOPCL
      ****      51   12.7  73.1 1F048B9A4D001B30   MP    000010  LOOPCL
      ****      48   11.9  85.1 1F048B9A4D001960   MP    00000B  LOOPCL
       ***      34    8.5  93.5 1F048B9A4D001840   MP    000007  LOOPCL
         *      13    3.2  96.8 1F048B9A4D001C58   MP    000012  LOOPCL
                 4    1.0  97.8 1F048B9A4D001890   MP    000008  LOOPCL
                 2    0.5  98.3 1F048B9A4D001B2C   MP    00000F  LOOPCL
                 2    0.5  98.8 1F048B9A4D00183C   MP    000006  LOOPCL
```

Figure 134. Performance Explorer Report

Performance Data—Performance Explorer

The following are the performance explorer data files collected by the system when using data collection commands. Type the following command to view the contents for a single file: `DSPFFD FILE(Qxxxxxxxxx)`, where `xxxxxxxxxx` is the file name that you want to display.

File Name	Description
QAYPEREF	Reference information
QAYPERUNI	General information
QAYPECOCFG	Configuration object information
QAYPEHWCFG	Hardware mode specific configuration information
QAYPEFQCFG	PMC selection
QAYPECICFG	Basic configuration information
QAYPESTCFG	Statistical mode specific configuration information
QAYPETRCFG	Trace mode specific configuration information
QAYPELCPLX	MI complex instructions collected on
QAYPELJOB	Jobs collected on
QAYPELMET	Metrics to collect data on
QAYPELMI	MI program, module, or procedures collected on
QAYPELLIC	LIC modules to collect data on
QAYPELNAMT	Task names to collect data on
QAYPELNUMT	Task number to collect data on
QAYPEMICPX	MI complex instructions mapping
QAYPEEVENT	Event type and subtype mapping
QAYPEHWMAP	Hardware mapping data
QAYPELICI	LIC address resolution mapping
QAYPEMII	MI program address resolution mapping
QAYPESEGI	Segment address resolution mapping

File Name	Description
QAYPETASKI	Process and task resolution mapping
QAYPENMI	List of MI programs that data was collected on
QAYPENLIC	List of LIC modules that data was collected on
QAYPETIDX	Common trace data for all events
QAYPEASM	Auxiliary storage management event data
QAYPEBASE	Base event data
QAYPEDASD	DASD event data
QAYPEDSRV	DASD server event data
QAYPEPGFLT	Page fault event data
QAYPERMPM	Resource management process event data
QAYPERMSL	Resource management seize lock event data
QAYPES36	Advanced 36 event data
QAYPESAR	Segment address range (SAR) data
QAYPEUNKWN	UNKNOWN event data
QAYPESTATS	Basic statistics data
QAYPEPSUM	Statistic profiling summary data
QAYPEPWDW	Statistics profiling window data
QAYPEPPANE	Statistics profiling pane data
QAYPELBRKT	Licensed internal code (LIC) bracketing data
QAYPEMIUSR	Machine interface (MI) user event data
QAYPEMBRKT	Machine interface (MI) program bracketing data
QAYPEMIPTR	Addresses of MI pointer
QAYPEUSRDF	User-defined bracketing hook data
QAYPEHMON	Hardware monitor data
QAYPEHTOT	Hardware monitor total data
QRLVRM	Release, version, modification level
QRLLVL	PEX level indicator
QAYPEJVA	PEX Java event data
QAYPEJVCI	PEX Java class info data
QAYPEJVMI	PEX Java method info data
QAYPEJVNI	PEX Java name info data

Chapter 12. Managing the Performance Tools Configuration

For the Manager feature, if you choose the `Configure and manage tools` option on the IBM Performance Tools menu, the Configure and Manage Tools display appears.

```
                          Configure and Manage Tools

Select one of the following:

     1. Work with functional areas
     2. Delete performance data
     3. Copy performance data
     4. Convert performance data
     5. Create performance data









Selection or command
===>

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel
```

Note: Option 4 (Convert performance data) and option 5 (Create performance data) only appear when the current user profile has authority to the command related to the task.

From this display you can manage or change the objects used in the Performance Tools.

For the Agent feature, choose option 2 (Manage performance data) on the IBM Performance Tools menu.

The Manage Performance Data display will appear. From this display you can manage the objects used in the performance tools.

Work with Functional Areas—Manager Feature

Functional areas provide a way to define and save selection values that you use on the System and Component Reports. For example, you might save a set of jobs or users as a functional area. Then each time you use the Print System Report (PRTSYSRPT) and Print Component Report (PRTCPTRPT) commands, you specify the name of the functional area to use. Functional areas also work with the Print Job Report (PRTJOBRPT), Print Pool Report (PRTPOLRPT), Print Transaction Report (PRTTNSRPT), and Display Performance Graph (DSPPFRGPH) commands. Specify these names on the select functional areas (SLTFCNARA) and the omit functional areas (OMTFCNARA) parameters.

If you choose option 1 (Work with functional areas) on the Configure and Manage Tools display, the Work with Functional Areas display appears.

```
                          Work with Functional Areas

 Library  . . . . . . . . . . .   QPFRDATA

 Type options, press Enter.
   1=Create     2=Change     3=Copy     4=Delete

           Functional
Option     Area                     Text
   1        My Func Area     My department
            ACCOUNTING              Func Area for Accounting
            DEPARTMENT A            Func Area for Dept. A
            DEPARTMENT B            Func Area for Dept. B
            DEPARTMENT C            Func Area for Dept. C
            DEPARTMENT D            Func Area for Dept. D
            MANAGEMENT              Func Area for Managers
            MANUFACTURING           Func Area for Manufacturing
            PAYROLL                 Func Area for Payroll
            SALES FORCE             Func Area for Sales Force
            SECRETARIAL             Func Area for Secretaries
                                                                   More...
 F3=Exit   F5=Refresh   F12=Cancel   F16=Sort by text
```

This display shows the functional areas that exist in the library you specified. To create a new functional area, type option 1, the name, and the description on the first line under the *Functional Area* and *Text* columns, and press the Enter key. To select an existing functional area, type a 2 (Change), 3 (Copy), or a 4 (Delete) in the Option column next to the functional area of your choice.

Creating a Functional Area—Manager Feature

If you choose to create a functional area, the Create Functional Area display appears.

```
                            Create Functional Area

 Functional Area  . . . . . . :   MY FUNC AREA

 Type options, press Enter.
   1=Select

 Option  Job         User                Option  Job         User
  _      __________  __________             _    __________  __________
  _      __________  __________             _    __________  __________
  _      __________  __________             _    __________  __________
  _      __________  __________             _    __________  __________
  _      __________  __________             _    __________  __________
  _      __________  __________             _    __________  __________
  _      __________  __________             _    __________  __________
  _      __________  __________             _    __________  __________
  _      __________  __________             _    __________  __________



                                                                   More...
 F3=Exit   F12=Cancel
```

On this display you specify the job name and the user ID (or both) you want to include in the functional area. If you choose, you can specify only a job name, only a user ID, a generic job name (of the form yyy*), or a generic user name. Thus, WS* in the *Job* column would include all jobs that have a job name starting with

WS and any user ID name. You can leave a blank field in the *Job* or *User* column to include all jobs with any job name or all jobs with any user ID name.

When you have finished entering all the job names and user IDs, press the Enter key to create the functional area. Make sure you put a 1 in front of each job and user you enter.

Changing a Functional Area—Manager Feature

If you choose to change a functional area, the Change Functional Area display appears.

```
                            Change Functional Area

Functional Area  . :   DEPARTMENT A
  Text . . . . . . .     Func Area for Dept. A

Type options, press Enter.
  1=Select     4=Delete

Option  Job         User                 Option  Job         User

  1     JOB1        MARY
  1                 OPGMR
  1     DSP02       A*
  1     M*
  _     _________   __________             _     _________   ________
  _     _________   __________             _     _________   ________
  _     _________   __________             _     _________   ________
                                                                       More...
F3=Exit   F5=Refresh   F12=Cancel   F15=Sort by job name
F16=Sort by user name
```

On this display you specify new job names and user IDs to include in the functional area by using option 1, or remove jobs and users from the functional area by using option 4. When you have made all of your entries, press the Enter key to change the functional area.

Deleting a Functional Area—Manager Feature

If you choose to delete a functional area, the Confirm Delete of Functional Areas display appears, listing the functional areas you selected for deletion. Press the Enter key to delete them.

Copying a Functional Area

If you choose to copy a functional area, the Copy Functional Area (CPYFCNARA) command prompt appears. Fill in the prompts and press the Enter key to copy the functional area.

Delete Performance Data

Use the `Delete performance data` option on the Configure and Manage Tools display to delete performance data that you no longer need on your system. When you choose option 2, the Delete Performance Data display appears.

```
                      Delete Performance Data

Library . . . . . .   QPFRDATA__

Type option, press Enter.
  4=Delete
Option   Member       Text                                 Date       Time
  _      XYZ                                               12/15/01   14:05:55
  _      PERFTESTC4   2 hours w/ 5 minute intervals        12/15/01   08:05:48
  _      PERFTESTC3   Duration of 2 hours                  12/14/01   09:21:44
  _      PERFTESTC2                                        12/11/01   14:42:46









                                                                       Bottom
F3=Exit   F5=Refresh   F12=Cancel   F15=Sort by member   F16=Sort by text
```

The members that appear on this display are those used on the Create Performance Data (CRTPFRDTA) command for the keyword MBR when data was collected. To delete a member from this list, type a 4 (Delete) next to the appropriate member and press the Enter key. The member you delete is deleted from the data collection files that are generated by Collection Services.

Copy Performance Data

Use the Copy performance data option on the Configure and Manage Tools display to make copies of performance data members. When you choose option 3, the Select Performance Member display appears.

```
                      Select Performance Member

Library . . . . . .   QPFRDATA__

Type option, press Enter.
  1=Select

Option   Member       Text                                  Date       Time
  _      FRIDAY       Performance Data for Friday           10/27/01   10:05:46
  _      THURSDAY     Performance Data for Thursday         10/26/01   12:00:34
  1      WEDNESDAY    Performance Data for Wednesday        10/25/01   13:50:15
  1      TUESDAY      Performance Data for Tuesday          10/24/01   13:55:08
  1      MONDAY       Performance Data for Monday           10/23/01   16:25:39
  _      TESTRUN      Test run of system                    10/19/01   20:31:42







F3=Exit    F12=Cancel   F15=Sort by member   F16=Sort by text
F19=Sort by date/time
```

The members that appear on this display are those used on the Create Performance Data (CRTPFRDTA) command for the keyword MBR when data was collected. To copy a member or members from the list, type a 1 (Select) next to the appropriate member and press the Enter key. The Copy Performance Data display appears.

```
                         Copy Performance Data Member

 Type choices, press Enter.

 --------Copy From--------    --------Copy To--------
 Member         Library       Member        Library
 MONDAY         QPFRDATA      MONDAY        NEWLIB
 TUESDAY        QPFRDATA      TUESDAY       NEWLIB
 WEDNESDAY      QPFRDATA      WEDNESDAY     NEWLIB
                                                                   Bottom











 F3=Exit   F12=Cancel
```

This display shows you the members you selected to copy and where they are to be copied to. For each member listed, type the name of the new member and the library that contains it in the *Copy To* entries of the display, and then press the Enter key. When the copy completes, you have exact copies of the old performance members in the new performance members for the database files that are generated by Collection Services.

Convert Performance Data (CVTPFRDTA) Command

Use the `Convert performance data` option on the Configure and Manage Tools display to convert performance data. The data is converted to the file formats needed to be processed by the current release of the performance measurement/analysis tools.

When you select option 4, the Convert Performance Data (CVTPFRDTA) command prompt display appears.

```
                 Convert Performance Data (CVTPFRDTA)

Type choices, press Enter.

From library . . . . . . . . . .  __________     Name
To library . . . . . . . . . . .  __________     Name
Job Description  . . . . . . . . *USRPRF____     Name, *USRPRF, *NONE
  Library  . . . . . . . . . . .  __________     Name, *LIBL, *CURLIB

                                                                      Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

The Convert Performance Data (CVTPFRDTA) command converts performance data from the previous release to the formats needed to be processed by the current release of the performance measurement/analysis tools. First, the release level on which the data was collected is determined. Then, all members of all files that need conversion are converted to the appropriate format.

The following files must be present for the conversion to take place:

QAPMCIOP	QAPMLIOP
QAPMCONF	QAPMPOOL
QAPMDIOP	QAPMRESP
QAPMDISK	QAPMSYS or QAPMSYSCPU and QAPMJSUM
QAPMJOBS or QAPMJOBMI and QAPMJOBOS	

The following files are copied, or converted if necessary, if they are present:

QACPCNFG	QAPMDMPT
QACPGPHF	QAPMECL
QACPPROF	QAPMETH
QACPRESP	QAPMHDLC
QAITMON	QAPMIDLC
QAPGHSTD	QAPMLAPD
QAPGHSTI	QAPMMIOP
QAPGPKGF	QAPMSBSD
QAPMASYN	QAPMTSK
QAPMBSC	QAPMX25
QAPMBUS	QAPTAPGP

The conversion can be done in the library in which the current data resides or in a different library. If the conversion is done in the same library, the current data is replaced by the new data. If the conversion is done in a different library, the new data exists in the new library while the current data continues to exist in the current library.

Notes:

1. If a different library is specified for the new data, those files in the current library that do not need conversion are copied to the new library.
2. If user-created logical files exist over any of these files, you must delete and re-create these logical files after the performance data has been converted.
3. Historical data cannot be converted without the Collection Services files required for converting.

To convert performance data collected prior to the current release, complete the following items on the display.

From library
Specifies the library that contains the data being converted.

To library
Specifies the library that contains the converted data.

Job Description
Specifies the job description used to submit the file-conversion job for batch processing.

The possible job description values are:

***USRPRF**
The job description defined for the submitting job's user profile.

job-description-name
Specify the name of the job description to be used.

***NONE**
A batch job is not submitted. Processing continues interactively while the user waits.

The possible library values are:

***LIBL** The library list is used to locate the job description.

***CURLIB**
The current library for the job is used to locate the job description. If no current library entry exists in the library list, QGPL is used.

library-name
The library where the job description is located.

Note: If the conversion takes place interactively, the user's work station is not available for other use during this time, which can be significant for long jobs.

Create Performance Data (CRTPFRDTA) command

Use the `Create performance data` option on the Configure and Manage Tools display to create performance data. This command creates a set of database files from performance information that is stored in a management collection (*MGTCOL) object. The database files are discussed in the Performance topic in the iSeries Information Center.

When you select option 5, the Create Performance Data (CRTPFRDTA) command prompt display appears.

```
                    Create Performance Data (CRTPFRDTA)

Type choices, press Enter.

From collection  . . . . . . . .                   Name, *ACTIVE
  Library  . . . . . . . . . . .    QPFRDATA       Name
To member  . . . . . . . . . . .   *FROMMGTCOL     Name, *FROMMGTCOL
To library . . . . . . . . . . .   *FROMMGTCOL     Name, *FROMMGTCOL
Text 'description' . . . . . . .   *SAME

Categories to process  . . . . .   *FROMMGTCOL     Name, *FROMMGTCOL, *APPN...
              + for more values
Time interval (in minutes) . . .   *FROMMGTCOL     *FROMMGTCOL, 0.25, 0.5, 1...
Starting date and time:
  Starting date  . . . . . . . .   *FROMMGTCOL     Date, *FROMMGTCOL
  Starting time  . . . . . . . .                   Time
Ending date and time:
  Ending date  . . . . . . . . .   *FROMMGTCOL     Date, *FROMMGTCOL, *ACTIVE
  Ending time  . . . . . . . . .                   Time

                                                                       Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Typically, you will specify that you want the database files created when you start collecting data. If for some reason you chose not to create the database files when you collected data, use the CRTPFRDTA command to create the files at a later time.

Chapter 13. A Problem Analysis Case Study

This chapter provides users of the iSeries server with an initial approach to determining the source of performance problems using available system tools (both operating system functions and additional licensed programs).

This example provides an introduction to performance analysis and shows you some performance analysis techniques. The scenario describes how a user who is experienced in performance analysis assists a company in resolving a performance concern. You can see how the expert identifies the real problem, isolates the cause, and provides the recommended solution.

Some of the tools discussed are not available in the Agent feature. Appendix C. Comparison of Performance Tools, provides additional information about Performance Tools functions.

Note: Although the technique used represents just one of many different approaches to performance analysis, and the problem described is a small subset of the real-life possibilities, the example is designed to provide initial guidance in developing an overall strategy for performance problem analysis. The names of people and the events described in this chapter are fictitious, and any likeness to actual people is purely coincidental. Because customer applications and requirements vary, IBM makes no representation or warranty that the methodology described herein will solve or eliminate unique customer performance problems.

Introduction to Performance Analysis

Performance problem analysis is a methodology for investigating, measuring, and correcting deficiencies so that system performance meets the user's expectations. It does not matter much that the "system" is a computer; it could be an automobile or a washing machine. The problem-solving approach is essentially the same:

1. Understand the symptoms of the problem.
2. Use tools to measure and define the problem.
3. Isolate the cause.
4. Correct the problem.
5. Use tools to verify that the problem is corrected.

Initially, the analyst knows the user is not satisfied with the way the system is working. For example, it may be running too slow, too noisy, too hot, and so on. The analyst, mechanic, or repair person must first understand what the problem really is. The best way to find out is to observe the problem condition personally. Can the analyst confirm the user's complaint? If the analyst cannot, he should get as much information as possible from those users who have experienced the problem. What are the most common problem descriptions?

The key to success with any performance issue is to have a clear definition of the users' performance criteria. In other words, given the application mix, what do the users want from the system in terms of interactive response time, batch throughput, and processing requirements? For example, a system that supports an interactive order-entry application may have a response time criterion to ensure that customers do not perceive abnormal delays. Another criterion may require that end-of-day processing be completed by a specific time. Given these requirements, the analyst can establish performance objectives around system resource utilization guidelines. With a clear statement of goals and objectives, performance analysis can proceed on a firm basis.

When the objectives are understood, it is important to assess whether the hardware configuration is adequate to support the workload. Is there enough processing unit capacity? Is main storage sufficient for the application mix? It the analyst answers these questions first, perhaps through capacity planning modeling techniques, needless effort can be avoided later.

With an understanding of the symptoms of the problem and the objectives to be met, the analyst can formulate a hypothesis that may explain the cause of the problem. The analyst can use certain OS/400 commands and Performance Tools to measure the system performance. The analyst should review the measured data to further define the problem and to validate or reject the hypothesis. When the apparent cause or causes have been isolated, a solution can be proposed. The analyst should deal with one solution at a time. Then changes can be made and tested. Again, the analyst's tools can, in many cases, measure the effectiveness of the solution and look for possible side effects.

To achieve optimum performance, one must recognize the interrelationship between the critical system resources and attempt to balance these resources, namely processing unit, disk, main storage, and, for communications, remote lines. Each of these resources may become a performance problem.

Improvements to system performance, whether to interactive throughput, interactive response time, batch throughput, or some combination, may take many forms from simply adjusting activity level or pool size to changing the application code itself. Ultimately, however, any improvement will come only through analysis of the critical resources (processing unit, main storage, disk, and remote lines) and contention for system and application objects.

The Case Study

This scenario starts with a company called Armstrong Sporting Goods, Inc. (a fictitious company). As a distributor of sporting equipment throughout the southeastern United States, Armstrong selected the iSeries server as a means for automating much of their order-entry, accounting, inventory, and shipping operations. High quality customer service is critical to the continued success of this company.

The Players

Sue Miller is the new data processing (DP) manager for Armstrong and is the person who provided the IBM support team with most of the information regarding the perceived performance problem. Having been the DP manager for just a short time, Sue is anxious to establish her credibility with the company by quickly addressing an end-user concern over system performance.

Bob Williams is the assigned IBM systems engineer. He has been asked by Sue to assist the DP staff in resolving the performance issue. In this scenario, he is the expert.

As you read through the rest of this story, you can look over Bob's shoulder as he observes the symptoms of Armstrong's performance problem and then proceeds to isolate the cause. Along the way, you will be introduced to additional people who prove to be instrumental in getting the problem resolved.

The Configuration

Here is the configuration of the system in this story:

- One Model 510, 384 megabytes main storage
- Two communications lines
  - A 2400 baud electronic customer support switched line
  - A spare line that is currently unused
- One 6380 Tape Unit
- One 4028 Printer
- Twenty-four 3197 Display Stations
- Two 4224 Printers
- Four 6603 Disk Units
- One 6607 Disk Unit
- OS/400 Version 5 Release 1 licensed program

With this information as the base for our example, let's begin!

The Problem

It was 9:00 a.m. Monday morning, and Sue Miller had just finished introducing herself as the new data processing manager to Bob Williams, a systems engineer from IBM. The two of them were in her office to review the systems management procedures currently in place at Armstrong. During the discussion, Sue mentioned that no formal attempt was being made to monitor the system's performance on a regular basis. Other activities, such as system backup and change management, had already been addressed by Armstrong, but Sue felt that she needed to have a better understanding of how well their current system was handling the daily demands of the company. This interest was actually prompted by concerns brought up at a recent meeting with the department managers. Some of the end users had complained that the system was running too slow and at times appeared to "go to sleep."

Bob was happy to hear that Sue wanted to start developing a performance management strategy for Armstrong. He remarked that he had worked with several companies in the past who unfortunately waited until a serious situation occurred before starting to make an effort to better understand their system requirements. Without historical information to compare past performance, the problem analysis became much more difficult.

Bob and Sue then continued talking the rest of the morning about other topics of interest involving the data processing department. At the close of their discussion, Bob suggested another meeting to further investigate the source of the performance concerns. In the meantime, Sue was asked to do the following:

1. Read the *Work Management* book and the Work Management topic in the iSeries Information Center to better understand performance guidelines and basic tuning techniques. This would help prepare Sue for the upcoming analysis activities that Bob would assist her with.
2. Use the error reporting functions, such as the Print Error Log (PRTERRLOG) command, to see if the system is experiencing hardware problems. Although

this should be a part of normal systems management, all performance analysis activities should first ensure that the system is running error free.

3. Install the Performance Tools Manager feature that Armstrong had purchased two weeks earlier. This would assist them in their investigation of the problem.
4. Survey the end users to find out who was experiencing unsatisfactory system performance and of what type (that is, interactive response time, batch throughput, and so forth). The performance objectives for those end users should then be determined and put in writing.

With that, Bob left with the agreement that they would get together on Friday morning.

Review

Sue is new to Armstrong and is not familiar with the system's performance history. She must quickly learn the objectives of the end users. How important is it that certain display station operators receive subsecond response time, and is it realistic given the requirements of the application? Are there any critical batch jobs that must be finished by the end of the day? These kinds of questions need to be answered for Sue to determine if a problem exists.

As Bob mentioned, even though the iSeries server provides software tools to monitor performance, both in the operating system and in optional licensed programs, many companies do not track their system's resource usage. Using the iSeries server's ability to continuously collect performance data, a business can review workload trends on a periodic basis.

At this point, Sue suspects a problem exists because of informal remarks by some of the end users. She has no solid evidence describing the problem and, therefore, cannot give Bob any concrete information to work with. We are not even sure if there is a performance problem. This is usually where many analysis experiences begin. Bob decided that before proceeding with the analysis, the customer should first review basic tuning guidelines, make sure an important software product he relies on (the Performance Tools Manager feature) is ready to use, check to see if the system is running without hardware problems, and gather more information from the end users.

Checking the System's Performance

On Friday morning, Bob returned to Armstrong to begin working with Sue on analyzing the system's performance. Two days earlier, Sue met with all of the department managers where she asked them to survey their staffs on how well they thought the system was performing. The results were to be returned to her by the following Monday. Also, a review of the system error reports did not indicate that the system was having hardware problems.

Bob felt that the first step in analyzing system performance was to review data from the system interactively using the control language (CL) commands:

- Work with System Status (WRKSYSSTS)
- Work with Active Jobs (WRKACTJOB)
- Work with Disk Status (WRKDSKSTS)

Using these commands, he could quickly see if the system was able to handle the requests for processing unit, disk, and main storage adequately at that instant in time. He cautioned that because the results changed dynamically with the workload, he could not determine for sure that the system had all the capacity it needed all the time. Also, it was important that the time selected to run these commands did not include work not normally running (for example, excessive sign-ons and sign-offs). Sue assured Bob that now would be a good time to look at the system.

The following illustrations show the results of the commands and how Bob interpreted them. First Bob issued the Work with System Status (WRKSYSSTS) command.

```
                            Work with System Status                  SYS400
                                                          07/07/01  09:31:43
% CPU used . . . . . . . :       55.7    Auxiliary storage:
Elapsed time . . . . . . :   00:09:31      System ASP . . . . . . :    8.12 G
Jobs in system . . . . . :        102      % system ASP used   . . :   57.5494
% perm addresses . . . . :      2.483      Total  . . . . . . . . :    8.12 G
% temp addresses . . . . :       .026      Current unprotect used :     326 M
                                           Maximum unprotect  . . :     328 M

Type changes (if allowed), press Enter.

System    Pool    Reserved    Max   -----DB-----  ---Non-DB---
 Pool   Size (M)  Size (M)  Active  Fault  Pages  Fault  Pages
   1    1065.64    293.56    +++++     .0     .0     .2    1.6
   2    1745.44         0        4     .9    2.9    1.8    4.6
   3      52.56         0        4     .0    1.3     .0     .4
   4    1068.52         0       12    3.2   27.2    3.9   24.1

                                                                       Bottom
Command
===>
F3=Exit   F4=Prompt           F5=Refresh   F9=Retrieve   F10=Restart
F11=Display transition data   F12=Cancel   F24=More keys
```

- The overall processing unit use was 55.7 percent and did not reflect an excessively busy system.
- The elapsed time for measurement was greater than 5 minutes but less than 15 minutes–a good choice when looking for valid data that is not skewed by short surges of activity or long periods that tend to average out problems.
- The number of jobs in the system at first appeared high to Sue, but Bob explained that this number reflected all the jobs the system was keeping track of, even if they had finished but still had output yet to print (for example, job logs).
- The fault rate of the machine storage pool (always system pool 1) did not exceed 1 fault per second, indicating that pool 1 was large enough. (More information on performance tuning is available in the *Work Management* book.)
- The fault rate of the rest of the machine storage pools (system pools 2 through 4) was not too heavy (database + nondatabase < 10) and the total faults of all the pools was less than 15. In general, main storage did not appear to be overcommitted.

Bob pressed F11 to select the second view.

```
                           Work with System Status                    SYS400
                                                             07/07/98  14:07:43
% CPU used . . . . . . . :       55.7    Auxiliary storage:
Elapsed time . . . . . . :   00:09:31      System ASP . . . . . . :    8.12 G
Jobs in system . . . . . :        102      % system ASP used  . . :   57.5494
% perm addresses . . . . :      2.483      Total  . . . . . . . . :    8.12 G
% temp addresses . . . . :       .026      Current unprotect used :     326 M
                                           Maximum unprotect  . . :     328 M

Type pool size and activity level changes, press Enter.

System    Pool    Reserved    Max   Active->  Wait->   Active->
 Pool   Size (M)  Size (M)  Active   Wait     Inel      Inel
   1    1065.64   293.56     +++++     .0       .0        .0
   2    1745.44        0        4     2.5       .0        .0
   3      52.56        0        4     8.3       .0        .0
   4    1068.52        0       12    20.1      2.0        .0

                                                                        Bottom
Command
===>
F3=Exit   F4=Prompt           F5=Refresh   F9=Retrieve   F10=Restart
F11=Display transition data   F12=Cancel   F24=More keys
```

- The ratio of Wait->Ineligible to Active->Wait for the interactive pool (system pool 4) was approximately 10% and confirmed to Bob that the activity level was set properly. He added that many customers set their activity levels so that the Wait->Ineligible is always zero. The level could be too high, causing major problems during exceptionally busy periods.
- Active->Ineligible for system pool 4 was zero. Usually, any value greater than zero in the interactive storage pool is a good indication that jobs are exceeding their time-slice values and may be candidates for submission to batch for processing.

  Bob then issued the Work with Active Jobs (WRKACTJOB) command.

```
                           Work with Active Jobs                      SYS400
                                                             07/07/01  09:47:30
CPU %:   57.2     Elapsed time:   00:08:46     Active jobs:   35

Type options, press Enter.
  2=Change   3=Hold   4=End   5=Work with   6=Release   7=Display message
  8=Work with spooled files   13=Disconnect ...

Opt  Subsystem/Job  User        Type  CPU %  Function        Status
    QBATCH         QSYS        SBS      .0                   DEQW
      ARPOST       ACT07       BCH    24.4  PGM-AR320        RUN
    QCMN           QSYS        SBS      .0                   DEQW
    QCTL           QSYS        SBS      .0                   DEQW
      DSP01        QSYSOPR     INT      .0  MNU-MAIN         DSPW
    QINTER         QSYS        SBS     1.0                   DEQW
      DSP02        SHIP01      INT     1.3  MNU-SM001        DSPW
      DSP09        SERV02      INT      .0  CMD-WRKSPLF      DSPW
      DSP10        SERV03      INT      .7  PGM=CS110        RUN
                                                                       More...
Parameters or command
===>
 F3=Exit   F5=Refresh       F7=Find      F10=Restart statistics
F11=Display elapsed data   F12=Cancel   F23=More options   F24=More keys
```

- The active job count was 35. When divided into the number of jobs in the system (102/35=3.0), the result showed that Armstrong was doing a good job of cleaning up the job logs and keeping the number of jobs the system tracked to a minimum.
- No interactive jobs were using an excessive amount of processing unit use (more than 2 percent).

  Next, Bob issued the Work with Disk Status (WRKDSKSTS) command.

```
                           Work with Disk Status                     SYS400
                                                           07/07/01  10:03:59
Elapsed time:   00:09:11

             Size    %     I/O   Request   Read  Write   Read  Write    %
Unit  Type    (M)  Used    Rqs  Size (K)    Rqs   Rqs     (K)   (K)   Busy
  1   6603   1967  67.1     .7      6.3      .2     .4    8.3    5.3     9
  2   6603   1967  56.6    1.1      4.5      .2     .8    5.0    4.4     5
  3   6607   4194  55.3    1.1      6.5      .5     .6    6.9    6.2    13




                                                                      Bottom
Command
===>
F3=Exit   F5=Refresh   F12=Cancel   F24=More keys
```

- Except for disk unit 1 (load source unit), all the other units had approximately the same amount of space used, indicating an evenly distributed system, and none of those units were over 75 percent full.
- No one drive was busy more than 13 percent of the time, and they were well under the threshold of 40 percent.

The net result of Bob's initial observation of the system showed that the system was responding well to the workload at that moment in time. Sue again commented that this period of the day was a good representation of Armstrong's normal demands on the system.

Bob felt he had a good idea of what the overall system was doing, but he planned to later validate his findings by using the `Advisor` option on the Performance Tools menu. The **advisor** is a tool that can be run over data gathered by Collection Services to provide conclusions and recommendations about system performance. In the meantime, with the feedback from the different departments still pending, Bob suggested using another means of gathering performance data from the system. This could be done by starting Collection Services from the Start Performance Tools menu. Collection Services allows you to continuously collect data without operator intervention. Bob and Sue wanted to collect data automatically so they accessed the Performance topic in the iSeries Information Center to find out how to start Collections Services automatically. The collected data could then be reviewed through commands provided by Performance Tools.

Collection Services gathers data with very low overhead, so Bob knew that they could run their collections continuously with very little effect to their performance. Bob suggested they collect data with 15-minute collection intervals. Using this size interval time would help to identify peak workloads that deserved further attention. Any longer intervals might mask a problem. Because Bob and Sue were still not sure of the type of problem that existed, they decided not to run the Start

Performance Trace (STRPFRTRC) command at this time. **Tracing** is a process by which information about each job state transition is recorded in a special table. The data may later be dumped to a database file, which can then be processed by Performance Tools. Tracing can result in a large amount of collected data, which could affect system performance when dumped. Normally, a more selective collection process can be used during problem isolation to limit the amount of data.

Sue entered the STRPFRT command, selected option 2, then option 1, and specified the values as shown in the following display:

```
                         Start Collecting Data

Type choices, press Enter.

  Library  . . . . . . . . . . . . . .   QMPGDATA     Name
  Collection interval (minutes)  . . .   15.00        0.25, 0.5, 1, 5, 15, 30,
                                                        60
  Retention period:
    Days . . . . . . . . . . . . . . .   7            *PERM, 0-30
    Hours  . . . . . . . . . . . . . .   0            0-23
  Cycling:
    Time to synchronize cycle  . . . .   00:00:00     HH:MM:SS
    Frequency to cycle collections . .   24           1-24
  Create database files  . . . . . . .   *YES         *YES, *NO
  Collection profile . . . . . . . . .   *STANDARDP   *MINIMUM, *STANDARD,
                                                        *STANDARDP, *ENHCPCPLN






F3=Exit   F12=Cancel
```

Bob left and planned to return at the end of the week to review the output with her. By that time, Sue should have collected data over two days and had time to go over the results of her end-user survey.

Review

Bob lacked information on who was experiencing the performance problem, so he decided to take some preliminary steps in understanding how well the system was responding to the daily workload. He did this by using the standard system commands, which dynamically show usage of main storage, processing unit, and disk. The important point that Bob wanted Sue to understand was that these commands only displayed this information for a very specific point in time and could not be used to represent the system's performance under all the different workloads it had to handle. This was a quick means of looking for obvious resource problems.

Because Bob and Sue are running Collection Services continuously, they can review the data to see if the problem is occurring at a specific time of the day.

In most everyday situations, performance data can be collected continuously to get a good idea of system activity and trends. Sampling intervals of longer duration (20 to 30 minutes) are fine for normal system tracking, but Bob and Sue are investigating a possible problem. Shorter intervals (10 to 15 minutes) would help to highlight a problem.

Still critical to Bob's investigation was the result of Sue's survey. They still did not know what kind of a problem they were facing. It is important to thoroughly define the problem.

Reviewing the End-User Survey Results

On Tuesday, Sue received the final survey results from all the end users. Following is a copy of the survey form Sue distributed.

Armstrong Computer End-User Survey

On a scale of 1 to 5, please rate how well the computer system meets your needs in the following categories:

1 = Excellent, 2 = Satisfactory, 3 = Average,
4 = Needs some improvement, 5 = Needs much improvement

1. Availability of the computer ___
2. Interactive response time ___
3. Timeliness of printed output requests ___
4. Timeliness of batch run requests ___

For those items answered with a 4 or 5, please indicate any concerns you might have.____
____
____

(We will follow up this survey with personal interviews for those who would like to help the data processing department improve its services to all the end users.)

Thirty-seven surveys were returned. Sue decided to concentrate on only the returned forms that indicated a 4 of 5 in any of the categories. She noticed that only two of the surveys had reflected a dissatisfaction with the system, and both were from the order-entry department. Also, the only category with negative responses was number two, *Interactive response time*. One of the two negative surveys included the following comment: Ever since the new procedure, which allowed customers to call in their orders, was put into use, the system seemed to take a very long time before the entry display appeared.

Sue met briefly with the order-entry department to discuss their survey responses and to better understand their performance requirements. During the meeting, Sue learned that the department's daily workload included both batch and interactive processing. Their batch jobs ran mostly in the evenings unattended and were not presenting a problem. The interactive jobs, however, were experiencing much longer response times than the department's objective of 2 seconds. Sue reviewed some basic application requirements, such as the average number of database read operations per transaction, and could not readily determine the source of the problem. Sue then decided that it would be better to review her findings with Bob on Friday.

Analyzing System Performance

On Friday morning, Bob arrived to analyze the collected performance data. First, Sue updated him on the results of the survey. Bob was very interested in the concerns of the order-entry department and commented that they would investigate the order-entry application. First, he would like to analyze the system performance once more using the advisor. Below is the sequence of events and displays that Bob used to perform the system analysis using the advisor.

Bob started at the Performance Tools menu and selected the `Advisor` option. He then selected the appropriate library and member and pressed the Enter key, which took him to the Select Time Intervals to Analyze display.

```
                       Select Time Intervals to Analyze

Member . . . . . . . .   PERFPROB      Library  . . . . . . :  QPFRDATA

Type options, press Enter
  1=Select

                   ---Tns----  --CPU Util---  High Util  --Pool Fault/Sec--
Opt  Date   Time   Cnt    Rsp  Tot  Int  Bch  Dsk  Unit  Mch  Usr  ID  Excp
 _   01/15  08:15  309    .84   16   10    3    1  0001    0    0  03  1920
 _   01/15  08:29  266    .46    6    3    1    1  0001    0    0  03  1015
 _   01/15  08:44  635    .87   24   15    5    1  0001    0    0  03  1174
 _   01/15  08:59  494    .92   53   30   15    1  0001    0    0  03  1229
 _   01/15  09:14  318    .70   62   32   20    1  0001    0    0  03  1103
 _   01/15  09:29  526    .89   71   40   25    1  0001    0    0  03  1573
 _   01/15  09:44  574    .73   43   20   15    1  0001    0    0  03  1668
 _   01/15  09:59  399    .94   48   20   19    1  0001    0    0  03  1350
 _   01/15  10:14  243   4.45   11    5    2    1  0001    0    0  03  1920
 _   01/15  10:29  246   1.49   24   15    3    1  0001    0    0  03  1834


                                                                        Bottom
F3=Exit   F5=Refresh   F11=Display histogram   F12 Cancel   F13=Select all
```

Bob suggested to Sue that they analyze all the intervals at this stage to get an idea of overall system performance. Sue agreed and Bob pressed F13 (Select all) and pressed the Enter key.

```
                           Display Recommendations

Member . . . . . . . :   PERFPROB        Library   . . . . . . :  QPFRDATA
System . . . . . . . :   SYS400          Version/release   . . :  5/1.0
Start date . . . . . :   07/01/01        Model   . . . . . . . :  D45
Start time . . . . . :   08:00:01        Serial number . . . . :  XX-XXXX
Type options, press Enter.
  5=Display details
Option     Recommendations and conclusions
  _                         Recommendations
  _        Examine error logs for indications of problems.
  _                           Conclusions
  _        Pool 3 fault rate is well below guidelines of 25.0
  _        Pool 4 fault rate is well below guidelines of 25.0
  _        Pool 2 W->I transition zero. Fault rate within guidelines.
  _        No performance problems were detected in system data file.
  _        No performance problems found on SDLC line MCLINE
  _        No performance problems found with DIOP(s)
  _        No performance problems found with CIOP(s)
  _                      Interval Conclusions
  _        ASP 1 arm % busy ranged from 21.9% on arm 0008 to 10.2% on arm 0004.
  _        Total system I/O during all selected intervals was 436203 .
                                                                      More
F3=Exit   F6=Print   F9=Tune system   F12=Cancel   F21=Command line
```

The Display Recommendations display showed Bob and Sue that the system was performing within the guidelines and that no system-related problems or errors where affecting the performance of the system. After having completed the system analysis using the advisor, which confirmed his analysis earlier in the week, he mentioned to Sue that another way to quickly analyze system data and view trends was to use performance graphics.

Using Performance Graphics—Manager Feature

Following is the sequence of events that Bob specified to produce the graphs. Bob went to the Performance Tools menu and selected Option 9 (Performance graphics). Then the following display appeared:

```
PERFORMG                Performance Tools Graphics
                                                            System:    SYS400

Select one of the following:

     1. Work with graph formats and packages
     2. Work with historical data
     3. Display graphs and packages

    70. Related commands










Selection or command
 ===> 3

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F16=System main menu
```

Bob explained to Sue that Performance Tools contains numerous pre-formatted graphs for customers to user. Option 1 allows the user to work with the graph formats and packages, and option 2 allows the user to create historical data from data collected over different monitor runs (for example, once a week for a month). Historical data summarizes performance members so you can display each member as a point on the historical graph. Then a user can view system performance trends in a graphical format. Because Armstrong had previously not been collecting performance data, Sue agreed to set up a collection schedule for once a week to establish some historical data. Bob suggested they use the IBM-supplied graph formats to show performance graphs (rather than historical graphs), so they selected option 3 (Display performance data graphs).

```
                          Display Graphs and Packages

Select one of the following:

     1. Display performance data graphs
     2. Display historical data graphs













Selection or command
 ===> 1

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel
```

Bob pointed out that the QIBMxxx formats are supplied by IBM. He commented that a good graph to begin with is the processing unit use versus time (by job type), so they selected the QIBMCPUTYP member and pressed the Enter key.

```
                       Select Graph Formats and Packages

Library  . . . . . . . . . . .   QPFRDATA

Type options, press Enter.
  1=Select   5=Display sample graph  8=Display package contents

        Format/
Option  Package     Type      Description
     QIBMPKG     PACKAGE   IBM GRAPH PACKAGE
     QIBMASYNC   FORMAT    Asynchronous Disk I/O per Second vs. Time
     QIBMCMNIOP  FORMAT    Communications IOP Utilization vs. Time
     QIBMCPUPTY  FORMAT    CPU Utilization vs. Time (Priority)
  1  QIBMCPUTYP  FORMAT    CPU Utilization vs. Time (Job Type)
     QIBMDSKARM  FORMAT    Disk Arm Utilization vs. Time
     QIBMDSKIOP  FORMAT    Disk IOP Utilization vs. Time
     QIBMDSKOCC  FORMAT    Percentage of Disk Occupied vs. Time
     QIBMLWSIOP  FORMAT    Local Workstation IOP Utilization vs. Time
     QIBMMFCIOP  FORMAT    Multifunction IOP (Comm) Util vs. Time
     QIBMMFDIOP  FORMAT    Multifunction IOP (Disk) Util vs. Time
                                                                       More
F3=Exit   F10=Restore list   F12=Cancel   F14=Sort by type   F15=Sort by name
F16=Sort by Description
```

On the following display Bob selected the performance data member to be graphed.

```
                        Select Performance Data Member

Library . . . . . .   QPFRDATA

Type options, press Enter.
  1=Select

        Member
Option  Name        Description                             Date      Time
  1     PERFPROB                                            07/07/01  14:33:24











                                                                      Bottom
F3=Exit   F5=Refresh      F12=Cancel   F15=Sort by member
F16=Sort by Description   F19=Sort by date/time
```

On the following display Bob pressed F6 (Include all data) and pressed the Enter key and proceeded to the next display (Figure 135 on page 334) containing the graph.

```
                   Select Categories for Performance Graphs

Member  . . . . . :   PERFPROB
  Library . . . . :     QPFRDATA

Type options, press Enter.  Press F6 to include all data in the graph.
  1=Select

Option     Category
           Job
           User ID
           Subsystem
           Pool
           Communications line
           Control unit
           Functional area





                                                                     Bottom
F3=Exit   F6=Include all data   F12=Cancel
```

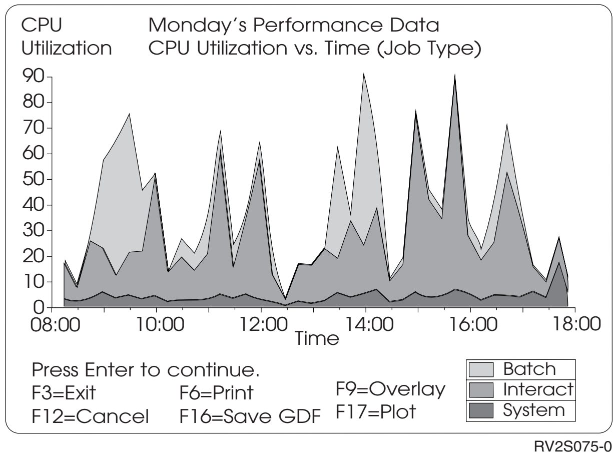
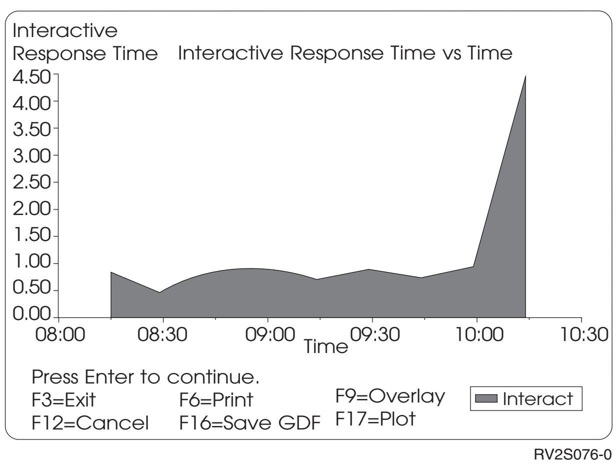
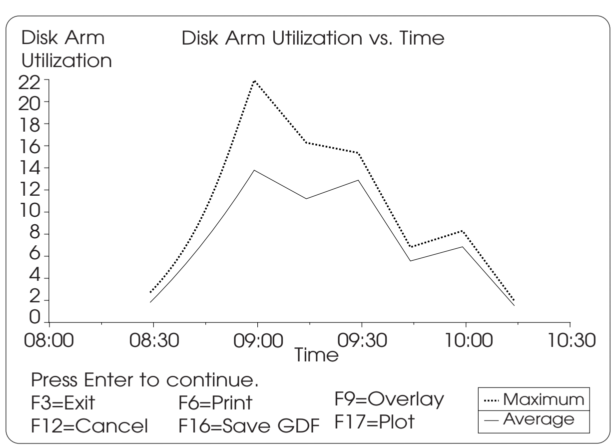
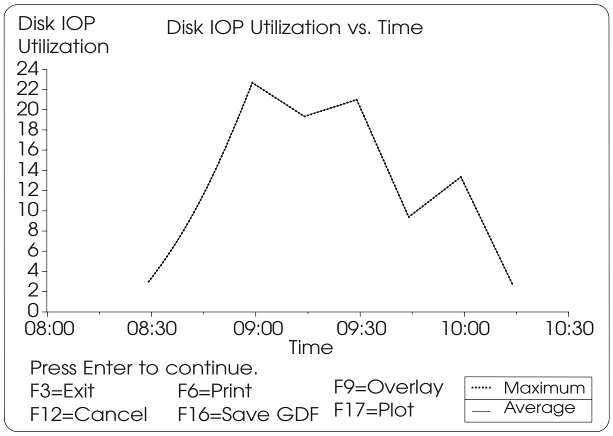


Figure 135. CPU Utilization

Here Bob commented to Sue that he would only show the first two and one-half hours of the collected data to give her a quick idea of what it would look like. He did this by changing the start and stop parameters to produce the following displays. The following are the graphs that Bob and Sue elected to look at (that is, they followed the same previous steps to use the formats QIBMRSP, QIBMDSKARM, and QIBMDSKIOP).







RV2S079-0

Bob then explained the graphs that they had produced and commented to Sue that the processing unit use, disk arm use, and disk IOP use showed no resource problems, and that the graphs were a quick way to pick up those types of problems without having to analyze the reports. The interactive response time graph, however, did show an abnormality just after 10:00 a.m., which should be investigated further. While the graphs gave a clear overview of how the system was performing, in Armstrong's situation, more detailed analysis was required of the gathered data.

Another way to review the collected data was to use the Display Performance Data (DSPPFRDTA) command. They could quickly see a summary of all the data interactively and isolate data of interest, which they could explore further. Following is the sequence of steps Bob used to perform further analysis.

```
                              Display Performance Data

Member . . . . . . . .   PERFPROB            F4 for list
  Library  . . . . . .     QPFRDATA

Elapsed time . . . . :   09:53:52       Version  . . . . . . :   5.0
System . . . . . . . :   SYS400         Release  . . . . . . :   1.0
Start date . . . . . :   07/07/01       Model  . . . . . . . :   510-2144
Start time . . . . . :   08:00:01       Serial number  . . . :   XX-XXXXX
QPFRADJ. . . . . . . :   0              QDYNPTYSCD . . . . . :   1

CPU utilization (priority) . . . . . . . . . . . :         23.55
CPU utilization (other)  . . . . . . . . . . . . :         14.78
Job count  . . . . . . . . . . . . . . . . . . . :           172
Transaction count  . . . . . . . . . . . . . . . :         15098
Transactions per hour  . . . . . . . . . . . . . :          1525
Average response (seconds) . . . . . . . . . . . :          1.45
Disk utilization (percent) . . . . . . . . . . . :          7.29
Disk I/O per second  . . . . . . . . . . . . . . :          20.9
Logical DB I/O for DDM jobs. . . . . . . . . . . :          52.9


F3=Exit      F4=Prompt   F5=Refresh   F6=Display all jobs   F10=Command entry
F12=Cancel   F24=More keys
```

1. As in the earlier Work with Active Job (WRKACTJOB) and Work with Disk Status (WRKDSKSTS) commands, Bob found that the overall use of the processing unit and disk was not exceptionally high. Also, Sue agreed with Bob that the average response time of 1.45 seconds was acceptable. (This value reflects the internal response time of the system and does not include line transmission time, which is usually not a big difference for local work stations.)

Bob then pressed F15 (Display by interval), which is available after pressing F24 (More keys).

```
                             Display by Interval

Member . . . . . . . :   PERFPROB        Elapsed time . . . . :   09:53:52
  Library  . . . . . :     QPFRDATA

Type options, press Enter.  Press F6 to display all jobs.
  5=Display jobs

                               CPU      Job       Tns    Average    Disk
Option  Date      Time        Util     Count     Count  Response     I/O
_       07/07/01  08:15:00   16.11        19       309       .84     486
_       07/07/01  08:29:59    6.97        16       226       .46    2897
_       07/07/01  08:44:57   24.97        25       635       .87   11705
_       07/07/01  08:59:56   53.18        28       494       .92   16719
_       07/07/01  09:14:54   62.45        24       318       .70   17373
_       07/07/01  09:29:53   71.60        31       526       .89   20635
_       07/07/01  09:44:51   43.06        29       574       .73    9642
_       07/07/01  09:59:49   48.08        19       399       .94    9409
5       07/07/01  10:14:47   11.97        15       243      4.45    3076
_       07/07/01  10:29:45   24.45        23       246      1.49   12556
                                                                       Bottom
F3=Exit   F6=Display all jobs   F12=Cancel   F13=Display by subsystem
F14=Display by job type
```

The Display by Interval display showed that the system was performing well for most of the users. Bob quickly rolled through all the displays, searching for the intervals where the average response times seemed noticeably higher than the average from the previous Display Performance Data display. Bob explained that if an intermittent response time problem existed, the shorter sampling interval should help to highlight it. This logic is not foolproof, he added, because high transaction counts could still reduce the average response time and mask a problem.

2. Bob found several intervals where the average response exceeded the 1.45 second average significantly. He reviewed the data to see who was having the worst response times by:
   a. Selecting option 5 (Display jobs) on the Display by Interval display
   b. Pressing F24 (More keys)
   c. Pressing F21 (Sort by response)

```
                                Display Jobs

Interval  . . . . :   10:14:47          Member  . . . . . :   PERFPROB
Elapsed time  . . :   09:53:52            Library . . . . :     QPFRDATA

Type options, press Enter.
  5=Display job detail

                                           Job      CPU      Tns     Avg    Disk
Option  Job         User        Number  Type    Util     Count    Rsp     I/O
  5     DSP18       ORDENTRY01  014273  INT      .55        17   15.6     169
  5     DSP19       ORDENTRY02  014274  INT     1.55        21   13.4     252
        DSP38       CREDIT03    014343  INT      .71         6    3.0     389
        DSP14       RECV01      014337  INT      .04         1    2.0      54
        DSP34       SALES02     014339  INT      .32        11    1.4     243
        DSP41       CREDIT01    014285  INT     1.93        24    1.3     493
        DSP11       SHIPPING01  014289  INT      .34         8    1.3     251
        DSP01       QSYSOPR     014276  INT     2.10        51     .8     832
        DSP22       SALES01     014322  INT      .55        28     .7     311
        DSP40       ACTRCV01    014329  INT     2.32        62     .3     216
                                                                       Bottom
F3=Exit           F12=Cancel   F15=Sort by job   F16=Sort by job type
F19=Sort by CPU   F24=More keys
```

DSP18 and DSP19 had very high average responses, but the total number of disk I/Os for each of these jobs did not appear to be high. Sue confirmed that these were the order-entry users that had been complaining.

3. Bob entered option 5 (Display job detail) on the Display Jobs display for both these jobs to further investigate them.

```
                             Display Job Detail

Job  . . . . . . . . :   DSP18          Job type . . . . . . :   INT
  User . . . . . . . :     ORDENTRY01    Subsystem  . . . . . :   QINTER
  Number . . . . . . :     014273        Pool . . . . . . . . :   04
Member . . . . . . . :   PERFPROB       Priority . . . . . . :   20
  Library  . . . . . :     QPFRDATA      Elapsed time . . . . :   09:53:52


            CPU       Tns    Average      Disk   Act->  Wait->   Act->
Interval  Seconds    Count  Response      I/O    Wait    Inel     Inel
10:14:47    2.070       17     15.6       169      .9      .0       .0






                                                                       Bottom
Press Enter to continue.

F3=Exit   F11=View 2   F12=Cancel   F15=Sort by interval   F24=More keys
```

The Display Job Detail display allowed Bob to review the job's resource requirements in greater detail. There are actually three views that make up the total detail picture.

As Bob scanned the interval data for DSP18, he remarked that the I/O counts per transaction did not justify the high response time average. Also, the Wait->Inel and the Act->Inel were both zero, indicating that the job was obtaining and holding an activity level when needed.

DSP19 showed the same situation.

Bob proceeded to review all the detail information for those two jobs. The following conclusions were drawn:

- Both jobs were experiencing extremely wide variations in average response times.
- These variations were occurring between 9:30 a.m. and 4:00 p.m. on both of the days that data was collected.
- Resource utilizations (processing unit, disk, and main storage) were not excessively high at those times.

Bob mentioned to Sue that these two jobs were definite candidates for further investigation. The sample data, however, would not give them the detail to determine the actual cause of the erratic response times. They would need to capture another type of data using the Start Performance Trace command. Trace data would give them greater detail on individual transactions, such as the program that was most likely running. First, though, they would meet with the order-entry personnel to get more information on how they use the system and what types of problems they were experiencing.

Sue made arrangements for all of them to meet.

Review

Bob reviewed the system performance by using the advisor to confirm his earlier conclusion about system performance. Bob and Sue then used the graphics to quickly see if there were intervals that showed particularly bad response times and high use of system resources (higher than the guidelines). This helped Bob and Sue focus on certain time intervals rather than the whole time period.

Bob decided that another way to quickly review the daily workload and its effect on system resources was to use the Display Performance Data (DSPPFRDTA) command. Rather than scan a printed report, he could interactively scan the collected sample data and isolate individual jobs that might be experiencing poor performance.

Normally, sample data could be collected with longer intervals (20 to 30 minutes) over longer periods (possibly all day) and be used to track the system's performance trends. This would enable a company to better manage its system's resources and perhaps prevent major performance surprises.

Though Sue informed Bob of the particular jobs to investigate, Bob decided to initially use the Display Performance Data command to review the overall system statistics. He then proceeded to focus on individual jobs. Bob could have just as easily selected only the order-entry jobs to look at. With no previous data to look at, Bob wanted to view all the jobs to get a feel for Armstrong's system usage.

Even with this type of data, more detail on what a job is doing must be gathered using the trace parameter of the Start Performance Trace command if the cause of the problem is to be isolated. Tracing, however, can generate a great deal of data and could affect the end users when dumping the trace tables. Tracing should only be used when in problem analysis mode and for shorter periods of time than when collecting just sample data. Bob wants to talk to the end users to help him understand the problem and hopefully trace the system at the most opportune time.

Understanding the Symptoms of the Problem

The two order-entry clerks met with Bob and Sue. Bob questioned them on the types of operations they performed, the problems with the system, and the types of additions or changes made that may be related to their problems. The following items were the results of their discussion:

1. Karen and Tim work in the order-entry department as clerks, processing the orders that are mailed in daily. They have their own private work station area, which restricts them from viewing each other's activities. Early in the morning, the orders are broken into two stacks. Each of the clerks takes a stack and types it into its own separate transaction file on the system. At the end of the day, a batch program posts both transaction files to the main order file. Basically, the orders are not officially in the system until the day after they are typed.
2. Armstrong gives its largest customers the ability to call in urgent orders. Normally, only Karen has the authority to take the call and run a menu option that allows her to enter the order directly into the order file without being first held in a transaction file. This type of action usually occurs about twelve to twenty times a day and requires very short interactive response times because the customer is on the telephone as the order is entered. In the past, Karen has had no problem with completing an entire telephone order in under 40 seconds.
3. Recently, Armstrong had changed its policy, allowing all of its customers the ability to call in urgent orders and inquire about order status. This has caused the number of telephone orders to increase to a point where, now, both Karen and Tim are authorized to take telephone orders and enter them directly into the order file. Each of them currently averages 40 calls a day. It seems to them that the same menu option that took less than a second to bring up the display can now take 30 to 40 seconds. This caused serious problems with customers waiting on the telephone.

Bob suggested a plan to help find the cause of the intermittent response time problem. Because transferring collected trace data to a database file might affect all of the users on the system, his plan involved controlling both the amount of time that the monitor ran and when the trace data would be dumped to a file.

Sue would run the Start Performance Trace (STRPFRTRC) command and end the tracing after one hour (ENDPFRTRC command). She would have the option to dump the trace table when she ended the trace. At the end of each run, she would call Karen or Tim and ask if the problem occurred. If it had, Sue would give Bob a call, and, at the end of the day, end the performance trace with the ENDPFRTRC command. If the problem had not occurred, Sue would continue to let the trace run. The problem happened often enough, so it should only take a few attempts to capture the necessary data.

They all agreed that this would be the best approach to resolve the problem without affecting the rest of the users. They would start the procedure that afternoon. Bob made arrangements to be back on Monday morning.

The following shows how Sue entered the Start Performance Trace (STRPFRTRC) command that afternoon:

```
                      Start Performance Trace (STRPFRTRC)

 Type choices, press Enter.

 Size . . . . . . . . . . . . . . SIZE           *CALC
 Omit trace points  . . . . . . . OMTTRCPNT      *NONE

                           Additional Parameters

 Job types  . . . . . . . . . . . JOBTYPE        *DFT
                          + for more values
 Job trace interval . . . . . . . JOBTRCITV      0.5

                                                                        Bottom
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
```

Initially in the afternoon, the problem did not occur. Later, however, Sue received word that Tim experienced two major response time problems when trying to enter a telephone order. At the end of the day (after most of the users had signed off), Sue issued the End Performance Trace (ENDPFRTRC) command to prepare the necessary data for Bob. The command looked like this:

```
                       End Performance Trace (ENDPFRTRC)

 Type choices, press Enter.

 Dump the trace . . . . . . . . .   *YES          *NO, *YES
 Member . . . . . . . . . . . . .   oeproblem     Name
 Library  . . . . . . . . . . . .   QPFRDATA      Name
 Text 'description' . . . . . . .   Order Entry Problem - Trace On

                                                                        Bottom
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
```

With that accomplished, Sue was ready for Bob's visit on Monday.

Analyzing the Data—Manager Feature

Bob returned that Monday. After Sue related the activities of Friday afternoon, the next step was to begin analyzing the data. Because the Display Performance Data command could only show sample data, Bob chose to print a job summary report using the Print Transaction Report (PRTTNSRPT) command. To reduce the amount of printed output to be analyzed, the report was limited to only the order-entry jobs.

```
                    Print Transaction Report (PRTTNSRPT)

Type choices, press Enter.

Member . . . . . . . . . . . . . . > oeproblem     NAME
Report title . . . . . . . . . . . > Order Entry Problem - Trace On

Report type  . . . . . . . . . . .   *SUMMARY      *SUMMARY, *TNSACT, *TRSIT...
               + for more values
Time period for report:

  Starting time  . . . . . . . .     *FIRST        TIME, *FIRST

  Ending time  . . . . . . . . .     *LAST         TIME, *LAST


                          Additional Parameters

Library  . . . . . . . . . . . . .   QPFRDATA      NAME
Report option  . . . . . . . . . .   *SS           *SS, *SI, *OZ, *EV, *HV, ' '

                                     *EV
                                                                    More...
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display        F24=More keys
```

```
                         Print Transaction Report (PRTTNSRPT)

Type choices, press Enter.

Select jobs  . . . . . . . . . . .   *ALL          Character value, *ALL

               + for more values
Omit jobs  . . . . . . . . . . . . > *NONE         Character value, *NONE

               + for more values

Select users . . . . . . . . . . .   ordentry*     Name, generic*, *ALL      .

               + for more values
Omit users . . . . . . . . . . . .   *NONE         Name, generic*, *NONE
               + for more values
Select pools . . . . . . . . . . .   *ALL          1-16, *ALL
               + for more values
Omit pools . . . . . . . . . . . .   *NONE         1-16, *NONE
               + for more values
Select functional areas  . . . . .   *ALL

               + for more values
Omit functional areas  . . . . . .   *NONE

                                                                    More...
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display        F24=More keys
```

The following pages show selected sections from the Print Transaction Report output with areas that Bob highlighted and discussed with Sue.

Job Summary

The job summary for the order-entry department had the report and results shown in Figure 136 on page 345.

The following information was extracted from this report:

- The average response time for ORDENTRY01 was 3.2 seconds and at least one of its transactions lasted 38.2 seconds. ORDENTRY01 is Tim's user profile. What was happening to that job?
- The average processing unit time per transaction was .24 seconds with at least one transaction using .42 processor seconds. These times could not be the reason for the poor performance.
- ORDENTRY01 showed an average of 15 disk I/O operations per transaction and a worst case of 51 disk I/Os per transaction. Using .05 seconds as an average disk I/O service time, these numbers do not justify the exceptionally long response times.

Sue asked Bob about the two in the *Lock Conflict* column. Bob remarked that this value indicated the number of times that ORDENTRY01 needed to wait for an object being held by another job.

This first page of the report indicated to Bob that Tim was definitely experiencing poor response times, especially because his workload was similar to Karen's. Bob needed further information on what components of the response time were causing the problem.

System Summary Data

Bob scanned further down the report to look at interactive transaction averages and exceptional-wait breakdown by job type. See Figure 137 on page 346.

The following performance information was extracted from this report:

- The average response time for 57 transactions was 1.613 seconds. This does not appear to be too high.
- However, the amount of processing unit time and disk time per transaction do not justify the 1.613 response time.
- Of the 1.613 seconds, 1.314 is spent in what is known as exceptional wait. The Excp Wait/Tns time is that portion of response time that cannot be attributed to processing unit or disk usage and is caused by contention for internal system resources (for example, waiting for a message queue). Normally, this value should be less than 10 percent of the total average response time.
- Almost all of the exceptional wait time is being spent in the Lock Wait category. (Remember Sue's question?)

Bob saw further data supporting the existence of a problem. He explained to Sue that these high numbers still reflected averages.

Analysis by Interactive Response Time

The next section Bob looked at in the report (Analysis by Interactive Response Time) would help define the makeup of the transactions as shown in Figure 139 on page 346.

The following information regarding response time was extracted from this trace report:

- Of the 57 transactions measured, only two were greater than 10 seconds, and together they averaged 36.664 seconds.
- Almost all of that time (36.497 seconds) was spent as exceptional wait time. Remember that exceptional wait time is nonproductive time. What were those two transactions doing?

This section of the report allows Bob to help evaluate performance versus objectives. Bob sees that both jobs are actually getting excellent service most of the time. Two transactions, however, seem to be the source of the high averages.

Individual Transaction Statistics

Bob needed to find out more about those two transactions, so he scanned further down the report to the Individual Transaction Statistics section as shown in Figure 138 on page 346.

This section lists the individual transactions of various statistics (longest response time, processing unit, service time, and so on).

- ORDENTRY01 had two very long response times during the collection period, one at 14:23:27 (38.157 seconds) and the other at 14:32:08 (35.171 seconds).
- Bob noticed that, at both of these times, the program involved in the transaction was ORD110.

Transactions with Longest Lock Wait Time

Bob then looked at the Transactions with the longest lock wait time.

At the same time as those long transactions, ORDENTRY01 experienced extremely long lock waits. In fact, almost the entire time spent in the transactions was spent waiting on locks. Again, program ORD110 was involved.

Bob and Sue now had an idea of what was causing the problem. But what kind of lock was it and why couldn't ORDENTRY01 get that lock? More questions needed answering.

Longest Seize/Lock Conflicts

Bob's next step was to go to the Longest Seize/Lock Conflicts section of the Job Summary Report. An example of this section is in Figure 141 on page 347.

This section lists the longest seize/lock conflicts in descending order with the time it happened, the requesting job, the holding job, and the held object.

- The two transactions with the long response times for ORDENTRY01 are listed here as the two longest instances of a lock conflict. The times coincide with those earlier in the report.
- The holding job (preventing ORDENTRY01 from obtaining the necessary lock) in both instances was ORDENTRY02 (Karen's interactive job).
- The lock request is for a file called ORDCTL in library OELIB.

Bob narrowed the problem to a conflict between the two jobs ORDENTRY01 and ORDENTRY02. However, Bob wanted to get a little more information on the transactions that both ORDENTRY01 and ORDENTRY02 were running during the lock conditions. Further detail on the transactions in question could be explored by running another Print Transaction Report, this time asking for transition detail information. This report normally produces a great deal of output. The report could be efficiently reviewed by selecting only the jobs and times involved with the problem.

Bob entered the Print Transaction Report (PRTTNSRPT) command to get the following display:

```
                    Print Transaction Report (PRTTNSRPT)

Type choices, press Enter.

Member . . . . . . . . . . . . . . > OEPROBLEM     Name
Report title . . . . . . . . . . > 'Order Entry Problem - Transitional Report'

Report type  . . . . . . . . . .   *TRSIT        *SUMMARY, *TNSACT, *TRSIT...
               + for more values
Time period for report:

  Starting time  . . . . . . . .   142000        TIME, *FIRST

  Ending time  . . . . . . . . .   143500        TIME, *LAST


                          Additional Parameters

Library  . . . . . . . . . . . .   QPFRDATA      Name
Report option  . . . . . . . . .   *SS           *SS, *SI, *OZ, *EV, *HV, ' '

               + for more values
                                                                       More...
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display        F24=More keys
```

```
                         Print Transaction Report (PRTTNSRPT)

Type choices, press Enter.

Select jobs  . . . . . . . . . .   *ALL          Character value, *ALL

               + for more values
Omit jobs  . . . . . . . . . . . > *NONE         Character value, *NONE

               + for more values

Select users . . . . . . . . . .   ordentry*     Name, generic*, *ALL       .

               + for more values
Omit users . . . . . . . . . . .   *NONE         Name, generic* *NONE
               + for more values
Select pools . . . . . . . . . .   *ALL          1-16, *ALL
               + for more values
Omit pools . . . . . . . . . . .   *NONE         1-16, *NONE
               + for more values
Select functional areas  . . . .   *ALL

               + for more values
Omit functional areas  . . . . .   *NONE

                                                                        Bottom
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display        F24=More keys
```

Notice that this time the output had been reduced to only showing information about the ORDENTRY01 and ORDENTRY02 jobs between 14:20:00 and 14:35:00.

Transition Report for ORDENTRY01

The example report in Figure 142 on page 347 shows sections of the Transition Report resulting from the PRTTNSRPT command just issued.

First, Bob scanned the Transition Report for ORDENTRY01 and noticed:

- At 14.23.28.135, ORDENTRY01 went into a lock wait for 37.819 seconds because of a request for file ORDCTL, over which job ORDENTRY02 had a lock.

- ORD110 appeared to be the order-entry program asking for the file. Programs starting with the letter Q (for example, QDBGETSQ) are normally IBM-supplied system service routines.
- The same condition appeared to be happening at 14.32.08.691.

Transition Report for ORDENTRY02

Next, Bob scanned the Transition Report for ORDENTRY02 and noted that at the times surrounding the lock waits for ORDENTRY01 (14.23.17.455 to 14.24.05.954 and 14.31.48.059 to 14.32.43.665), ORDENTRY02 was also running ORD110. An example of this report is in Figure 143 on page 348.

Bob felt that exploring program ORD110 might help them understand why the locks were occurring. Sue took Bob to the data processing department to talk with Armstrong's lead programmer.

Review

Bob and Sue together determined that they would first select only the order-entry jobs when producing the transaction summary reports. They could do this only because they had a good idea of the jobs in question. Under different circumstances, using all of the jobs as input to the report may be necessary. Limit the number of transactions to analyze whenever possible.

Through the different sections of the report, Bob was able to isolate not only the job in trouble, but also the individual transactions, times, and programs involved in the problem.

It is important to note that Bob did not stop at finding the job having a problem. It is much more critical that the cause of the problem be found. ORDENTRY01 is the job preventing ORDENTRY02 from obtaining service. By looking at job transition information and matching times, the suspected program (ORD110) was identified.

With this information, Bob and Sue could now approach the application developers for a solution.

Case Study Data Reports—Manager Feature

Analyzing the data in the following example reports helped Bob and Sue understand their problem.

Job Summary Reports

```
                                             Job Summary Report                                                 07/08/01 10:33:42
                                                Job Summary                                                             Page 0001
                                     Order-Entry Problem - Trace On

Member  . . . : OEPROBLEM  Model/Serial  . . : 510-2144/XX-XXXXX  Main storage . . :  384.0 M   Started  . . . . : 07/07/01 14:03:19
  Library . . : QPFRDATA   System name . . . :      SYS400        Version/Release  :   5/ 1.0   Stopped  . . . . : 07/07/01 14:57:50

                     *On/Off*    T  P  P  Tot  Response Sec        CPU Sec        ---- Average DIO/Transaction -----   Number  K/T
   Job        User     Job       y  t  r  Nbr  -------------  ------------------  ------ Synchronous ----- --Async--    Cft    /Tns
   Name       Name     Number Pl p  y  g  Tns    Avg    Max   Util   Avg    Max   DBR  NDBR  Wrt  Sum  Max  Sum  Max  Lck Sze  Sec
---------- ---------- ------ -- -- -- - ----  ------ ------  ---- ------ ------  ---- ---- ---- ---- ---- ---- ----  ------  -----
DSP18      ORDENTRY01 031288  02 I  20 N   26     3.2   38.2    .4    .24    .42     4    8    3   15   51    1   13    2   2    85
DSP19      ORDENTRY02 031289  02 I  20 N   31      .3    2.0    .5    .26    .87     3    9    2   14   29                        74
```

Figure 136. Job Summary: Order-Entry Problem - Trace On

```
 DATA FOR SELECTED TIME INTERVAL (OR TOTAL TRACE PERIOD IF NO TIME SELECTION).

  INTERACTIVE TRANSACTION AVERAGES BY JOB TYPE.

 T                                     Avg     CPU/   ----- Sync Disk I/O Rqs/Tns -----  Async   W-I     Excp    Key/    Active  Est
 y        Nbr     Nbr    Pct    Tns    Rsp     Tns     DB    DB     NDB   NDB             DIO    Wait    Wait    Think   K/T     Of
 p  Prg  Jobs     Tns    Tns   /Hour  (Sec)   (Sec)   Read  Write   Read  Write   Sum    /Tns   /Tns    /Tns     /Tns   /Tns    AWS
 -- ---  ----  ------  -----  -----  ------  ------  -----  -----  -----  -----  -----  -----  ------  -------  ------  ------  ---
I   NO      2      57  100.0     62   1.613    .253      3      2      8      1     14      0    .000    1.314  79.092  55.254

  EXCEPTIONAL WAIT BREAKDOWN BY JOB TYPE.

                       A-I         Short      Short       Seize      Lock        Event      Excs       EM3270     DDM Svr      Other
                       Wait        Wait       WaitX       Wait       Wait        Wait       ACTM        Wait       Wait         Wait
Type        Purge      /Tns        /Tns       /Tns        /Tns       /Tns        /Tns       /Tns        /Tns       /Tns         /Tns
----        -----      ------      ------     ------      ------     ------      ------     ------      ------     -------      ------
I           NO          .000        .033       .000        .003      1.277        .000       .001        .000        .000         .
```

Figure 137. Data for Selected Time Interval

```
                                                      Job Summary Report                                              07/08/01 18:33:42
                                              Individual Transaction Statistics                                               Page 0021
                                                Order-Entry Problem - Trace On

Member  . . . : OEPROBLEM  Model/Serial  . . : 510-2144/XX-XXXXX Main storage . . :  384.0 M   Started  . . . . : 07/07/01 14:03:19
  Library . . : QPFRDATA     System name . . . :      SYS400     Version/Release  :   5/ 1.0   Stopped  . . . . : 07/07/01 14:57:50

TRANSACTIONS WITH LONGEST RESPONSE TIMES

Rank        Value        Time         Program        Job Name         User Name          Number        Pool       Type       Priority
----       --------   ------------   ----------     ----------       ----------         ------        ----       ----      ---------
  1          38.157   14.23.27.921   ORD110         DSP18            ORDENTRY01         031288         02         I             20
  2          35.171   14.32.08.618   ORD110         DSP18            ORDENTRY01         031288         02         I             20
  3           2.274   14.36.11.625   QUIINMGR       DSP18            ORDENTRY01         031288         02         I             20
  4           1.951   14.41.22.705   QUIINMGR       DSP19            ORDENTRY02         031289         02         I             20
  5           1.543   14.05.56.163   QUIINMGR       DSP18            ORDENTRY01         031288         02         I             20
  6           1.041   14.05.47.886   QUIINMGR       DSP18            ORDENTRY01         031288         02         I             20
  7            .777   14.35.55.734   QUIINMGR       DSP18            ORDENTRY01         031288         02         I             20
  8            .567   14.33.08.820   QUIINMGR       DSP19            ORDENTRY02         031289         02         I             20
  9            .562   14.35.40.131   QUIINMGR       DSP18            ORDENTRY01         031288         02         I             20
 10            .491   14.29.15.071   QUIINMGR       DSP19            ORDENTRY02         031289         02         I             20
```

Figure 138. Individual Transaction Statistics

```
ANALYSIS BY INTERACTIVE RESPONSE TIME.
                    Avg                   Cum     Avg               Cum     ----- Sync Disk I/O Rqs/Tns -----    Async   Excp      Avg
                    Rsp     Nbr    Pct    Pct     CPU      CPU      CPU      DB     DB     NDB    NDB              DIO     Wait      K/T
    Category        /Tns    Tns    Tns    Tns     /Tns     Util     Util    Read   Write   Read   Write   Sum     /Tns    /Tns     /Tns
----------------  -------  -----  -----  -----  -------   -----    -----   -----  -----  -----  -----  -----    -----  -------  --------
Sub-Second           .332     51   89.5   89.5     .229      .2       .2       1      1      2             4               .037   51.979
1 - 1.999 Sec       1.512      3    5.3   94.8     .498               .2       7            12      9     28        1             10.028
2 - 2.999 Sec       2.274      1    1.8   96.6     .419               .2       2     25      1     23     51       13              1.185
3 - 4.999 Sec                             96.6                        .2
5 - 9.999 Sec                             96.6                        .2
GE 10 Seconds      36.664      2    3.5  100.1     .091               .2                     2             2              36.497  233
```

Figure 139. Analysis by Interactive Response Time

```
TRANSACTIONS WITH LONGEST LOCK WAIT TIME

Rank        Value        Time         Program        Job Name         User Name          Number        Pool       Type       Priority
----       --------   ------------   ----------     ----------       ----------         ------        ----       ----      ---------
  1          37.822   14.23.27.921   ORD110         DSP18            ORDENTRY01         031288         02         I             20
  2          34.977   14.32.08.618   ORD110         DSP18            ORDENTRY01         031288         02         I             20
  3
  4
  5
  6
  7
  8
  9
 10
```

Figure 140. Transactions with Longest Wait Time

```
                                      Job Summary Report                                      07/08/01 10:33:42
                                   Longest Seize/Lock Conflicts                                       Page 0026
                                  Order-Entry Problem - Trace On

Member  . . . : OEPROBLEM  Model/Serial  . . : 510-2144/XX-XXXXX Main storage . . :  384.0 M   Started  . . . . : 07/07/01 14:03:19
  Library . . : QPFRDATA     System name . . . :      SYS400     Version/Release  :   5/ 1.0   Stopped  . . . . : 07/07/01 14:57:50

                             Job        User      Job                        Holder- Job Name.. User Name. Number   Pool  Type  Pty
Rank   Value       Time          Name       Name     Number Pl Typ Pty S/L  Object- Type.. Library... File...... Member.... RRN......
---- --------  ------------  ---------- ---------- ------ -- --- --- ---  ----------------------------------------------------------
  1   37.819  14.23.28.135  DSP18      ORDENTRY01 031288 02  I   20  L   HOLDER- DSP19      ORDENTRY02 031289    02    I     2
                                                                          OBJECT- DS     OELIB      ORDCTL     ORDCTL
  2   34.974  14.32.08.691  DSP18      ORDENTRY01 031288 02  I   20  L   HOLDER- DSP19      ORDENTRY02 031289    02    I      20
                                                                          OBJECT- DS     OELIB      ORDCTL     ORDCTL
  3     .090  14.32.43.670  DSP18      ORDENTRY01 031288 02  I   20  S   HOLDER- DSP19      ORDENTRY02 031289    02    I      20
                                                                          OBJECT- DS     OELIB      ORDCTL     ORDCTL
  4     .089  14.24.05.959  DSP18      ORDENTRY01 031288 02  I   20  S   HOLDER- DSP19      ORDENTRY02 031289    02    I      20
                                                                          OBJECT- DS     OELIB      ORDCTL     ORDCTL
```

Figure 141. Longest Seize/Lock Conflicts

Transition Reports

```
                                      Transition Report                                       07/087/01 11:41:45
                                  Order-Entry Problem - Trace On                                      Page 0001

Member  . . . : OEPROBLEM  Model/Serial  . . : 510-2144/XX-XXXXX Main storage . . :  384.0 M   Started  . . . . : 07/07/01 14:20:00
  Library . . : QPFRDATA     System name . . . :      SYS400     Version/Release  :   5/ 1.0   Stopped  . . . . : 07/07/01 14:35:00
Job name  . . : DSP18        User name . . . . :    ORDENTRY01   Job number . . . :   031288   TDE/Pl/Pty/Prg . :     01B4 02 20

Job type  . . : I       Elapsed Time -- Seconds           Sync/Async Phy I/O     -MPL-
                        -----------------------        ------------------------ C  I     Last 4 Programs in Invocation Stack
             State Wait   Long   Active   Inel    CPU    DB    DB  NDB   NDB      u  n ------------------------------------------
    Time     W A I Code   Wait    /Rsp*   Wait    Sec    Read  Wrt Read  Wrt  Tot r  l    Last      Second      Third      Fourth
------------ ----- ---- ------- ------- ------- -------- ---- ---- ---- ---- ---- -- -- ---------- ---------- --------------------

*****    NO  Is The New Purge Attribute.       -

14.23.27.921 ->A                                                                 1
14.23.28.135       LKWT      */  37.819/*                       HOLDER-- DSP19       ORDENTRY02 031289
                                                                 OBJECT- DS     OELIB      ORDCTL     ORDCTL
14.23.28.136 W<-   LKW             .215           .078                           1    QDBGETSQ   ORD110     QUIMNDRV   QUICMENU
14.24.05.957 ->A        37.822                                                   2
14.24.05.959       SZWT      */    .089/*                       HOLDER-- DSP19       ORDENTRY02 031289
                                                                 OBJECT- DS     OELIB      ORDCTL     ORDCTL
14.24.06.077 W<-                   .120           .014                           2    QT3REQIO   QWSGET     ORD110     QUMNDRV
 ----------  ORD110              38.157*          .092    0    0    4    0    4*


<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<    Later in the report...    >>>>>>>>>>>
;>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>



14.32.08.618 ->A       167.297                                                   1
14.32.08.691       LKWT      */  34.974/*                       HOLDER-- DSP19       ORDENTRY02 031289
                                                                 OBJECT- DS     OELIB      ORDCTL     ORDCTL
14.32.08.692 W<-   LKW             .075           .075                           1    QDBGETSQ   ORD110     QUIMNDRV   QUICMENU
14.32.43.669 ->A        34.977                                                   2
14.32.43.670       SZWT      */    .090/*                       HOLDER-- DSP19       ORDENTRY02 031289
                                                                 OBJECT- DS     OELIB      ORDCTL     ORDCTL
14.32.43.788 W<-                   .119           .014                           2    QT3REQIO   QWSGET     ORD110     QUIMNDRV
 ----------  ORD110              35.171*          .089    0    0    0    0    0*
14.33.24.806 ->A        41.018    .001            .001                           1
                                                               2
14.33.24.918   W                   .112           .019                           1    QT3REQIO   QWSCLOSE   QDMCLOSE   ORD110
                                                                                      PAG=    0  XSum=    0 PWrt=    2
14.33.24.949   A                   .030           .001                           1
14.33.25.012   W                   .064           .057                           1    QT3REQIO   QWSPUT     QUIMNDRV   QUICMENU
14.33.25.072   A                   .059           .001                           1
14.33.25.087 W<-                   .015           .014                           1    QT3REQIO   QWSGET     QUIMNDRV   QUICMENU
 ----------  QUIMNDRV             .281*          .093    0    2    0    0    2*      PAG=    0  XSum=    0 PWrt=    2
```

Figure 142. Transition Report for ORDENTRY01

```
                                                          Transition Report                                        07/08/01 11:31:45
                                                    Order-Entry Problem - Trace On                                         Page 0003

Member  . . . : OEPROBLEM  Model/Serial  . . : 510-2144/XX-XXXXX Main storage . . :  384.0 M   Started  . . . . : 07/07/01 14:20:00
  Library . . : QPFRDATA     System name . . . :      SYS400     Version/Release  :   5/ 1.0   Stopped  . . . . : 07/07/01 14:35:00
Job name  . . : DSP19        User name . . . . :    ORDENTRY02   Job number . . . :   031289   TDE/Pl/Pty/Prg . :    01C3 02 20

Job type  . . : I       Elapsed Time -- Seconds           Sync/Async Phy I/O    -MPL-
                        -----------------------        ------------------------ C   I     Last 4 Programs in Invocation Stack
             State Wait   Long   Active   Inel    CPU    DB    DB  NDB   NDB      u   n -------------------------------------------
    Time     W A I Code   Wait    /Rsp*   Wait    Sec    Read  Wrt Read  Wrt  Tot r   l    Last      Second      Third      Fourth
------------ ----- ---- ------- ------- ------- -------- ---- ---- ---- ---- ---- -- -- ---------- ---------- --------------------

*****    NO  Is The New Purge Attribute.      -

14.22.44.088   A                 .027             .001                               1
14.22.44.145   W                 .057             .055                               1    QT3REQIO   QWSPUT     QUIMNDRV   QUICMENU
14.22.44.222   A                 .077                                                1
14.22.44.237 W<-                 .016             .014                               1    QT3REQIO   QWSGET     QUIMNDRV   QUICMENU
 ----------  QUIMNDRV            .350*            .088    0    2    0    1    3*        PAG=    0  XSum=    0 PWrt=    3
14.23.17.455 ->A        33.217   .001             .001                               1
14.23.17.538 W<-                 .083             .082                               1    QT3REQIO   QWSGET     ORD110     QUIMNDRV
 ----------  ORD110              .084*            .083    0    0    0    0    0*
14.24.05.885 ->A        48.347                                                       1
14.24.06.954       LKRL                                             WAITER- DSP18       ORDENTRY01 031288     37.819 SECS
                                                                    OBJECT- DS     OELIB      ORDCTL     ORDCTL
14.24.06.049       SZRL                                             WAITER- DSP18       ORDENTRY01 031288       .089 SECS
                                                                    OBJECT- DS     OELIB      ORDCTL     ORDCTL
14.24.06.061   W                 .176             .018                               2    QT3REQIO   QWSCLOSE   QDMCLOSE   ORD110
                                                                                          PAG=    0  XSum=    0 PWrt=    3
14.24.06.094   A                 .033             .001                               1
14.24.06.151   W                 .057             .055                               1    QT3REQIO   QWSPUT     QUIMNDRV   QUICMENU
14.24.06.228   A                 .077                                                1
14.24.06.243 W<-                 .016             .015                               1    QT3REQIO   QWSGET     QUIMNDRV   QUICMENU
 ----------  QUIMNDRV            .359*            .089    0    2    0    1    3*        PAG=    0  XSum=    0 PWrt=    3


<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<   Later in the report...   >>>>>>>>>>>
;>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

 ----------  QUIMNDRV            .219*            .135    0    0    0    0    0*
14.31.48.059 ->A       148.910                                                       1
14.31.48.138 W<-                 .079             .077                               1    QT3REQIO   QWSGET     ORD110     QUIMNDRV
 ----------  ORD110              .079*            .077    0    0    0    0    0*
14.32.43.598 ->A        55.460   .001             .001                               1
14.32.43.665       LKRL                                             WAITER- DSP18       ORDENTRY01 031288     34.974 SECS
                                                                    OBJECT- DS     OELIB      ORDCTL     ORDCTL
14.32.43.760       SZRL                                             WAITER- DSP18       ORDENTRY01 031288       .090 SECS
                                                                    OBJECT- DS     OELIB      ORDCTL     ORDCTL
                                                               2         1
14.32.43.773   W                 .175             .018                               2    QT3REQIO   QWSCLOSE   QDMCLOSE   ORD110
                                                                                          PAG=    0  XSum=    0 PWrt=    3
14.32.43.806   A                 .034             .001                               1
14.32.43.865   W                 .058             .057                               1    QT3REQIO   QWSPUT     QUIMNDRV   QUICMENU
14.32.43.942   A                 .077                                                1
14.32.43.957 W<-                 .015             .014                               1    QT3REQIO   QWSGET     QUIMNDRV   QUICMENU
 ----------  QUIMNDRV            .360*            .091    0    2    0    1    3*        PAG=    0  XSum=    0 PWrt=    3
```

Figure 143. Transition Report for ORDENTRY02

Finding the Cause and Correcting the Problem

Mike Brown was the senior applications programmer for Armstrong. Although not directly responsible for the order-entry application code, he could get the necessary documentation on ORD110 for Bob so that the record lock problem could be analyzed.

1. Mike and Bob reviewed the program's flowchart and source code and were able to determine that ORD110 is an RPG/400 program that opens four files:

   CUSMSTL
   Customer master file, input only

   ORD110D
   Work station display file, input and output

   ORDFILL
   Open orders file, output only (add)

ORDCTL
: Order control file, update

2. When *Enter a new order* is selected, ORD110 gets the single control record from ORDCTL, which contains the next order number. Every order must have a unique order number.
3. The order-entry clerk responds to a prompt from display file ORD110D, asking the clerk for the customer number. This customer number is then used by the program to get customer information from the CUSMSTL logical file, which in turn is presented to the clerk.
4. The clerk enters the necessary order data. When finished, the data is added to ORDFILL as a new order.
5. Finally, the order number field of the control record is incremented by one and written back to ORDCTL. This allows the next order entered to have the next higher order number.

To Bob and Mike, the record lock conflict for ORDCTL was very obvious. With only one clerk using ORD110, the lock on the control record for update did not present any problem. Armstrong's original policy of having Karen as the only authorized user of ORD110 ensured that only one clerk would use ORD110. The other orders received through the mail would not be assigned an order number until the night time batch job.

With the change in policy allowing multiple clerks to access ORD110, two clerks could now attempt to enter an order at the same time. Only one clerk, though, could have the ORD110D display available to them because they would first need an exclusive lock on the control record. This record would be locked for the entire order process. The requesting job's display would be inhibited while the holding job completed its order. Because the process only lasted about 30 seconds, the control record was released before another requesting job timed out (the default wait time on a record lock is 60 seconds). Had the time-out occurred, a function check would have alerted the data processing department to a lock problem much sooner.

Mike quickly created a coding correction for ORD110 such that the reading, incrementing, and updating of the control record would be done at the end of the order process. This would allow the records to be locked and released in an instant and allow other jobs to do the same. Later on, a more efficient technique, such as using a data area to store the control information, could be further explored.

Sue would review the next day the performance data that had been collecting continuously to measure the results of the change. Bob felt that they did not need to continue running the performance trace. The order-entry department was to notify her if the response time situation occurred again. At a later date, Bob would return to work with Sue on developing some system monitoring practices that Armstrong should use with Performance Tools.

Final Review

The case study you just read is an example of one person's approach to solving a typical application performance problem. The methodology was based on several logical steps:

1. Understand the symptoms of the problem

   Initially, Bob was made aware of a problem with very little information to help him to solve it. His first actions involved using commands to determine how well the system was reacting to the overall workload. By isolating the users having problems and talking to them, he was able to identify their objectives and substantiate the existence of a problem. The information he collected through the interview with the order-entry personnel was critical in effectively analyzing the situation.

2. Use tools to measure and define the problem

   Performance Tools proved instrumental in determining not only what jobs were part of the problem, but also what programs were involved and at what times. Problems like poor response time have a definite cause and, in most cases, the available system tools can help capture and report the vital information. Selecting specific times and jobs enabled Bob to reduce the amount of data that had to be analyzed.

3. Isolate the cause and correct the problem

   Bob and Mike carefully analyzed the problem and examined the application and database design to develop a solution. They also ensured that the solution did not produce negative effects for other jobs or cause incorrect data in the business operations.

4. Use tools to verify the problem is corrected

   As mentioned earlier, Sue ran Collection Services continuously which allowed her to review the results of the change. If new problems appeared, the above steps would be repeated until the solution became acceptable.

Armstrong's story is an example of a single, isolated problem. In some cases, a system may have many different problems occurring at the same time. Prioritize the problems to select which items to investigate first. When those problems are resolved, go after the next in line until the situation no longer justifies the time and effort.

Another situation may be that a big problem is the result of an accumulation of many little design flaws. Some poor programming techniques may not affect one user much, but if multiplied by many jobs running at the same time, the result can be dramatic.

Finally, the fact may be that the resources are seriously overcommitted and that it is time for a model upgrade or another disk controller. Use the capacity planning option of Performance Tools to help you determine the additional resources needed to meet the performance objectives.

Learn the proper usage of the tools available to you, and start to put into place a strategy that will help you get the most out of your iSeries server.

Chapter 14. Working with Historical Data—Agent Feature

This chapter describes the commands used to maintain historical data. Historical data is a summary of the performance data created by Collection Services.

The Agent feature allows you to create historical data, which may then be analyzed on another iSeries server that has the Manager feature installed. You can also analyze the data using your own programs or queries. Historical data is transmitted to a central iSeries server for analysis using the Manager feature. The Manager feature provides the capability to present historical data in the form of graphics. Appendix C. Comparison of Performance Tools provides more information on the functions provided in Performance Tools.

Note: Files are created to contain the historical data. For each performance member with historical data, there is a single value for each type of information that can be graphed for each day of the member's performance collection period. Thus, the amount of data is reduced and summarized into the historical files. Once you have historical data for a member, you may choose to delete the performance data (DLTPFRDTA) created through the initial performance data collection to free file storage space.

Since historical data can help show trends in your system's performance, it is recommended that you create historical data in a given library for members that are collected at the same time. (For example, you might want to compare data that was all collected on Wednesdays from 8:00 a.m. to 12:00 p.m., whereas you probably would not want a historical data with one member collected on Wednesday from 8:00 a.m. to 12:00 p.m. and the other on Saturday from 1:00 to 5:00 p.m.)

To simplify data management, consider using separate libraries for comparable collections of data.

If you select option 3 (Work with historical data) on the Performance Tools Graphics menu, the Work with Historical Data display appears.

```
                         Work with Historical Data

Library . . . . . .   QPFRDATA

Type options, press Enter.
  1=Create historical data   4=Delete historical data

        Member      Historical
Option  Name           Data     Date      Time
  _     Q953180843      NO      11/14/95  08:43:15
  _     Q953171050      NO      11/13/95  10:51:00
  _     SATDATA         YES     11/11/01  10:42:48
  _     TESTDATA        YES     11/11/01  10:26:12
  _     NOV112001       NO      11/11/01  09:57:27
  _     Q953150955      NO      11/11/95  09:55:41
  _     FRIDAY          YES     11/10/01  11:17:03
  _     Q953132332      YES     11/09/95  23:32:19
  _     Q953121407      YES     11/08/95  14:07:11
  _     Q953121142      NO      11/08/95  11:42:30
  _     Q953111538      NO      11/07/95  15:39:02
                                                                       More...
F3=Exit   F5=Refresh   F11=Display text   F12=Cancel  F15=Sort by Member
F16=Sort by text
```

The member name, a historical data indicator, and the date and time you collected each set of performance data appear on this display. To display the member text description, press F11 (Display text). If you cannot find the data you want to work with, use the appropriate function key to sort the sets of performance and historical data. You can sort them by member name, text description, or by the date and time the member was created. When you find the data you want to work with, indicate the function you want to perform by typing the appropriate option.

If you are searching for performance or historical data located in a library that is different from the one currently listed in the *Library* field at the top of the display, type a new library name in the *Library* field and press the Enter key. A list of performance and historical data members available in the library you specified appears. You can then select one of them to work with.

Note: All of the members in the historical data must have unique names. If you create a member that has the same name as a historical data member, you may want to change the name by using the Copy Performance Data (CPYPFRDTA) command to use the new member for historical purposes.

Create Historical Data

To create historical data for performance members, type a 1 (Create) by the members, and press the Enter key. The Confirm Create of Historical Data display appears.

```
                      Confirm Create of Historical Data

Library . . . . . :   QPFRDATA

Press Enter to confirm your choices for 1=Create.
Press F12=Cancel to return to change your choices.

        Member      Historical
Option  Name           data     Date      Time
  1     Q953180843      NO      11/14/95  08:43:15
  1     Q953171050      NO      11/13/95  10:51:00
  1     SATDATA         YES     11/11/01  10:42:48









                                                                      Bottom
F11=Display text   F12=Cancel
```

On this display, press the Enter key to create historical data for the members. Once historical data has been created for a member, you can delete the original performance data using the Delete Performance Data (DLTPFRDTA) command if the data is not needed for performance analysis, capacity planning, or performance graphing.

Delete Historical Data

To delete the historical data created by the Create Historical Data command, type a 4 (Delete) by members that contain historical data, and press the Enter key. This does not delete the original performance data.

Note: If the performance data for a member no longer exists, you cannot re-create historical data for that member after the historical data has been deleted.

Chapter 15. Managing the Performance Data—Agent Feature

If you choose the `Manage performance data` option on the IBM Performance Tools menu for the Agent feature, the Manage Performance Data display appears.

```
                        Manage Performance Data

 Select one of the following:

      1. Delete performance data
      2. Copy performance data
      3. Convert performance data
      4. Create performance data














Selection or command
===> ______________________________________________________________________
___________________________________________________________________________
F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel
```

Note: Option 3 (Convert performance data) and option 4 (Create performance data) only appear when the current user profile has authority to the command related to the task.

From this display you can manage the performance data that you collected.

Delete Performance Data

Use option 1 (Delete performance data) on the Manage Performance Data display to delete performance data that you no longer need on your system. When you choose option 1, the Delete Performance Data display appears.

```
                        Delete Performance Data

Library . . . . . .   QPFRDATA__

Type option, press Enter.
  4=Delete
Option   Member       Text                                 Date       Time
  _      XYZ                                               12/15/01   14:05:55
  _      PERFTESTC4   2 hours w/ 5 minute intervals        12/15/01   08:05:48
  _      PERFTESTC3   Duration of 2 hours                  12/14/01   09:21:44
  _      PERFTESTC2                                        12/11/01   14:42:46















                                                                       Bottom
F3=Exit   F5=Refresh   F12=Cancel   F15=Sort by member   F16=Sort by text
```

The members that appear on this display are those used on the Create Performance Data (CRTPFRDTA) command for the keyword TOMBR. To delete a member from this list, type a 4 (Delete) next to the appropriate member and press the Enter key. The member you delete is deleted from the Collection Services data collection files.

Copy Performance Data

Use option 2 (Copy performance data) on the Manage Performance Data display to make copies of performance data members. When you choose option 2, the Select Performance Member display appears.

```
                        Select Performance Member

Library . . . . . .   QPFRDATA__

Type option, press Enter.
  1=Select

Option   Member       Text                                  Date       Time
  _      FRIDAY       Performance Data for Friday           10/27/01   10:05:46
  _      THURSDAY     Performance Data for Thursday         10/26/01   12:00:34
  1      WEDNESDAY    Performance Data for Wednesday        10/25/01   13:50:15
  1      TUESDAY      Performance Data for Tuesday          10/24/01   13:55:08
  1      MONDAY       Performance Data for Monday           10/23/01   16:25:39
  _      TESTRUN      Test run of system                    10/19/01   20:31:42
  _      Q952910958                                         10/18/95   09:58:45
  _      Q952902009                                         10/17/95   20:09:23






F3=Exit    F12=Cancel   F15=Sort by member   F16=Sort by text
F19=Sort by date/time
```

The members that appear on this display are those used on the Create Performance Data (CRTPFRDTA) command for the keyword TOMBR. To copy a member or members from the list, type a 1 (Select) next to the appropriate member(s) and press the Enter key.

The Copy Performance Data Member display appears.

```
                         Copy Performance Data Member

Type choices, press Enter.

--------Copy From--------    --------Copy To--------
Member         Library       Member        Library
MONDAY         QPFRDATA      MONDAY        NEWLIB
TUESDAY        QPFRDATA      TUESDAY       NEWLIB
WEDNESDAY      QPFRDATA      WEDNESDAY     NEWLIB
                                                                 Bottom















F3=Exit   F12=Cancel
```

This display shows you the members you selected to copy and where they are to be copied to. For each member listed, type the name of the new member and the library that contains it in the *Copy To* entries of the display, and then press the Enter key. When the copy completes, you have exact copies of the old performance members in the new performance members for the Collection Services collection files.

Convert Performance Data (CVTPFRDTA) Command

Use option 4 (Convert performance data) on the Configure and Manage Tools display.

When you select option 4, the Convert Performance Data (CVTPFRDTA) display appears. You can also use the CVTPFRDTA command to select the CVTPFRDTA display.

```
                 Convert Performance Data (CVTPFRDTA)

Type choices, press Enter.

From library . . . . . . . . . .  __________     Name
To library . . . . . . . . . . .  __________     Name
Job Description  . . . . . . . . *USRPRF____     Name, *USRPRF, *NONE
  Library  . . . . . . . . . . .  __________     Name, *LIBL, *CURLIB











                                                                    Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

The Convert Performance Data (CVTPFRDTA) command converts performance data from the previous release to the formats needed to be processed by the current release of the performance measurement/analysis tools. First, the release level on which the data was collected is determined. Then, all members of all files that need conversion are converted to the appropriate format.

The following files must be present for the conversion to take place:

QAPMCIOP
QAPMCONF
QAPMDIOP
QAPMDISK
QAPMJOBS or QAPMJOBMI and QAPMJOBOS
QAPMLIOP
QAPMPOOL
QAPMRESP
QAPMSYS or QAPMSYSCPU and QAPMJSUM

The following files are copied, or converted if necessary, if they are present:

QACPCNFG
QACPGPHF
QACPPROF
QACPRESP
QAITMON
QAPGHSTD
QAPGHSTI
QAPGPKGF
QAPMASYN
QAPMBSC
QAPMBUS
QAPMDMPT
QAPMECL
QAPMETH
QAPMHDLC
QAPMIDLC
QAPMLAPD
QAPMMIOP
QAPMSBSD
QAPMTSK
QAPMX25
QAPTAPGP

The conversion can be done in the library in which the current data resides, or in a different library. If the conversion is done in the same library, the current data is replaced by the new data. If the conversion is done in a different library, the new data exists in the new library while the current data continues to exist in the current library.

Note: If a different library is specified for the new data, those files in the current library that do not need conversion are copied to the new library.

To convert performance data collected prior to the current release, complete the following items on the display.

From library
Specifies the library that contains the data being converted.

To library
Specifies the library that contains the converted data.

Job Description
Specifies the job description used to submit the file-conversion job for batch processing.

The possible job description values are:

***USRPRF**
The job description defined for the submitting job's user profile.

job-description-name
Specify the name of the job description to be used.

***NONE**
A batch job is not submitted. Processing continues interactively while the user waits.

Note: The user's work station is not available for other use during this time, which can be significant for long jobs.

The possible library values are:

***LIBL** The library list is used to locate the job description.

***CURLIB**
The current library for the job is used to locate the job description. If no current library entry exists in the library list, QGPL is used.

library-name
The library where the job description is located.

Convert Performance Thread Data (CVTPFRTHD) Command

The Convert Performance Thread Data (CVTPFRTHD) command converts performance data records collected by Collection Services. The specified member of database file QAPMJOBS or file QAPMJOBL contains records with thread-level performance data. You can use the CVTPFRTHD command to convert the data and write the records to a member in file QAPMTJOB. The output file member contains records with job-level performance data which are a total of the performance information for all threads running within the job.

```
                    Convert Pfr Thread Data (CVTPFRTHD)

Type choices, press Enter.

Member . . . . . . . . . . . . .                 Name
Library  . . . . . . . . . . . .   QPFRDATA      Name
Replace  . . . . . . . . . . . .   *YES          *YES, *NO

                                                                       Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Create Performance Data (CRTPFRDTA) command

Use the Create performance data option on the Configure and Manage Tools display to create performance data. This command creates a set of database files from performance information that is stored in a management collection (*MGTCOL) object. The database files are discussed in the Performance topic in the iSeries Information Center.

When you select option 5, the Create Performance Data (CRTPFRDTA) command prompt display appears.

```
                    Create Performance Data (CRTPFRDTA)

Type choices, press Enter.

From collection  . . . . . . . .                 Name, *ACTIVE
  Library  . . . . . . . . . . .     QPFRDATA    Name
To member  . . . . . . . . . . .   *FROMMGTCOL   Name, *FROMMGTCOL
To library . . . . . . . . . . .   *FROMMGTCOL   Name, *FROMMGTCOL
Text 'description' . . . . . . .   *SAME

Categories to process  . . . . .   *FROMMGTCOL   Name, *FROMMGTCOL, *APPN...
               + for more values
Time interval (in minutes) . . .   *FROMMGTCOL   *FROMMGTCOL, 0.25, 0.5, 1...
Starting date and time:
  Starting date  . . . . . . . .   *FROMMGTCOL   Date, *FROMMGTCOL
  Starting time  . . . . . . . .                 Time
Ending date and time:
  Ending date  . . . . . . . . .   *FROMMGTCOL   Date, *FROMMGTCOL, *ACTIVE
  Ending time  . . . . . . . . .                 Time

                                                                       Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Typically, you will specify that you want the database files created when you start collecting data. If for some reason you chose not to create the database files when you collected data, use the CRTPFRDTA command to create the files at a later time.

Appendix A. Performance Tools Menu Authorities

The table in this appendix shows what authority is needed for objects that are referenced by the main Performance Tools menu (PERFORM) and the menu options. To see what the command authorities are needed for the Performance commands, refer to the *iSeries Security Reference* manual. Commands identified by (Q) are shipped with public authority *EXCLUDE. Appendix C of the *iSeries Security Reference* manual shows with IBM-supplied user profiles are authorized to the command. The security officer can grant *USE to others.

Following are descriptions of the columns in the tables:

Referenced Object: The objects listed in the *Referenced Object* column are objects to which the user needs authority when using the menu or the menu option.

Authority Needed for Object: The authorities specified in the table show the object authorities and the data auhtorities required for the object when using the menu or the menu options.

Authority Needed for Library: This column shows what authority is needed for the library containing the object. For most operations, *EXECUTE authority is needed to locate the object in the library. Adding an object to a libary usually requires *READ and *ADD authority.

Menu option	Referenced Object	Authority Needed	
		For Object	For Library
Access to PERFORM menu	PERFORM menu	*USE	*EXECUTE
	QPFR/QMNMAIN0 *PGM	*USE	*EXECUTE
1. Select type of status			
1.1. Work with system status	WRKSYSSTS command	*USE	*EXECUTE
1.2. Work with subsystem	WRKSBS command	*USE	*EXECUTE
1.3. Work with current job	WRKJOB command	*USE	*EXECUTE
1.4. Work with submitted job(s)	WRKSBMJOB command	*USE	*EXECUTE
1.5. Work with specified job(s)	WRKJOB command[3]	*USE	*EXECUTE
1.6. Work with active jobs	WRKACTJOB command[3]	*USE	*EXECUTE
1.7. Work with disk status	WRKDSKSTS command	*USE	*EXECUTE
2. Collect performance data			
2.1. Start collecting data	Collection object library		*USE
2.2. Stop collecting data			
3. Print performance reports			
3. (Print performance reports - Sample data)			
3.1. System report	Performance data[2]		*ADD, *READ
	Job description	*USE	*EXECUTE
3.2. Component report	Performance data[2]		*ADD, *READ
	Job description	*USE	*EXECUTE

Menu option	Referenced Object	Authority Needed	
		For Object	For Library
3.3. Job report	Performance data[2]		*ADD, *READ
	Job description	*USE	*EXECUTE
3.4. Pool report	Performance data[2]		*ADD, *READ
	Job description	*USE	*EXECUTE
3.5. Resource report	Performance data[2]		*ADD, *READ
	Job description	*USE	*EXECUTE
3. (Print performance reports - Trace data)			
3.1. Transaction report	QAPMDMPT *FILE	*CHANGE	*ADD, *READ
	Job description	*USE	*EXECUTE
3.2. Lock report	PRTLCKRPT command (Q)	*USE	*EXECUTE
	QAPMDMPT *FILE	*CHANGE	*ADD, *READ
	Job description	*USE	*EXECUTE
3.3. Batch job trace report	Trace file (QTRJOBT) library		*EXECUTE
	Job description	*USE	*EXECUTE
4. Capacity Planning	QPFR/QCYBMAIN *PGM	*USE	*EXECUTE
	Performance data (all QAPM* files)	*USE	*EXECUTE
	Model library		*EXECUTE, *ADD
5. Performance Utilities			
5.1. Work with job traces			
5.1.1. Start job trace	STRJOBTRC command (Q)	*USE	*EXECUTE
	QPFR/QPTTRCJ1 *PGM	*USE	*EXECUTE
5.1.2. Stop job trace	ENDJOBTRC command (Q)	*USE	*EXECUTE
	QPFR/QPTTRCJ0 *PGM	*USE	*EXECUTE
	Output file library		*EXECUTE
	Job description	*USE	*EXECUTE
5.1.3. Print job trace reports	PRTJOBTRC command (Q)	*USE	*EXECUTE
	QPFR/QPTTRCRP *PGM	*USE	*EXECUTE
	Job trace file (QAPTTRCJ) library		*EXECUTE
	Job description	*USE	*EXECUTE
5.2. Work with Performance Explorer			
5.2.1. Add Performance Explorer Definition	ADDPEXDFN command (Q)	*USE	*EXECUTE
	QUSRSYS/QAPEXDFN *FILE	*OBJOPR, *ADD	*EXECUTE
5.2.2. Change Performance Explorer Definition	CHGPEXDFN command (Q)	*USE	*EXECUTE
	QUSRSYS/QAPEXDFN *FILE	*CHANGE, *ALTER	*EXECUTE
5.2.3. Remove Performance Explorer Definition	RMVPEXDFN command (Q)	*USE	*EXECUTE
	QUSRSYS/QAPEXDFN *FILE	*OBJOPR, *DLT	*EXECUTE
5.2.4. Start the Performance Explorer	STRPEX command (Q)	*USE	*EXECUTE
	QUSRSYS/QAPEXDFN *FILE	*OBJOPR, *READ	*EXECUTE

Menu option	Referenced Object	Authority Needed	
		For Object	For Library
5.2.5. End the Performance Explorer	ENDPEX command (Q)	*USE	*EXECUTE
	QPEXDATA[1]*LIB		*EXECUTE, *ADD[2]
5.2.6. Print Performance Explorer Reports	PRTPEXRPT command	*USE	*EXECUTE
	QPEXDATA[1]*LIB		*EXECUTE, *ADD[2]
5.2.7. Delete Performance Explorer Data	DLTPEXDTA command (Q)	*USE	
	QPEXDATA[1]*LIB		*EXECUTE, *ADD[2]
5.3. Select file and access group utilities			
5.3.1. Analyze program/file use	ANZPGM command (Q)	*USE	*EXECUTE
	QPFR/QPTANZPC *PGM	*USE	*EXECUTE
	Application libraries that contain the programs to be analyzed		*EXECUTE
	Job description	*USE	*EXECUTE
5.3.2. Analyze physical/logical file relationships	ANZDBF command (Q)	*USE	*EXECUTE
	QPFR/QPTANZDC *PGM	*USE	*EXECUTE
	Application libraries that contain the database files to be analyzed		*EXECUTE
	Job description	*USE	*EXECUTE
5.3.3. Analyze file key structure	ANZDBFKEY command (Q)	*USE	*EXECUTE
	QPFR/QPTANZKC *PGM	*USE	*EXECUTE
	Job description	*USE	*EXECUTE
5.3.4. Collect/display access group data	DSPACCGRP command (Q)	*USE	*EXECUTE
	QPFR/QPTPAGD0 *PGM	*USE	*EXECUTE
	Output file (QAPTPAGD)	*CHANGE	*EXECUTE, *ADD
5.3.5. Analyze access group data	ANZACCGRP command (Q)	*USE	*EXECUTE
	QPFR/QPTPAGA0 *PGM	*USE	*EXECUTE
	Job description	*USE	*EXECUTE
5.4. Start performance trace	STRPFRTRC command (Q)	*USE	*EXECUTE
5.5. End performance trace	ENDPFRTRC command (Q)	*USE	*EXECUTE
6. Configure and manage tools			
6.1. Work with functional areas	Functional areas library		*CHANGE
6.2. Delete performance data	Performance data (all QAPM* files)	*CHANGE	*EXECUTE
6.3. Copy performance data	From library		*EXECUTE
	To library		*EXECUTE, *ADD
6.4. Convert performance data	CVTPFRDTA command (Q)	*USE	*EXECUTE
	To library		*USE, *ADD
	From library		*USE
	Job description	*USE	*EXECUTE

Menu option	Referenced Object	Authority Needed	
		For Object	For Library
6.5. Create performance data	CRTPFRDTA command (Q)	*USE	*EXECUTE
	To library		*ADD, *READ
	From library		*EXECUTE
7. Display performance data	Performance data[2]		*ADD, *READ
8. System activity			
8.1. Work with system activity	WRKSYSACT command (Q)[3]	*USE	*EXECUTE
	QPFR/QITMONCP *PGM	*USE	*EXECUTE
	Output file (QAITMON)	*CHANGE, *ALTER	*EXECUTE, *ADD
8.2. Print activity report	PRTACTRPT command (Q)	*USE	*EXECUTE
	QPFR/QITPRTAC *PGM	*USE	*EXECUTE
	Activity file (QAITMON) library		*USE
	Job description	*USE	*EXECUTE
9. Performance Graphics			
9.1. Work with graph formats and packages	Format or package library		*EXECUTE, *ADD
9.2. Work with historical data			
9.2.1. Create historical data	CRTHSTDTA command (Q)	*USE	*EXECUTE
	QPFR/QPGCRTHS *PGM	*USE	*EXECUTE
	Performance data[2]		*EXECUTE, *READ, *ADD
9.2.2. Delete historical data	QAPGHSTD *FILE in the historical data library	*CHANGE	*EXECUTE
	QAPGHSTI *FILE in the historical data library	*CHANGE	*EXECUTE
	QAPGSUMD *FILE in the historical data library	*CHANGE	*EXECUTE
9.3. Display graphs and packages			
9.3.1. Display performance data graphs	Format or package library		*EXECUTE
	Performance data[2]		*EXECUTE
	Output file library		*EXECUTE, *ADD
	Output queue	*USE	*EXECUTE
9.3.2. Display historical data graphs	Format or package library		*EXECUTE
	Historical data library		*EXECUTE
	Output file library		*EXECUTE, *ADD
	Output queue	*USE	*EXECUTE
10. Advisor	Performance data [2]		*ADD, *READ

1 If default library (QPEXDATA) is specified, authority to that library is not checked.

2 Authority is needed to the library that contains the set of database files. Authority to the individual set of database files is not checked.

3 To use this command, you must have *JOBCTL special authority.

Granting access to all of the commands or to a group of users

Follow these steps to grant access to all of the commands or to a group of users:

1. Ggrant *USE authority to *ALL for the Performance Tools commands.
2. Grant *USE authority to *ALL *PGMs in the QPFR library.
3. Grant *CHANGE authority to the Performance library.

Granting access to a specific interface

Follow these steps to grant access to users for a specific interface:

1. Grant *USE authority to the interface that you want the user to access.
2. Grant *USE authority to its State to call program (CPP). Use the Display Command (DSPCMD) to find this value or refer to the Security Reference table D90.
3. Grant the corresponding authorities to the performance library according to the Security Reference table D90.

For example, if you wanted to authorize a user to the Start Performance Tools menu. You would need to grant the following authorities:

1. *USE authority to STRPFRT .
2. *USE authority to QMNMAIN0. This is the State to call program (CPP) value for the STRPFRT command.
3. *READ and *ADD authorities to the performance library.

Appendix B. Defining Transaction Boundaries

Performance tools reports show different values for transaction service time and resource use, depending on what command you use to analyze the performance data. These values vary because of differences in the data collected by the commands, and can supply different values for the transaction boundary start and end times. Be careful when you analyze and compare data collected for the same run using different tools.

Some of the commands used in this appendix are available only in the Manager feature. Appendix C. Comparison of Performance Tools, provides additional information about Performance Tools functions.

Elements of Response Time

The elements of end-user (external) response time to interactive transactions are composed of communications time (input and output) and host (internal) response time, as shown in Figure 144. For locally attached display stations, communications time managers the local Work Station Input/Output Processor (IOP) time. For remotely attached display stations, communications time includes communications line time, communications IOP time, and Remote Work Station Controller time as appropriate.

```
<──────────────── End-User Response Time ────────────────>
                 (External Response Time)
│              │                             │              │
│──────────────┼─────────────────────────────┼──────────────│
│              │                             │              │
Input             Host Response Time          Output
Communications  (Internal Response Time)      Communications
Time                                          Time
```

Figure 144. Elements of Interactive Response Time

The interactive response time values reported by the Work with Active Job (WRKACTJOB), Print System Report (PRTSYSRPT), Print Component Report (PRTCPTRPT), and Print Transaction Report (PRTTNSRPT) commands refer only to the host (internal) response time. (An exception to this is the Local Work Station Report, shown in Figure 35 on page 91. This report does factor in local work station IOP time.)

For locally attached displays, the communications time is usually less than 1 second. For remote displays, the communications time may be longer. To approximate the actual time, use the line speed and number of characters sent and received, assuming that the line is not heavily loaded. If the line is heavily loaded, the external response time increases due to the queuing time. Review the line utilization and data transmission values on the System Report, shown in “What Is the System Report?” on page 73 to determine line component to approximate line time.

You can also use the BEST/1 capacity planning tool to estimate external response times at local and remote display stations, because BEST/1 projects both internal and external response times. BEST/1 supports only 5250-type devices that are attached either locally through twinaxial cable, remotely through SDLC communications lines, or through LAN-attached work stations.

The host response time can, however, be shown in more detail, as in Figure 145.

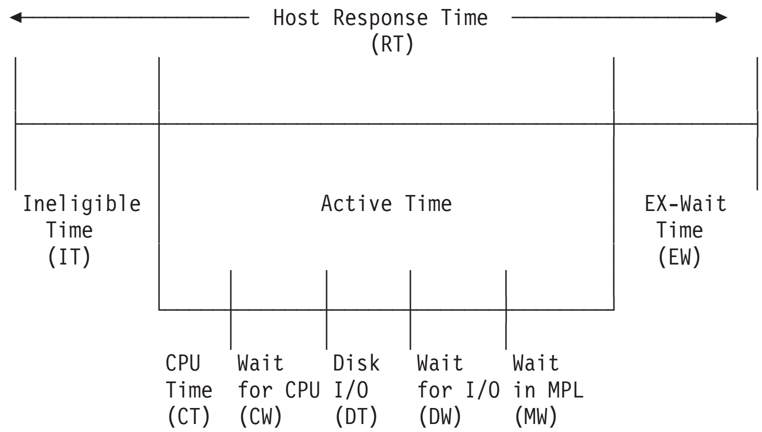


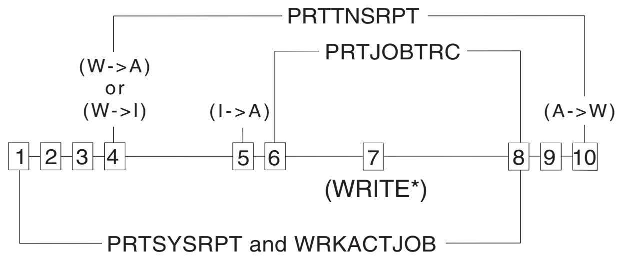
Figure 145. Elements of Host Response Time

Note: Multiprogramming Level (MPL) is a term used interchangeably with Activity Level.

The average ineligible time, processing unit time, wait in MPL time, and exceptional wait time per transaction are available directly from the output of the PRTTNSRPT command.

Differences in the Transaction Response Reports

Figure 146 on page 369 compares the ways that the Print Job Trace (PRTJOBTRC) command, the PRTTNSRPT command, the PRTSYSRPT command, and the WRKACTJOB command determine transaction boundaries.



Work Station I/O Manager
(1) External I/O request received (PRTSYSRPT start)
(2) Licensed internal code processing complete
(3) Job put into activity level or ineligible state
(4) Trace record generated (PRTTNSRPT start)

OS/400 System Application
(5) Ineligible time complete (I-A)
(6) Return to QWSGET (Start of transaction on job trace)
(7) Write to Work Station

Work Station I/O Manager
(8) Call QT3REQIO (End of transaction on job trace, Transaction response times, PRTSYSRPT transaction end)
(9) Job goes to IOM to wait on I/O (PRTSYSRPT transaction end)
(10) A-W trace recorded (PRTTNSRPT transaction end)

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Figure 146. Comparison of Transaction Boundary Definitions

PRTSYSRPT and WRKACTJOB define a transaction from the time it is processed by the Licensed Internal Code I/O manager (Licensed Internal Code IOM) until the system work station I/O program QT3REQIO is called to wait for input.

PRTTNSRPT defines a transaction from the time trace records are produced at the beginning when the job state changes from wait-to-active or wait-to-ineligible (the start) until the job goes to a long wait (active-to-wait).

Note: Values *DI and *DQ on the OPTION parameter use existing transaction boundary trace records to count transactions instead of the wait-to-active transition.

These commands include the time the job spent in the ineligible state waiting for an activity level as part of the transaction response time.

PRTJOBTRC defines a transaction from the time the job becomes eligible (for example, it is granted an activity level) within the system work station input program (QWSGET), until the system work station I/O program QT3REQIO is called to wait for input.

Note: This command does not include the time spent in the ineligible state waiting for an activity level in the transaction boundary definition.

Operational Considerations

Limitations exist in the system's ability to detect certain types of transactions.

When you review performance reports, be aware of when your system workload consists of any of the following types of work:

- Programmable work station servers
- Distributed data management (DDM) servers
- 3270 emulation jobs
- Finance terminals
- Pass-through jobs

Transaction-type data (such as the data collected for throughput and response time) is unavailable sometimes, and in some instances (such as for finance types of work), cannot be associated with the individual jobs or terminals that originated the transactions.

When you find that differences exist between the sample data reports (PRTSYSRPT or PRTCPTRPT) and the trace data report (PRTTNSRPT), it is often due to the presence of one or more of these types of work. Use the Select/omit option on the reporting commands to remove these types of jobs so the information shown on the reports is more representative of your environment.

You may find that the performance tools transaction information is inaccurate for applications such as RM/COBOL-85 for the AS/400 licensed program that do field-by-field processing. (Field-by-field processing implies that for every field in which data is entered, there is processing by the CPU as the field is exited.) The tools report each field processed as a transaction. Because these 'field' transactions may not do much processing other than return to the screen to enable the next field to be entered, the transaction information is skewed. When all of the fields on the screen have been entered, what would be viewed as a normal transaction occurs, that is, all of the information is processed.

If the transaction information is skewed due to field by field processing, it cannot be used as input to BEST/1. BEST/1 uses the transaction information to establish its base information. It then uses the base information to predict the modes, response time, transactions, and utilizations for a given number of work stations. If the transaction information is skewed, BEST/1 may give incorrect results.

Appendix C. Comparison of Performance Tools

This appendix compares the functional capability of the Manager feature and the Agent feature. It specifically notes the differences in the supported menu options and performance commands.

Comparison of Functions, Menu Options, and Commands

The Agent feature of Performance Tools provides functions to simplify the collection, management, online display, data reduction, and analysis of performance data. Also included in the Agent feature is the performance explorer tool (performance utilities). The major Performance Tools functions not contained in the Agent feature are performance and trace reports, capacity planning, performance utilities (job traces and select file and access group), system activity monitoring, and performance graphics.

If you require analysis of trace data, viewing data graphically, viewing system activity in real time, or managing and tracking system growth, the Manager feature of the Performance Tools licensed program is more useful.

Table 25 shows the Performance Tools menu options supported by the Agent feature.

Table 25. Comparison of Menu Options

Performance Tools Menu Options	Agent Feature
1. Select type of status	No
2. Collect performance data	Yes
3. Print performance report - Sample data	No
1. System report	
2. Component report	
3. Job report	
4. Pool report	
5.Resource report	
3. Print performance report -Trace data	No
1. Transaction report	
2. Lock report	
3. Batch job trace report	
4. Capacity planning/modeling	No
5. Create BEST/1 model from performance data	
5. Performance utilities	
1. Work with job traces	
2. Work with Performance Explorer	
3. Select file and access group	
4. Start performance trace	
5. End performance trace	
6. Configure & manage tools	
1. Work with functional areas	
2. Delete performance data	
3. Copy performance data	Yes
4. Convert performance data	Yes
5. Create performance data	

Table 25. Comparison of Menu Options (continued)

Performance Tools Menu Options	Agent Feature
7. Display performance data	Yes
8. System activity	Yes
9. Performance graphics	
1. Work with graph formats and packages	No
2. Work with historical data	Yes
3. Display graphs and packages	No
10. Advisor	Yes

Table 26 shows performance-related commands, and indicates whether they are part of OS/400, part of the Manager feature of Performance Tools, or part of the Agent feature of Performance Tools.

Table 26. Comparison of Performance Commands

Command	Description	OS/400	Manager Feature	Agent Feature
ADDPEXDFN	Add performance explorer definition	X		
ANZACCGRP[1]	Analyze variable and file usage		X	
ANZBESTMDL	Analyze BEST/1 model		X	
ANZDBF	Analyze files to be used by a program		X	
ANZDBFKEY	Analyze logical to physical database file relationships		X	
ANZPFRDTA	Advisor		X	X
ANZPGM	Analyze files used by a program		X	
CHGFCNARA	Change functional area		X	
CHGGPHFMT	Change graph format		X	
CHGGPHPKG	Change graph package		X	
CHGPEXDFN	Change performance explorer definition	X		
CPYFCNARA	Copy functional area		X	
CPYGPHFMT	Copy graph format		X	
CPYGPHPKG	Copy graph package		X	
CPYPFRDTA	Copy performance data		X	X
CRTBESTMDL	Create BEST/1 model		X	X
CRTFCNARA	Create functional area		X	
CRTGPHFMT	Create graph format		X	
CRTGPHPKG	Create graph package		X	
CRTHSTDTA	Create historical data		X	X
CRTPFRDTA	Create performance data		X	X
CVTPFRDTA	Convert performance data from one release to another	X		
CVTPFRTHD	Convert performance data from thread-level data to job-level data	X		
DLTBESTMDL	Delete BEST/1 model		X	X
DLTFCNARA	Delete functional area		X	

Table 26. Comparison of Performance Commands (continued)

Command	Description	OS/400	Manager Feature	Agent Feature
DLTGPHFMT	Delete graph format		X	
DLTGPHPKG	Delete graph package		X	
DLTHSTDTA	Delete historical data		X	X
DLTPEXDTA	Delete performance explorer data	X		
DLTPFRDTA	Delete performance data		X	X
DMPTRC	Dump trace data	X		
DSPACCGRP[1]	Display variable and file usage for jobs		X	
DSPHSTGPH	Display historical graph		X	
DSPPFRDTA	View Collection Services sample data		X	X
DSPPFRGPH	Display performance graph		X	
ENDJOBTRC	End job data collection activity		X	
ENDPEX	End Performance Explorer	X		
| ENDPFRTRC	End performance trace	X		
PRTACTRPT	Print activity report		X	
PRTCPTRPT	Print component report		X	
PRTJOBRPT	Print job report		X	
PRTJOBTRC	Print job trace report		X	
PRTLCKRPT	Print lock report		X	
PRTPEXRPT	Print performance explorer report		X	X
PRTPOLRPT	Print pool report		X	
PRTRSCRPT	Print resource report		X	
PRTSYSRPT	Print system report		X	
PRTTNSRPT	Print transaction report		X	
PRTTRCRPT	Print batch job data collected by trace		X	
RMVPEXDFN	Remove performance explorer definition	X		
STRPEX	Start performance explorer	X		
STRBEST	Capacity planning model		X	
STRJOBTRC	Start job trace		X	
STRPFRG	Start performance graphics		X	
STRPFRT	Start Performance Tools		X	X
| STRPFRTRC	Start performance trace	X		
WRKACTJOB	Job performance data	X		
WRKDSKSTS	Disk space and busy	X		
WRKFCNARA	Work with function areas		X	
WRKSYSACT	Display or record task CPU and disk usage		X	X
WRKSYSSTS	Memory demand and workload rate	X		

Table 26. Comparison of Performance Commands (continued)

Command	Description	OS/400	Manager Feature	Agent Feature
[1] You should not use this command because the Licensed Internal Code no longer uses process access groups for caching data used by a job.				

Appendix D. Performance Checklist—Manager Feature

You may find these checklists useful for planning system performance.

Planning for Performance and Tuning

- Provide proper training:
  - OS/400 structure, tailoring, basic tuning
  - OS/400 performance analysis and capacity planning
- Set measurement criteria:
  - Define performance objectives
  - Set goals
  - Take measurements (will you measure peaks or averages?)
  - Review measurements
- Analyze the data.

  This requires an understanding of:
  - OS/400 commands for collecting data
  - Performance Tools programs and reports
  - Parameters that affect performance on the iSeries server, such as:
    - Storage pool size, paging
    - Activity levels
    - Time slice
    - Job states and transitions
- Schedule performance review meetings—as often as required to review log entries and trends.
- Tune the system using the QPFRADJ (performance adjust) system value. The values could be 0, 1, 2, or 3.

  0 QPFRADJ is off

  1 QPFRADJ adjusts shared pools at IPL only

  2 QPFRADJ automatically tunes the system at IPL and continually

  3 QPFRADJ tunes continually, but not at IPL

  QPFRADJ compares system performance to the IBM guidelines every 20 seconds. If it is not within the guidelines on three consecutive comparisons, QPFRADJ changes the pool sizes, activity level, or both.

  Note: You may want to complete QPFRADJ tuning (and then set to 0) before you run Performance Tools.
- Print the error log (PRTERRLOG) for hardware problems, and start the system service tools (STRSST command) to display errors.

Basic Tuning

You can choose to let the system tune itself **dynamically** (QPFRADJ system value set to 2 or 3), or you can tune it manually. To tune **manually**:

- For initial tuning before you begin performance analysis, compare the pool size and activity levels to the performance guidelines.
- After you complete the initial system tuning:
  – Evaluate all changes by measuring.
  – Make one change at a time.
- Use the OS/400 CL commands:
  – WRKJOB (Work with Job)
  – WRKSYSSTS (Work with System Status)
  – WRKACTJOB (Work with Active Job)
  – WRKDSKSTS (Work with Disk Status)
- If you have Performance Tools installed, use the WRKSYSACT (Work with System Activity) command.

  Note: This command requires Performance Tools. It is an efficient way to display currently active jobs and Licensed Internal Code tasks that used CPU or disk I/O operations since the last time the display was refreshed.
  – It can monitor an individual job.
  – One job on the system can use the command.
- Start Collection Services to collect data.

  Note: Collection Services runs without the Performance Tools program. However, Performance Tools is needed to create the reports.
  – To collect sample data, suggested parameters on this command are:
    - Specific member name
    - 5-minute interval
    - Run continuously
  – Trace data is collected for detailed performance problem analysis. Use the Start Performance Trace (STRPFRTRC) command.

Work with System Status Tips

The Work with System Status identifies page faulting and wait-to-ineligible transitions for each main storage pool.

- For interactive pools, typically you want the wait-to-ineligible transition values to be very small (less than 10% of the active-to-wait value). If you see any wait-to-ineligible value at all, increase the MAXACT value by 5 to 10 until the wait-to-ineligible is 0. Remember to press F10 to reset the statistics. Wait 10 seconds between refreshes.
- The machine pool (pool 1) should have fewer than 10 faults per second, which is the sum of the database and nondatabase faults. You can ignore the Pages column.
- If only system jobs and subsystem monitors are running in *BASE, then the fault rate for that pool should be less than 30 faults per second.
- The basic method for tuning your storage pools is to move storage from pools with good performance to pools with bad performance. In this situation, you should measure performance in response time or as throughput. Continue to move storage until the pool with the bad performance gets better, or until the pool with the good performance gets worse. Do not decrease a pool by more than 10% at a time.

- Determining a good fault rate for the user pools can be complicated and will vary from pool to pool and from system to system. The fault rate alone is not necessarily a measure of good performance or bad performance.
  - For interactive jobs, look at how much the faults contribute to the end response time (`faults/transaction * disk response`).
  - For batch jobs, look at how much the faults add to the elapsed time of the job (`total faults * disk response`).
- Use the following formula to calculate the approximate number of page faults per transaction:

  ```
  [(db faults + ndb faults) / active->wait] X 60
  ```

Work with Disk Status Tips

The Work with Disk Status shows the percentage of space used and the percentage of time that the disk arms are busy. If the average percent for the Busy column is over 50%, you may need to install more disk arms. The suggestion to install more disk arms assumes that any page faulting problems have been addressed.

Work with System Activity Tips

The Work with System Activity display lists active jobs that have used any CPU in the last few seconds. The list is sorted in the order of the amount of CPU seconds that are used, which is the default view. If a high priority job (low number) is using a lot of CPU (>50%) for an extended period of time, then that job could cause the entire system to have poor response times. Here are some suggestions for improving your response time in this situation:

- If a job or a small set of jobs seems to be using a large percentage of the CPU, check the job priority (PTY). If the priority of the job is a lower number than the jobs with poor performance, you may want to consider changing the priority of the offending job or jobs. Use option 5 (Work with job), then option 40 (Change job), and specify a larger RUNPTY value (greater than the priority of the jobs that you want to ran faster).
- If the offending job is an interactive job that is running a job that is better suited to run in batch mode, you may want to contact the user and recommend one of the following:
  - That they submit their work as a batch job
  - That they change the priority of the job to 50. 50 is the typical priority for a batch job.
- If the CPU utilization is high (>80%) and all jobs seem to have an equal, but small, CPU percent, this situation could mean that you have too many active jobs on the system.

General Tuning Tips

- Favor output over input.
  - The activity level should not be too high.
  - Allow the work to finish.
- Do not mix different types of jobs and priorities in the same pool. (For example, do not mix class entries in subsystem descriptions.)
- Remove batch jobs from *BASE by creating another batch pool.
  - Route batch jobs to *SHRPOOL1. One batch job to a pool is ideal. (Job description (JOBD) for routing data; subsystem description (SBSD) for routing entry).

- Remove programmers from the interactive pool (*INTERACT) by creating another interactive pool, *SHRPOOL2 (job description (JOBD) for routing data, subsystem description (SBSD) for routing entry).

General Performance Facts

- You can collect two types of data:
  - **Sample Data** allows you to print the following reports:
    - Advisor Report
    - System Report (Workload; Resource Utilization; Resource Utilization Expansion; Storage Pool Utilization; Disk Utilization; Communication Summary, TCP/IP Summary)
    - Component Report (Interval Activity; Job Workload; Storage Pool; Disk Activity; IOP Utilization; Local Workstation/Resp time, Database Journaling Summary, TCP/IP Activity)
  - **Trace Data** allows you to print the following reports:
    - Advisor Report
    - Summary, Transaction, Transition Reports (more detail about transactions)
- QTOTJOB system value (QADLTOTJ amount added after original amount).
  - Allocates space at IPL
  - Sets permanent job structures (work control block table)

  Note: QTOTJOB system value should be set at 10% higher than the highest number of total jobs in the system. Use the Work with System Status (WRKSYSSTS) command to display the jobs. Leave the value for QADLTOTJ as it is.
- QACTJOB system value (QADLACTJ amount added after original amount).
  - Space for temporary job structures allocated at IPL.
  - Should be set at highest active job number found. Use the Work with Active Jobs (WRKACTJOB) command to display. Leave the value for QADLACTJ as it is.
- QJOBSPLA remains unchanged.
- If you are in a Client Access environment with the QPFRADJ system value set to 2, the machine pool could be adjusted too low.
- Logical database I/O is one indicator of job activity. Batch or job run time depends on the CPU time, number of disk operations, and number of exceptional waits.

Bibliography

The following is a list of related printed information that may help you as you use this book.

The books below are listed with their full title and base order number.

- *BEST/1 Capacity Planning Tool*, SC41-5341-01, provides information about determining your current system performance and predicting your future data processing needs by using BEST/1 to create a model of your system and analyze it. This book contains scenarios that will help you get started with capacity planning, plus in-depth information about specific topics, such as memory modeling.
- *Software Installation*, SC41-5120-05, provides the system operator or system administrator with step-by-step procedures for installing the licensed programs from IBM.
- *Work Management*, SC41-5306-03, provides information about how to create and change a work management environment. Other topics include a description of tuning the system, collecting performance data including information on record formats and contents of the data being collected, working with system values to control or change the overall operation of the system, and a description of how to gather data to determine who is using the system and what resources are being used.

  For the most current information about work management, go to the Work Management topic in the Information Center.

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