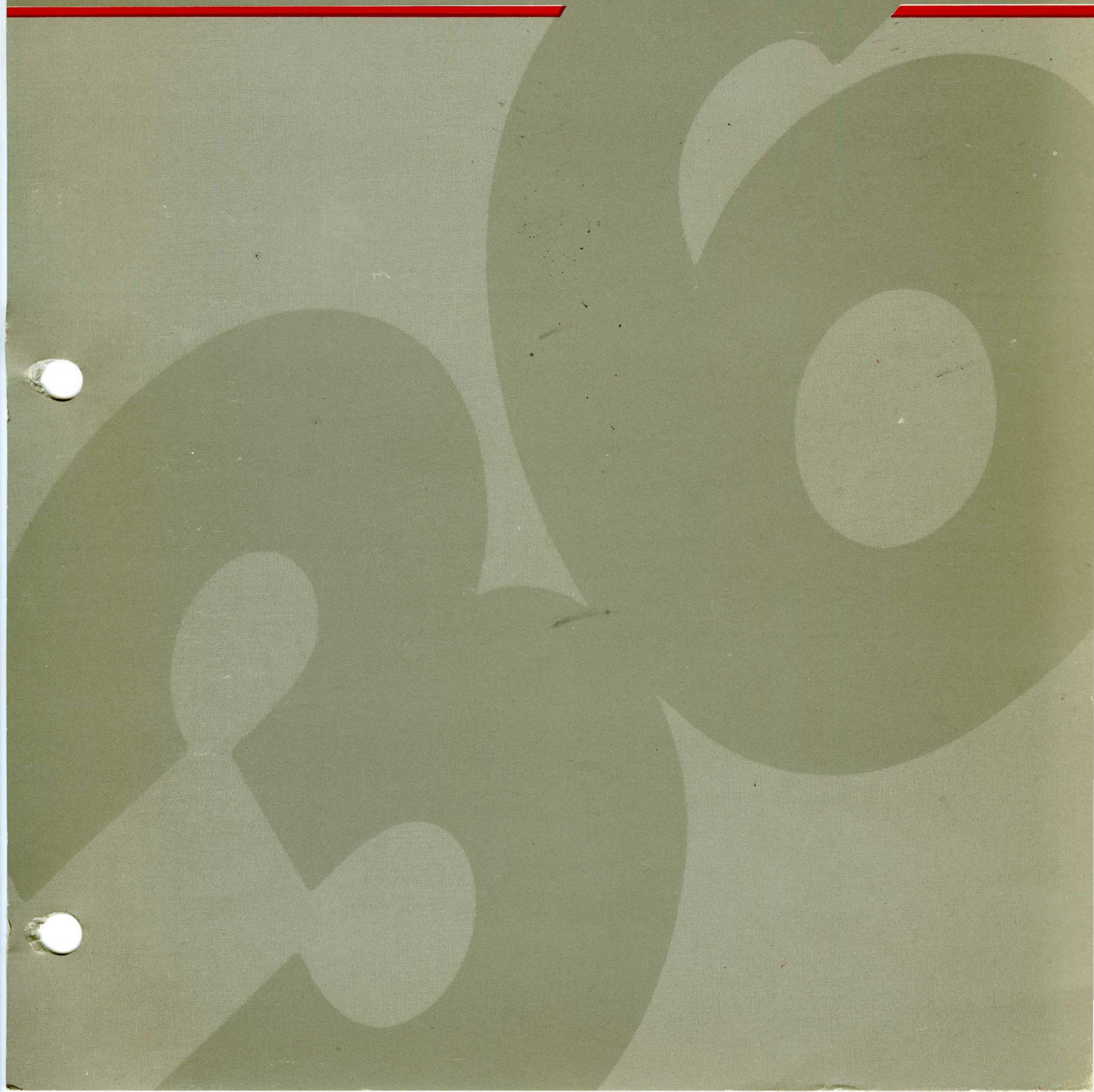
 System/36

**System Measurement  
Facility Guide**  
5360, 5362



**IBM** System/36

**System Measurement Facility Guide**

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This major revision makes obsolete SC21-9025-2. Changes or additions to the text and illustrations are indicated by a vertical line to the left of the change or addition. See "About This Manual" for a summary of changes.

Changes are periodically made to the information herein; any such changes will be reported in subsequent revisions or Technical Newsletters.

This edition applies to Release 4, Modification Level 0, of IBM System/36 System Support Program Product (Program 5727-SS1 for the 5360 and 5362 System Units, and Program 5727-SS6 for the 5364 System Unit), and to all subsequent releases and modifications until otherwise indicated in new editions or Technical Newsletters. Also, this publication contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

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## **About This Manual**

### **Who should use this manual . . .**

This manual is intended as a reference for programmers and system analysts using the System/36 system measurement facility (SMF), a part of the System Support Program (SSP).

### **How this manual is arranged . . .**

Chapters 1 and 2 of this manual, which give an introduction to SMF and describe SMF's storage requirements and the procedures to start and stop it, should be read before you attempt to use SMF. Chapter 3 is a reference to the items listed on an SMF report, and Chapter 4 suggests ways to use that report: They may be read as needed.

### **What you should know . . .**

To use SMF effectively, you must start with an understanding of your present computing environment. You should know about the most important jobs being run by the system, the resources those jobs require, and the ways those jobs are regularly processed. As you learn more about your system, SMF will become more useful to you.



## **If you need more information . . .**

These IBM System/36 publications contain information that further describes topics discussed in this manual.

- *Concepts and Programmer's Guide*, SC21-9019
- *System Reference*, SC21-9020
- *Performing the First System Configuration for Your System*, SC21-9022
- *Changing Your System Configuration*, SC21-9052
- *Operating Your Computer*, SC21-9026
- *Overlay Linkage Editor*, SC21-7077
- *Creating Displays*, SC21-7902
- *Programming with BASIC*, SC21-9003
- *Programming with FORTRAN IV*, SC21-9005
- *SSP Interactive Communications Feature Guide and Examples*, SC21-7911
- *SSP Interactive Communications Feature Reference*, SC21-7910
- *Multiple Session Remote Job Entry Guide*, SC21-7909
- *3270 Device Emulation Guide*, SC21-7912
- *System Messages*, SC21-7938
- *Communications and Systems Management Guide*, SC21-8010
- *Distributed Data Management Guide*, SC21-8011

## **How this manual has changed . . .**

The following are the major changes from the previous edition of this manual:

- Work Station Controller 2 Queue
- Work Station Controller 2
- SMF MINI report snapshot
- Disk cache information
- Memory resident overlay

## Chapter 1. Introduction

The System Measurement Facility (SMF) is a tool for evaluating how efficiently you are using system resources. If the performance of the application programs that you run on System/36 does not meet your requirements, you can use the data collected by SMF to:

- Determine if you need to allocate system resources differently
- Show the effect on resources of mixing various programs and to determine more efficient job scheduling
- Reveal resources at peak capacity and slowing response time
- Evaluate the effect of newly-added applications on resources
- Judge the need for additional main storage and disk space

SMF takes a statistical sample or *snapshot* of the way system resources are being used while application programs are running. It collects information about device usage, tasks active, storage totals, and system event and input/output (I/O) counters. The report of this usage can be used to diagnose possible performance problems.

The methods that SMF uses to determine usage are approximate and you should be aware that the figures presented are not exact. They should be used only to indicate relative usage. Also, you should be careful when drawing conclusions from only one run of SMF's data collection program. The data gathered in just one run might not be representative of your total work load. In other words, you must assess the potential benefits of SMF: IBM assumes no responsibility for the interpretation of its reports.

## Description of SMF

SMF actually performs three functions: data collection, communications data collection, and report writing. These functions are started by procedures, using displays with questions that prompt you for the parameters that the procedures use to run. The various SMF procedures—SMF, SMFSTART, SMFSTOP, SMFPRINT, and SMFDATA— are explained in Chapter 2, "SMF Procedures."

The *data collection program* records configuration data and takes snapshots of system activity at a sample interval that you specify on the SMFSTART procedure display. The snapshots consist of data, such as the number of swaps in, swaps out, and disk input/output (I/O) operations, collected from various system counters and written to a disk file called the data collection file.

*Communications data collection*, an optional routine of the data collection program, measures the activity on each line associated with data communications. Binary synchronous communications (BSC), synchronous data link control (SDLC) and asynchronous communications (ASYNC) lines are measured. The data collection program records the communications data measurements in the data collection file. Communications usage information is only collected if communications is active and if the user selects the *collect communications data* option on the SMFSTART procedure display.

The *report writer program*, using the SMFPRINT procedure, processes and prints the collected data directly from the data collection file and can be run after one or more sample intervals. The SMF report lists in order:

1. Configuration data at the time SMF was started
2. Snapshots of system activity
3. The contents of various system counters
4. Communications line data if data communications was active and that option is selected

*Note: No communications line data is collected for autocal units or X.25 lines.*

5. A summary of the system activity
6. A summary of the collected system counters

The SMFDATA procedure writes the output from the report writer program to a disk file which can in turn be used as input for analysis by application programs.

## SMF Storage Requirements

The data collection program, communications data collection routine, and report writer program have the following control storage, main storage, and disk space requirements.

### Data Collection Program

The control storage section of the data collection program requires 0.75K bytes and is resident. The data collection program occupies 24K bytes of main storage while it is being initialized. After the initialization phase, data collection consists of a 6K- byte, swappable (can be swapped) main storage program and a 2K- byte control storage transient that is loaded at every snapshot.

### Communications Data Collection Routine

The communications data collection routine uses 2.5K bytes of control storage. You may not be able to collect communications usage data if you are running certain combinations of programs together on your system. See “Control Storage Considerations” in the *Concepts and Programmer’s Guide* for information about what combinations of programs you can run at the same time you are collecting communications usage data. If you receive error message SYS-1327 while trying to collect communications usage data, refer to that message in the *System Messages* manual for guidelines on what should be done. Collecting communications line data also requires an additional 2K bytes of swappable main storage, for a total of 8K bytes.

## Report Writer Program

The report writer program does not require control storage, but takes up 48K bytes of swappable main storage. The SMF work file, created by the report writer program as a scratch file to hold information while the report is being printed, requires 10 blocks of disk space.

Figure 1-1 shows the functions of SMF and their storage requirements.

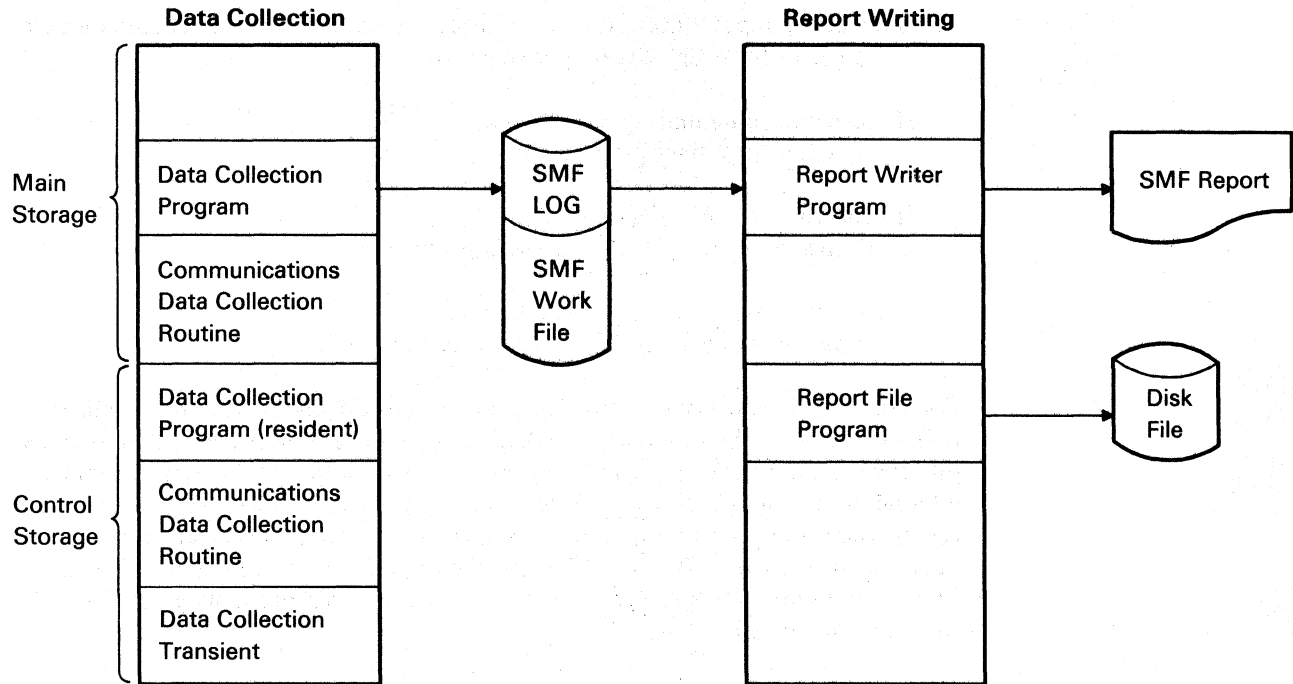


Figure 1-1. Functions of SMF

## Data Collection File

You can specify a disk size from 1 block (10 sectors) to 312,815 blocks for the data collection file. When determining the data collection file size consider that SMF uses:

- 1 sector per snapshot for a time stamp and system usage information
- 1 sector for every 3 tasks per snapshot

If collecting input/output (I/O) and system event counter (SEC) data by task:  
1 sector for every 2 tasks per snapshot

If collecting communications line data:  
1 sector for 4 lines per snapshot

If collecting only user data by file:  
1 sector for every 4 files accessed per snapshot

If collecting user and system data by file:  
1 sector for every 4 files accessed per snapshot

For example, if six tasks are active on your system and you decide not to collect I/O and SEC data by task, communications line data, and user and system data by file, each snapshot will require three sectors of disk space. At the default sample interval of one minute, or 60 snapshots per hour, the data collection program will use up 180 sectors, or 18 blocks, of disk space in one hour. This means that the default data collection file size of 200 blocks will fill with data in about 11 hours. These figures are only approximations; however, they will probably give a larger file size than you strictly require.

*Note: The maximum size of 312,815 blocks applies to a four 200 megabyte drive system. Different disk capacity configurations will have different maximum block values.*

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## Chapter 2. SMF Procedures

This chapter describes the procedures used to start and to stop the data collection program, to print its output using the report writer program, and to write the output to disk using the report file program.

### The SMF Procedure

When you sign on System/36, the Main help menu is displayed:

```

                                MAIN
                                Main System/36 help menu
                                W4

Select one of the following:

1. Display a user menu
2. Perform general system activities
3. Use and control printers, diskettes, or tape
4. Work with files, libraries, or folders
5. Use programming languages and utilities
6. Communicate with another system or user
7. Define the system and its users
8. Use problem determination and service
9. Use office products
10. Sign off the system

Cmd3-Previous menu   Cmd7-End       Cmd12-How to use help   Home-Sign on menu

Ready for option number or command

                                (c) 1985 IBM Corp.
```



Selecting option 8 (*Problem determination and service*) from the Main help menu will display the PROBSERV menu:

```
PROBSERV W4
Problem determination and service
Select one of the following:
  1. Online problem determination
  2. Run service aid procedures

Cmd3-Previous menu  Cmd5-Main help menu  Cmd7-End  Home-Sign on menu
Ready for option number or command

(c) 1983 IBM Corp.
```

Selecting option 2 (*Run service aid procedures*) on the PROBSERV menu will display the Service menu:

```
SERVICE W4
Run service aid procedures
Select one of the following:
  1. Diagnose system or user task failures
  2. Diagnose device failures
  3. Diagnose communications failures
  4. Use system measurement facility
  5. Update or list the system service log
  6. Install or remove PTFs
  7. List, copy, or erase history file entries
  8. Collect diagnostic information
  9. Start or stop system service authorization
 10. Display or change disk or diskette sectors

Cmd3-Previous menu  Cmd5-Main help menu  Cmd7-End  Home-Sign on menu
Ready for option number or command

(c) 1983 IBM Corp.
```

You can also display this menu by entering `HELP SERVICE` on the entry line of any display. Selecting option 4 (*Use system measurement facility*) on the Service menu will display the options on the SMF menu:

```
SMF                                                                    W4
Use system measurement facility

Select one of the following:

1. Collect SMF data for the SMF report
2. Stop collecting SMF data
3. Print the SMF report
4. Create a SMF report file

Cmd3-Previous menu   Cmd5-Main help menu   Cmd7-End   Home-Sign on menu
Ready for option number or command

(c) 1984 IBM Corp.
```

You can also obtain the SMF menu by entering the procedure command `SMF` without any parameters or by entering `HELP SMF`. From this menu, you enter the number that identifies what you want to do with SMF.

## The SMFSTART Procedure

You can start the data collection program by:

- Selecting option 1 on the SMF menu
- Entering the `SMFSTART` procedure command without parameters, or entering `HELP SMFSTART` on the entry line of any display
- Entering the `SMFSTART` procedure command with parameters on the entry line of any display
- Selecting a user-defined menu item that contains the `SMFSTART` procedure command
- Creating your own procedure that calls the SMF data collection program

## Without Parameters

If you select option 1 on the SMF menu, enter the SMFSTART procedure command without parameters, or enter HELP SMFSTART, the following display appears:

```
SMFSTART PROCEDURE                               Optional-*
Starts SMF data collection program

Data collection time interval in minutes and
seconds . . . . . 0:10-5:00 1 : 00
Size of data collection file in blocks . . . . . 1-312815 200
Collect communications data? . . . . . N,Y N
Name of data collection file . . . . . SMF.LOG

Cmd3-Previous menu                               (c) 1985 IBM Corp.
```

If you specify a Y for the (*Collect communications data*) prompt, the following information appears on your display:

```
SMFSTART PROCEDURE                               Optional-*
Starts SMF data collection program

Data collection time interval in minutes and
seconds . . . . . 0:10-5:00 1 : 00
Size of data collection file in blocks . . . . . 1-312815 200
Collect communications data? . . . . . N,Y Y
Name of data collection file . . . . . SMF.LOG
Line speed in bits per second for line 1 . . . . . 0-64000
Line speed in bits per second for line 2 . . . . . 0-64000
Line speed in bits per second for line 3 . . . . . 0-64000
Line speed in bits per second for line 4 . . . . . 0-64000
Line speed in bits per second for line 5 . . . . . 0-64000
Line speed in bits per second for line 6 . . . . . 0-64000
Line speed in bits per second for line 7 . . . . . 0-64000
Line speed in bits per second for line 8 . . . . . 0-64000
Collect I/O and SEC data by task? . . . . . N,Y N
Collect user and system data by file? . . . . . N,Y,U N

Cmd2-Page back                               (c) 1985 IBM Corp.
```

For more detail about the SMFSTART procedure prompts, position the cursor at the prompt you want explained and press the Help key. You can also page forward and backward between help displays with the Roll keys. You must return to the procedure display to respond to the prompts.

## SMFSTART Prompts and Parameters

The following paragraphs describe the SMFSTART display prompts and procedure command parameters. If any of the prompts other than those specifying a line speed are responded to, the data collection program is started; default values are used for any parameters not specified on the display.

*Data collection time interval in minutes and seconds:* Your response to this prompt specifies the sample interval for the data collection program. Data is collected at each snapshot and the records are written to the data collection file. You specify the sample interval in minutes and seconds. The minutes field and the seconds field are separate fields. The minimum sample interval you can specify is 10 seconds (010); the maximum interval is 5 minutes (500). The default value for the sample interval is 1 minute.

*Note:* After SMF has run for 24 hours, a message is displayed to inform you of this fact, and the data collection program stops. You can continue collecting data in the same data collection file by starting the program again using the same data collection file name.

*Size of data collection file in blocks:* Your response to this prompt specifies the size of the data collection file. If the file already exists, any entry for this parameter is ignored by the system. The amount of data that can be written into the file depends upon the sample interval, the number of jobs running, the space saved for the file, and the options selected at the start of the SMF run. If data from a previous SMF run is already in the file, the data collected from the current run immediately follows the previously-collected data. If the file becomes full while SMF is running, a message is issued informing you of this fact, and the data collection program stops. If the file is full from a previous run of SMF, you can restart SMF and collect data in a new data collection file by specifying a new file name.

The file can be a maximum of 312,815 blocks in size. See “Data Collection File” in Chapter 1 for an example of determining an appropriate file size.

*Collect communications data?* Your response to this prompt specifies whether you want to collect data about your communications environment. Additional time is required to collect this data, and additional space in the data collection file is used. Refer to Appendix A, “How SMF Affects System Performance,” for an explanation of how these demands on system resources may affect performance.

If you choose to collect communications usage data, you must specify on the display the line speed information for the lines on which you want to collect data. If you do not enter the line speed information, no communications data is collected by SMF, even if you specify Y for this prompt.

*Note:* You may not be able to collect communications usage data if you are running certain combinations of programs together on your system. See “Control Storage Considerations” in the *Concepts and Programmer’s Guide* for information about what combinations of programs you can run at the same time you are collecting communications usage data.

*Name of data collection file:* Your response to this prompt specifies the name of the data collection file to which you want SMF to write data. The name can be up to 8 characters (letters, numbers, or punctuation marks) long.

You do not have to specify a data collection file name before running the SMFSTART procedure. If the file SMF.LOG does not exist, SMF automatically creates a new file with that name and the file size you specify. You can specify a name other than SMF.LOG for a data collection file, but, if this file already exists and contains non-SMF data, SMF will issue an error message.

*Line speed information:* Your response to these prompts specifies the line speed in bits per second for each communication line that is configured and active. If you do not want SMF to collect communications data for a particular line, do not answer the prompt for that line. The actual speed, full- or half-rated, of the line should be entered: If you enter the wrong speed, you will get an inaccurate percentage on the SMF report. The line speed information is a 5-digit field. Commas are not allowed and leading zeros are not required. SMF will not collect data on an autocal unit or an X.25 line.

*Collect I/O and SEC data by task?* Your response to this prompt specifies whether you want to collect counters separately for each task as well as for the entire system. Additional time is required to collect data by task, and additional space in the data collection file is used. Refer to Appendix A, "How SMF Affects System Performance," for an explanation of how these demands on system resources may affect performance.

*Collect user and system data by file:* Your response to this prompt specifies whether you want to collect access counts for user and system files on your disk. N indicates that no data by file will be collected; Y indicates that data for both user and system files will be collected; and U indicates that data for only user files will be collected. You cannot collect data for system files only.

A user file is created and accessed via disk data management. System files are created and accessed via system disk I/O routines other than disk data management. Some examples of system files are #LIBRARY, #SYSHIST, ##SPOOL, and ##JOBQ. Additional time is required to collect data by file, and additional space in the data collection file is used. Refer to Appendix A, "How SMF Affects System Performance," for an explanation of how these demands on system resources may affect performance.

## **With Parameters**

You can also enter the SMFSTART procedure command with parameters. See the *System Reference* manual for the format of the SMFSTART procedure command.

## From a Menu

When you use a menu other than the Main help menu to run SMFSTART, the necessary parameters are defined by the user who creates the menu. You select the specified menu item when you want to run SMFSTART. The following figure illustrates a menu in which item 8 runs the SMFSTART procedure.

```
COMMAND          Menu:  DAILYX      Library:  DAILYT      W4
1. START COMMUNICATIONS          13.
2. START TIME CARD VERIFICATION  14.
3. EDIT SALES RECEIPTS           15.
4. PRODUCE ACCOUNTING REPORT     16.
5. PRODUCE DAILY MASTER FILE     17.
6. PRODUCE ACCOUNT EXCEPTIONS    18.
7. PRODUCE DAILY SALES REPORT    19.
8. START SMF RUN                 20.
9.                               21.
10.                              22.
11.                              23.
12.                              24.

Ready for option number or command:
8
```

For more information about creating a menu, refer to the BLDMENU procedure in the *System Reference* or *Creating Displays* manuals.

## With a Procedure Command

To define your own procedure to begin running SMFSTART, create a procedure member in a library with the necessary parameters specified. If you include any of the parameters (other than those specifying a line speed) for the SMFSTART procedure command, the default values for the rest of the parameters are assumed. If you omit all of these parameters, the SMFSTART display will appear when you run your procedure.

The following examples illustrate the use of procedures to begin running SMFSTART.

Example 1 is an illustration of a procedure member labeled SMFGO that, because only communications information is specified, will cause the SMFSTART procedure display to appear. The line speed parameters already specified may be changed on that display.

```
Example 1: Procedure Member SMFGO
SMFSTART , , Y , , 1200, 2400, 4800, 9600
```

Example 2 runs the SMFSTART procedure directly, bypassing the SMFSTART procedure display. The first three parameters have data and the fourth parameter *data collection file name* has the default value of SMF.LOG. The desired line speed parameters are specified, and input/output (I/O) and system event counter (SEC) data by task will be collected. User file and system file access counter data will not be collected.

```
Example 2: Procedure Member SMFRUN
SMFSTART 200,50,Y,,1200,2400,4800,9600,Y
```

A work station operator does not have to know the data communication line speeds to run the SMFSTART procedure in either of these examples.

## The SMFSTOP Procedure

If you select option 2 (*Stop collecting SMF data*) on the SMF menu, enter HELP SMFSTOP on the entry line of any display, or enter SMFSTOP and press the Help key, the following display appears:

```
SMFSTOP PROCEDURE

Stops the system measurement facility (SMF) collection program

No parameters; press the Enter key to continue.

KEYS YOU CAN USE

Cmd3 - Display the previous menu
Cmd4 - Place a job on the job queue
Cmd5 - Display the main menu
Cmd6 - Display your beginning help menu
Cmd7 - End help
Home - Display your sign-on menu

(c) 1983 IBM Corp.
```

The SMFSTOP procedure has no parameters and no help display. Pressing the Enter key at the SMFSTOP display will immediately stop the data collection program. Consequently, the last reported sample interval might be shorter than the specified interval. The reported usage statistics are still accurate; however, because they are based on the full sample interval.

The system operator can also stop the data collection program by entering the STOP SYSTEM control command. The data collection program then waits for the next sample interval to pass before stopping.

# The SMFPRINT Procedure

The report writer program can be run while the data collection program is still active (the data is printed from the existing data collection file) or after it has ended. Like SMFSTART, SMFPRINT can be started from the general SMF menu, from other menus or displays, and from your own procedure. If you select option 3 (*Print SMF data*) on the SMF menu, enter the SMFPRINT procedure command without parameters, enter SMFPRINT on the entry line of any display, or enter SMFPRINT and press the Help key, the following display appears:

```
SMFPRINT PROCEDURE                                Optional-*
Prints a report of collected SMF data

Report option . . . . . DETAIL,ALL,MINI,SUMMARY  DETAIL
Delete data collection file after printing? . . . . . Y,N  N
SYSTEM or printer ID . . . . . SYSTEM,printer ID  SYSTEM
Name of data collection file . . . . . SMF.LOG
Starting date . . . . . yymmdd                    *
Starting time . . . . . hhmmss                     *
Ending time . . . . . hhmmss                       *

Cmd3-Previous menu      Cmd4-Put on job queue      (c) 1985 IBM Corp.
```

For more detail about the SMFPRINT prompts, position the cursor at the prompt you want explained and press the Help key. You can also page forward and backward between help displays with the Roll keys. You must return to the procedure display to respond to the prompts.

## SMFPRINT Prompts and Parameters

The following paragraphs describe the SMFPRINT display prompts and procedure command parameters. If one or more prompts are responded to, the report writer program is started; default values are used for any parameters not specified on the display.

**Report option:** Your response to this prompt specifies the type of report to be produced by the report writer program. Four types of reports can be produced: SUMMARY, MINI, DETAIL, and ALL. Figure 2-1 shows the types of information that are listed on each report. Chapter 3, "SMF Reports," gives a detailed description of the data listed in the reports. Chapter 4, "Suggestions for Using SMF," tells how the most significant counters collected by the MINI report can be used to help identify possible performance problems. DETAIL is the default value for this parameter.



<b>SUMMARY Report</b>	<b>MINI Report</b>	<b>DETAIL Report</b>	<b>ALL Report</b>
IPL configuration information	IPL configuration information	IPL configuration information	IPL configuration information
	Communications configuration data, if active and selected	Communications configuration data, if active and selected	Communications configuration data, if active and selected
	<ul style="list-style-type: none"> <li>• Statistics for each sample interval: <ul style="list-style-type: none"> <li>– Device usage rates</li> <li>– Task work area usage</li> <li>– Significant counters as defined in Chapter 4 with the following exceptions: <ul style="list-style-type: none"> <li>— Disk record waits is not on a per task basis but the total for all tasks</li> <li>— Data by file information is not reported</li> </ul> </li> <li>– Number of active tasks</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Statistics for each sample interval: <ul style="list-style-type: none"> <li>– Device usage rates</li> <li>– Task work area usage</li> <li>– Disk cache utilization</li> <li>– Task status</li> <li>– Storage totals</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Statistics for each sample interval: <ul style="list-style-type: none"> <li>– Device usage rates</li> <li>– Task work area usage</li> <li>– Disk cache utilization</li> <li>– Task status</li> <li>– I/O and SEC information by task, if selected</li> <li>– Terminated task data</li> <li>– User file access counters</li> <li>– System file access counters</li> <li>– Storage totals</li> <li>– System event counters (SEC)</li> <li>– I/O counters</li> <li>– Data storage attachment (DSA) usage</li> <li>– Communications line usage, if active and selected</li> </ul> </li> </ul>
Summary information	Summary information	Summary information	Summary information

Figure 2-1. Options for SMF Reports

*Delete data collection file after printing?:* Your response to this prompt specifies whether the data collection file should be removed from the disk after the report writer program ends. A Y indicates the file should be deleted; an N indicates the file should not be deleted. N is the default value for this parameter.

*SYSTEM or printer ID:* Your response to this prompt specifies the printer to be used by the report writer program. The possible entries are:

**SYSTEM**      The report writer program will use the currently-defined system printer. **SYSTEM** is the default value for this parameter.

**printer ID**    The report writer program will use the printer identified by the 2-character printer ID.

*Name of data collection file:* Your response to this prompt specifies the name of the data collection file to be used as input for the report writer program. SMF.LOG is the default value for this parameter. The file name you specify is printed on each page of the SMF report.

*Starting date:* Your response to this prompt specifies a beginning date in year, month, and day (yymmdd) for the report file program. All 6 digits must be entered.

*Starting Time:* Your response to this prompt specifies a beginning time in hours, minutes, and seconds (hhmmss) for the report writer program. Any time from 000000 through 235959 may be entered. All 6 digits must be entered. The report writer diagnoses invalid times (for example, 240000), and an error message is displayed. The default value for this parameter is blank or 000000, which means that the printing of data should begin with the first record in the data collection file. Only samples recorded at or after this beginning time are processed by the report writer program.

*Ending time:* Your response to this prompt specifies an ending time in hours, minutes, and seconds (hhmmss) for the report writer program. After the program begins printing data, it will print until the specified 'to' time is reached. Any time from 000000 through 235959 may be entered. All 6 digits must be entered. The report writer program diagnoses invalid times, and an error message is displayed. The default value for this parameter is blank or 000000, which means that the printing of data should end with the last record in the data collection file.

To print samples that were recorded between 10:30 p.m. and 2 a.m., for example, you would enter the *from* limit as 223000 and the *to* limit as 020000.

## The SMFDATA Procedure

The report file program can be run while the data collection program is still active (the data is formatted from the existing data collection file) or after it has ended. Like SMFSTART, SMFDATA can be started from the general SMF menu, from other menus or displays, and from your own procedure. If you select option 4 (*Create a SMF report file*) on the SMF menu, enter the SMFDATA procedure command without parameters, or enter SMFDATA and press the Help key, the following display appears:

```
SMFDATA PROCEDURE                               Optional-*
Creates a report file from the SMF data collection file )

Report option . . . . . ALL,DETAIL,SUMMARY ALL
Delete data collection file
after creating report file? . . . . . Y,N N
Name of data collection file . . . . . .SMF.LOG
Name of report file . . . . . .SMF.DATA
Starting date . . . . . yyymmdd *
Starting time . . . . . hhmmss *
Ending time . . . . . hhmmss *

Cmd3-Previous menu      Cmd4-Put on job queue      (c) 1984 IBM Corp.
```

For more detail about the SMFDATA prompts, position the cursor at the prompt you want explained and press the Help key. You can also page forward and backward between help displays with the Roll keys. You must return to the procedure display to respond to the prompts.

## SMFDATA Prompts and Parameters

The following paragraphs describe the SMFDATA display prompts and procedure command parameters. If one or more prompts are responded to, the report file program is started; default values are used for any parameters not specified on the display.

*Report option:* Your response to this prompt specifies the type of file to be created by the report file program. Three types of files can be created: **SUMMARY**, **DETAIL**, and **ALL**. Figure 2-2 shows the types of information that are contained in each file. Chapter 3, "SMF Reports," gives a detailed description of the types of information that can be contained in the file. **ALL** is the default value for this parameter.

SUMMARY Report File	DETAIL Report File	ALL Report File
IPL configuration information	IPL configuration information	IPL configuration information
	Communications configuration data, if active and selected	Communications configuration data, if active and selected
	<ul style="list-style-type: none"> <li>• Statistics for each sample interval:               <ul style="list-style-type: none"> <li>– Device usage rates</li> <li>– Task work area usage</li> <li>– Disk cache utilization</li> <li>– Task status</li> <li>– Storage totals</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Statistics for each sample interval:               <ul style="list-style-type: none"> <li>– Device usage rates</li> <li>– Task work area usage</li> <li>– Disk cache utilization</li> <li>– Task status</li> <li>– I/O and SEC information by task, if selected</li> <li>– Terminated task data</li> <li>– User file access counters</li> <li>– System file access counters</li> <li>– Storage totals</li> <li>– System event counters (SEC)</li> <li>– I/O counters</li> <li>– Data storage attachment (DSA) and tape usage</li> <li>– Communications line usage, if active and selected</li> </ul> </li> </ul>
Summary information	Summary information	Summary information

Figure 2-2. Options for SMF Report Files

*Delete data collection file after creating report file:* Your response to this prompt specifies whether the data collection file should be removed from the disk after the report file program ends. A Y indicates the file should be deleted; an N indicates the file should not be deleted. N is the default value for this parameter.

*Name of data collection file:* Your response to this prompt specifies the name of the data collection file to be used as input for the report file program. SMF.LOG is the default value for this parameter.

*Name of report file:* Your response to this prompt specifies the name you want to call the report file that will contain the data from the data collection file. SMF.DATA is the default value for this parameter.

*Starting date:* Your response to this prompt specifies a beginning date in year, month, and day (yymmdd) for the report file program. All 6 digits must be entered.

*Starting time:* Your response to this prompt specifies a beginning time in hours, minutes, and seconds (hhmmss) for the report file program. Any time from 000000 through 235959 may be entered. All 6 digits must be entered. The report file program diagnoses invalid times (for example, 240000), and an error message is displayed. The default value for this parameter is blank or 000000, which means that the report file should begin with the first record in the data collection file. Only samples recorded at or after this beginning time are processed by the report file program.

*Ending time:* Your response to this prompt specifies an ending time in hours, minutes, and seconds (hhmmss) for the report file program. After the program begins creating the report file, it will continue to copy data until the end time is reached. Any time from 000000 through 235959 may be entered. All 6 digits must be entered. The report file program diagnoses invalid times, and an error message is displayed. The default value for this parameter is blank or 000000, which means that the copying of data should end with the last record in the data collection file.

To create a report file containing data that was recorded between 10:30 p.m. and 2 a.m., for example, you would enter the starting time as 223000 and the ending time as 020000.

## Chapter 3. SMF Reports

SMF uses the parameters that you define in Chapter 2 to produce a report of system activity during the specified time. The information printed on an SMF report is divided into the following sections:

- Initial program load (IPL) configuration information
- Communications configuration information, printed for active communications lines
- Device usage information
- Task work area information
- Disk cache information
- Task status information
- Input/output (I/O) and system event counter (SEC) information by task
- Terminated task data
- User file access counters
- System file access counters
- Storage totals information
- Detailed system information, including system event counters, I/O counters, and data storage attachment (DSA) and tape usage
- Communications line usage data
- Mini report snapshot
- SMF summary information

Descriptions of the information printed in each of the report sections follow.

*Note: Counters that are boxed in the sample listings throughout this chapter reflect the state of the system at the time of the snapshot, and are not accumulated over the sample interval.*

# IPL Configuration Information

The first section of an SMF report describes the system and the communications configuration at the time of the most recent IPL. IPL configuration information is printed on all SMF reports. Figure 3-1 shows the system and communications configuration section of a sample SMF report.

```

----- I P L   C O N F I G U R A T I O N -----
MAIN STORAGE SIZE . . . . . 1024 K          SMF DATA COLLECTION DATE. . . . . 85/06/11
DISK CAPACITY . . . . . 757.69 MB         RELEASE/MODIFICATION LEVEL. . . . . 04/00
TASK WORK AREA SIZE . . . . . 888 BLOCKS   CONFIGURATION MEMBER NAME . . . . . SMFCNFIG
3262 PRINTER SUPPORTED. . . . . Y        COMMUNICATION LINES SUPPORTED . . . 1,2,3,4,5,6,7,8
SPOOLING SUPPORTED. . . . . Y           AUTOCALL LINES SUPPORTED. . . . . NONE
REMOTE WORKSTATIONS SUPPORTED . . . . . Y X.21 LINES SUPPORTED. . . . . 5
COMM CONTROLLER ATTACHED. . . . . Y     X.25 LINES SUPPORTED. . . . . NONE
DSC ATTACHED. . . . . N                 TAPE DRIVES SUPPORTED . . . . . NONE
WSC ATTACHED. . . . . Y                 DISK DRIVES ATTACHED. . . . . 3
                                           SYSTEM MODEL NUMBER . . . . . 53602
  
```

```

----- C O M M U N I C A T I O N   C O N F I G U R A T I O N -----
LINE NUMBER. . . . . 3      4      6      7      8
LINE USER. . . . . ASYNC  ASYNC  SDLC-P  BSC-B  BSC-B
LINE PRIORITY. . . . . DYN   DYN   DYN     DYN     DYN
LINE TYPE. . . . . PT-TO-PT PT-TO-PT PT-TO-PT PT-TO-PT PT-TO-PT
LINE RATE. . . . . FULL    FULL    FULL    FULL    FULL
LINE SPEED (BITS/SECOND) . . . 1200   1200   9600   9600   9600
  
```

Figure 3-1. IPL and Communications Configuration Information

**Main Storage Size:** The main storage capacity of your system. The size of main storage on the System/36 can be 128, 256, 384, 512, 768, 1024, or 2048K bytes.

**Disk Capacity:** The disk capacity of your system.

**Task Work Area Size:** The task work area is an area on disk that contains control information and work spaces, including the program swap area, related to a certain task. The size of the task work area is originally established during system configuration. You can change the size through the CNFIGSSP procedure (see the *Changing Your System Configuration* manual for more information). See "Task Work Area Information" later in this chapter for more information about how SMF reports on the task work area; see the *Concepts and Programmer's Guide* for a description of the task work area.

**3262 Printer Supported:** Identifies whether a 3262 Printer is supported on your system. See the description of "3262 Printer Ops" in the "I/O Counter Information" section later in this chapter.

**Spooling Supported:** Identifies whether spooling is supported on your system.

**Remote Work Stations Supported:** Identifies whether remote work stations are supported on your system.

**Comm Controller Attached:** Identifies whether you have a multiple line communications controller attached to your system.

**DSC Attached:** Identifies whether you have a data storage controller (DSC) on your system.

**WSC Attached:** Identifies whether the work station controller (WSC) is attached by an expansion feature (Y) or is part of the base system. A work station controller that is part of the base system is supported only by systems with a *System Model Number* of 5362.

**SMF Data Collection Date:** Identifies the date of this SMF run.

**Release/Modification Level:** Identifies the current SSP release level.

**Configuration Member Name:** Identifies the name of the member that defines the system configuration being used at the time SMF was running.

**Communication Lines Supported:** Identifies the numbers of the communications lines that are configured on your system.

**Autocall Lines Supported:** Identifies, by line number, which of the communications lines are to be used with autocall units. You can have up to four autocall lines. If you do not have autocall units, NONE will show up on the report. No communications line usage data is collected for the autocall units.

**X.21 Lines Supported:** Identifies, by line number, which of the communications lines support the X.21 function. If you do not have an X.21 line, NONE will appear on the report. No communications line usage data is collected for X.21 short-hold mode.

**X.25 Lines Supported:** Identifies, by line number, which communications lines support X.25. If you do not have an X.25 line, NONE will appear on the report. No communications line usage data is collected for X.25 lines.

**Tape Drives Supported:** Identifies the number of tape drives supported on your system: NONE, 1, or 2.

**Disk Drives Attached:** Identifies the number of disk drives attached to your system: 1, 2, 3, or 4.

**System Model Number:** Identifies the model number of your system: 5360, 5362, or 5364. (If the number 2 follows the model number 5360, you have a stage 2 processor.) For information about the stage 2 processor, see "Control Storage Processor" in the *Concepts and Programmer's Guide*.



## Communications Configuration Information

Communications configuration information will be printed any time SMF detects a new line active, or when a line goes down and comes back up between snapshots. Data will be collected for the next snapshot after the line becomes active. The following paragraphs describe the communications configuration information.

**Line Number:** Identifies, by line number, those active communications lines that were selected for usage data.

**Line User:** Identifies what the line is being used for at the time it is made active. The possible uses of the line are:

- ASYNC: Asynchronous communications
- BSC-B: Batch binary synchronous communications (BSC) (RPG II T-spec or Assembler \$DTFB)
- BSC-I: Interactive BSC (SSP-ICF)
- BSC-EM: BSC-3270 emulation
- MSRJE: BSC multiple session remote job entry
- SDLC-P: Synchronous data link control primary, which includes:
  - Finance
  - Peer
  - Remote Work Station
  - Station Test
  - C/SNA (APPC)
- SDLC-S: SDLC secondary, which includes:
  - Peer
  - C/SNA (which includes MSRJE, SNA Upline Facility (SNUF), SNA 3270 emulation, and APPC, although these are not apparent to SDLC)

**Line Priority:** Identifies the priority of the communications line as either high, low, or dynamic. Dynamic indicates the MLCA controller can change the line priority based on line utilization (the higher the utilization the higher the priority). If the priority is not dynamically determined, line 4 is always high priority and lines 1, 2, and 3 are low priority. Line 4 should be your highest speed line.

**Line Type:** Identifies the type of line for which the system is configured. The possible line types are:

Nonswitched point-to-point (PT-TO-PT)  
Multipoint (MULTI-PT)  
Switched point-to-point (SWITCHED)  
Switched network backup (SW-BKUP)

**Line Rate:** Indicates whether the line is being used at its full-rated speed or at half of its rated speed and is valid only if you are using internal clocking.

**Line Speed (Bits/Second):** The bits-per-second (bps) line speed as specified on the SMFSTART procedure display for each line. This rate is used to calculate communications line usage statistics.

## Device Usage Information

Device usage information is printed for each sample interval if the print option MINI, DETAIL, or ALL was specified in the SMFPRINT procedure. Figure 3-2 shows this section of a sample report when ALL was specified. Listed are the percentages of time that certain system devices were used during the sample interval. The usages are calculated by various methods. They are not intended to be exact values, but they can be used to determine how your system is running. The following paragraphs describe the device usage information.

SNAPSHOT TIME - 12.59.41.546 SAMPLE INTERVAL - 1.00.481

```
----- DEVICE USAGE RATES -----
MAIN STORAGE PROCESSOR . . . . 63 %   COMMUNICATION LINE 1. . . . 95 %
CONTROL STORAGE PROCESSOR. . . 72 %   COMMUNICATION LINE 2. . . . 96 %
WORKSTATION CONTROLLER QUEUE . 67 %   COMMUNICATION LINE 3. . . . 17 %
WORKSTATION CONTROLLER . . . . 61 %   COMMUNICATION LINE 4. . . . 20 %
WORKSTATION CONTROLLER 2 QUEUE 5 %    COMMUNICATION LINE 5. . . . ** %
WORKSTATION CONTROLLER 2 . . . . 0 %   COMMUNICATION LINE 6. . . . ** %
PC PROCESSOR . . . . . . . . . . 0 %   COMMUNICATION LINE 7. . . . ** %
DATA STORAGE CONTROLLER. . . . 10 %   COMMUNICATION LINE 8. . . . ** %
DATA STORAGE ATTACHMENT. . . . 29 %
DISK 1 . . . . . . . . . . . . . . 14 %
DISK 2 . . . . . . . . . . . . . . 26 %
DISK 3 . . . . . . . . . . . . . . 79 %
DISK 4 . . . . . . . . . . . . . . 41 %
```

Figure 3-2. Device Usage Information

**Snapshot Time:** The time of the snapshot, which is the same as the time the sample ends. The snapshot time is based on a 24-hour clock, which is set by the system operator during IPL, and is listed in hours, minutes, seconds, and milliseconds. You can use the time to relate the SMF data to actual operating events.

**Sample Interval:** The amount of time that has passed since the last SMF snapshot. The elapsed time is listed in minutes, seconds, and milliseconds. Because of extra SMF processing time, the elapsed time will be slightly greater than the sample interval you specified on the SMFSTART procedure display.

**Main Storage Processor:** The percentage of the sample interval during which the main storage processor was busy. Some tasks, such as sorts and program compilations, use the main storage processor to a much greater extent than others.

**Control Storage Processor:** The percentage of the sample interval during which the control storage processor was busy. System functions such as swapping, task dispatching, disk I/O, and work station I/O use the control storage processor. In addition, programs that use data communications and programs that use the scientific instruction set (for example, BASIC and FORTRAN programs) can increase control storage processor usage significantly.

**Work Station Controller Queue:** The percentage of the sample interval during which the work station I/O control handler microcode requested service from the work station controller to perform an I/O operation. This percentage includes the *work station controller* time as well as any time for system activity of a higher priority than the actual work station I/O operation. This type of system activity could include such things as disk I/O and SVC processing.

**Work Station Controller:** The percentage of the sample interval during which the work station controller was busy processing work station I/O operations.

**Work Station Controller 2 Queue:** The percentage of the sample interval during which the second work station I/O control-handler microcode requested service from the second work station controller to perform an I/O operation. This percentage includes the *work station controller* time as well as any time for system activity of a higher priority than the actual work station I/O operation. This type of system activity could include such things as disk I/O and SVC processing.

**Work Station Controller 2:** The percentage of the sample interval during which the second work station controller is busy processing work station I/O operations.

**PC Processor:** The percentage of the sample interval during which the PC processor is busy running a DOS session and supporting I/O devices (base work station, PC-attached printer, and communications).

**Data Storage Controller:** The percentage of the sample interval during which the data storage controller (DSC) was busy. The DSC controls disk, diskette, and tape input/output operations and handles interfacing with the control storage processor. A DSC is required to handle tape input/output operations. If a DSC is not attached to your system, disk and diskette input/output operations are handled by the control storage processor.

**Data Storage Attachment:** The percentage of the sample interval during which only one DSA buffer was allocated plus the percentage that two DSA buffers were allocated to a task. Because the DSA has two buffers, SMF divides in half the usage when only one buffer is allocated before computing the total value. The DSA is shared by the disk drive and the diskette drive.

**Disk 1:** The percentage of the sample interval during which disk drive 1 was busy. This value includes disk I/O services and disk I/O control handler processing time, disk arm seek time, and time waiting for a data storage attachment (DSA) buffer.

**Disk 2:** The percentage of the sample interval during which disk drive 2 was busy.

**Disk 3:** The percentage of the sample interval during which disk drive 3 was busy.

**Disk 4:** The percentage of the sample interval during which disk drive 4 was busy.

**Communications Lines 1 through 8:** For each communications line identified (1-8), the percentage of the sample interval during which that communications line was being used to transfer data. See the description of “Total Line Usage” in the “Communications Line Usage Information” section later in this chapter. (Asterisks [\*\*] are printed if the line is not active or if communications data is not collected.)

## Task Work Area Information

Task work area information is printed for each sample interval if the print option MINI, DETAIL, or ALL was specified in the SMFPRINT procedure. Figure 3-3 shows this section of a sample report when ALL was specified. The following paragraphs describe the task work area information.

```
----- TASK WORK AREA -----  
TASK WORK AREA SIZE, . . . . . 3100 BLKS  
TASK WORK AREA USAGE . . . . . 49 %  
TASK WORK AREA EXTENTS . . . . . 0
```

**Figure 3-3. Task Work Area Information**

**Task Work Area Size:** See “Task Work Area Size” in the “IPL Configuration Information” section earlier in this chapter, where this counter first appears. The size shown reflects the size of the task work area at the time of the snapshot and includes the disk space for each extent.

**Task Work Area Usage:** The percentage of the current total task work area that is being used at the time of the snapshot. The usage of the task work area depends on the number of active display stations and the number of tasks running.

**Task Work Area Extents:** The system allocates a continuous segment of the task work area for each task that can be swapped. If the task work area is broken up so that enough continuous space does not exist for a new task, the system will create a task work area extent. This extent can be anywhere on disk and is considered a part of the task work area. This counter reflects the number of extents on disk at the time of the snapshot and does not include the original task work area.

For each extent, the system tries to allocate 410 blocks. If the space is not available, it tries to allocate 400 blocks, then 390 blocks, and so on until the allocation is successful or until it is determined that no disk space is available for the extent.

For performance suggestions regarding the task work area, see “Task Work Area Counters” in Chapter 4.

## Disk Cache Information

Disk cache information is printed for each sample interval if the print option **DETAIL** or **ALL** is specified in the SMFPRINT procedure. Figure 3-4 shows this section of a sample report when **ALL** is specified. The following paragraphs describe the disk cache information.

DISK CACHE	
CACHE SIZE . . . . .	512 K
CACHE PAGE SIZE . . . . .	2 K
CACHE UTILIZATION . . . . .	67 %

**Figure 3-4. Disk Cache Information**

**Cache Size:** The size of the main storage used for the disk cache. This size reflects the size of the disk cache at the time of the snapshot.

**Cache Page Size:** The size of the pages used by the disk cache. This size reflects the page size of the disk cache at the time of the snapshot.

**Cache Utilization:** The percentage of the disk cache read operations found in the disk cache.

*Note: Since the cache can be stopped during a snapshot interval, cache utilization may have a nonzero value while the cache size and cache page size are zero.*

# Task Status Information

Task status information is printed for each sample interval if the print option **DETAIL** or **ALL** was selected in the **SMFPRINT** procedure. Figure 3-5 shows this section of a sample report when **ALL** was specified. The first section of information defines the condition of each active task at the time of the snapshot. The second and third section of information will be printed only if you choose to collect *I/O and SEC data by task* on the **SMFSTART** procedure display and select the print option **ALL** on the **SMFPRINT** procedure display. The following paragraphs describe the task status information.

TASK STATUS																
JOB	PROCEDURE	PROGRAM	PROG SIZE	TYPE	REQ CNT	WS OPS	PRIORITY	USER ID	ATTRIBUTE EXEC STOR	PROG SWAPS	STATUS			TWS	TWS SWAPS	
											SWAP	--WAIT--	SCHD			
1		SYS TASK	0 K	CMD-PR				SYSTEM	RENT NUC			NUC	EC	LW	0 K	
2	W1111635	GMTEST	\$SMFML 8 K	SMF				SYSTEM DSJ	RELD SWAP	2		IN			0 K	
3		SYS TASK	8*K	*SDLC-M				SYSTEM	RELD NSW			NSW			0 K	
4		SYS TASK	6 K	*SDLC-I				SYSTEM	RELD SWAP			IN	EC		0 K	
5		SYS TASK	12*K	INTER				SYSTEM	RELD NSW			NSW	EC		0 K	
6		SYS TASK	14 K	BGCEL				SYSTEM	RELD SWAP			IN	EC		0 K	
7		SYS TASK	14 K	RWS				SYSTEM	RELD SWAP			IN	EC		0 K	
8	S1111443	NB04B	NB04R 28 K	MRT	4	84	V-MED	*****	RELD SWAP	20		IN	EC	LW	0 K	
9	S2111444	NB04C	NB04R 28 K	MRT	5	107	V-MED	*****	RELD SWAP	11		IN	EC	LW	0 K	
10	S3111445	NR12B	NR12R 16 K	MRT	3	46	V-MED	*****	RELD SWAP	7		IN	EC	LW	0 K	
11	R3111452	NR12A	NR12R 16 K	MRT	3	39	V-MED	*****	RELD SWAP	11		IN	EC	LW	0 K	
12	R1111448	NB04A	NB04R 28 K	MRT	4	74	V-MED	*****	RELD SWAP	18		IN			0 K	
13	B1111555	NI03A	NI03R 12 K	SRT	1	16	V-MED	TB1L	RELD SWAP	7		IN	EC	LW	0 K	
14	B2111557	NI03B	NI03R 12 K	SRT	1	16	V-MED	TB2L	RELD SWAP	7		IN	EC	LW	0 K	
15		SPOLPAP8	6 K	SPOOL				MEDIUM	RENT REFR			IN	EC	LW	6 K	24
16		SPOLPAP9	-- K	SPOOL				MEDIUM	RENT REFR				EC	LW	6 K	10
17		SPOLMSP4	-- K	SPOOL				MEDIUM	RENT REFR				EC		6 K	
18		SPOLMSP2	-- K	SPOOL				MEDIUM	RENT REFR				EC		6 K	
19		SPOLMSP3	-- K	SPOOL				MEDIUM	RENT REFR				EC		6 K	
20	W1111630	EXQXYP9	#DFEX 30 K	SRT				V-LOW DSJ	RELD SWAP			IN	EC		0 K	2
21	W1111631	SAVE10MB	\$COPY 24 K	SRT				V-LOW DSJ	RELD SWAP	2		IN	EC		18 K	2
22	W1111628	MIXR2T	MIREAL 16 K	SRT				V-LOW DSJ	RELD SWAP			IN	EC		0 K	1
23	W1111632	NF10P6D	NF10P 6 K	SRT				V-LOW DSJ	RELD SWAP			IN	EC		0 K	
24	W1110348	GMTEST	NB40P 16 K	SRT	1			V-LOW DSJ	RELD SWAP			IN			0 K	

Figure 3-5 (Part 1 of 2). Task Status Information

JOB	PROC/TYP	MSP	DISK 1			DISK 2			DISK 3			DISK 4		
		USAGE	READ	SCAN	WRITE	READ	SCAN	WRITE	READ	SCAN	WRITE	READ	SCAN	WRITE
1		CMD-PR	0%	0	0	0	0	0	0	0	0	0	0	0
2	W1111635	SMF	0%	0	0	2	0	0	0	0	0	0	0	0
3		SDLC-M	2%	0	0	0	0	0	0	0	0	0	0	0
4		SDLC-I	0%	0	0	0	0	0	0	0	0	0	0	0
5		INTER	0%	0	0	0	0	0	0	0	0	0	0	0
6		BSCCL	0%	0	0	0	0	0	0	0	0	0	0	0
7		RWS	2%	0	0	0	0	0	0	0	0	0	0	0
8	S1111443	NB04B	3%	49	17	33	27	22	0	0	0	0	0	0
9	S2111444	NB04C	4%	59	17	40	32	22	0	0	0	0	0	0
10	S3111445	NR12B	1%	5	0	18	17	12	0	0	0	0	0	0
11	R3111452	NR12A	1%	4	0	17	17	11	0	0	0	0	0	0
12	R1111448	NB04A	2%	42	13	28	23	17	0	0	0	0	0	0
13	B1111555	NI03A	0%	6	6	6	6	6	0	0	0	0	0	0
14	B2111557	NI03B	0%	6	6	6	6	6	0	0	0	0	0	0
15		SPDOL	0%	0	0	0	4	0	0	0	0	0	0	0
16		SPDOL	0%	0	0	0	9	0	1	0	0	0	0	0
17		SPDOL	0%	0	0	0	9	0	0	0	0	0	0	0
18		SPDOL	1%	0	0	0	23	0	0	0	0	0	0	0
19		SPDOL	1%	0	0	0	23	0	0	0	0	0	0	0
20	W1111630	EXQXYP9	4%	141	96	1	15	6	24	0	0	0	0	0
21	W1111631	SAVE10MB	0%	65	3	38	0	0	0	0	0	0	0	0
22	W1111628	MIXR2T	3%	114	116	112	0	1	0	0	0	0	0	0
23	W1111632	NF10DP6D	0%	0	0	0	15	0	0	0	0	0	0	0
24	W1110348	GMTEST	5%	72	0	16	147	150	11	0	0	0	0	0

JOB	PROC/TYP	PRNTR	WKSTN	XIENT	XXFER	GEN	REC	JOB	RES	MSP	NOT
		-OPS-	COUNT	CALLS	CALLS	WAITS	WAITS	STEPS	T-OUT	T-OUT	USED
1		CMD-PR	0	0	0	0	0	0	0	0	0
2	W1111635	SMF	0	0	0	0	0	0	0	0	0
3		SDLC-M	0	0	0	0	0	0	3	0	0
4		SDLC-I	0	0	0	0	0	0	0	0	0
5		INTER	0	0	0	0	0	0	0	0	0
6		BSCCL	0	0	0	0	0	0	0	0	0
7		RWS	0	0	0	3	0	0	16	0	0
8	S1111443	NB04B	0	35	0	70	0	0	0	0	0
9	S2111444	NB04C	0	45	0	90	0	0	0	0	0
10	S3111445	NR12B	0	19	0	38	0	0	0	0	0
11	R3111452	NR12A	0	15	0	34	0	0	0	0	0
12	R1111448	NB04A	0	30	0	58	0	0	0	0	0
13	B1111555	NI03A	0	6	0	12	0	0	0	0	0
14	B2111557	NI03B	0	6	0	12	0	0	0	0	0
15		SPDOL	0	0	0	0	0	0	0	0	0
16		SPDOL	0	0	0	5	0	0	0	0	0
17		SPDOL	0	0	0	0	0	0	16	0	0
18		SPDOL	0	0	0	0	0	0	40	0	0
19		SPDOL	0	0	0	0	0	0	40	0	0
20	W1111630	EXQXYP9	259	0	6	85	0	1	20	0	0
21	W1111631	SAVE10MB	0	0	0	9	0	0	36	0	0
22	W1111628	MIXR2T	0	0	2	22	0	0	21	0	0
23	W1111632	NF10DP6D	37	0	0	37	0	0	9	0	0
24	W1110348	GMTEST	270	0	0	9	0	0	28	0	0

Figure 3-5 (Part 2 of 2). Task Status Information

**Job:** The system-assigned name of the job that is running. This field is blank for certain system tasks such as SDLC.

**Procedure:** The name of the first-level procedure (started by the operator) that called the job that is running.

**Program:** The name of the program that is running. If the task is in the process of starting (initiation), ending (termination), or is between job steps, the name SCHEDULR might appear in this field. For certain system tasks such as SDLC or SNA, this field will contain the name SYS TASK.

**Prog Size:** The actual amount of main storage used by the program in K bytes. If the program is not swappable (cannot be swapped), an asterisk will appear next to the number of K bytes. This indicates that the space occupied by the program reduces the user space available.

**Type:** The type of user program or system task.

*Note: An asterisk (\*) before the task type indicates that this is a system subtask; that is, a task created by another task. An example of a system subtask is SDLC.*

Possible user program types (attributes) are:

- MRT: The program is a multiple requester program.
- NEP-MRT: The program is a long-running, multiple requester program (never-ending program).
- NEP-NRT: The program does not have any attached requesters and is long-running.
- NEP-SRT: The program is a long-running, single-requester program.
- NRT: The program does not have any attached requester.
- SRT: The program is a single requester program.

Possible system types are:

- ASYNC-I: The task is the asynchronous communications interrupt handler.
- ASYNC-M: The task is the asynchronous communications subsystem.
- AUTO-CL: The task is the autocall task.
- APPC: The task is the APPC subsystem.
- BSC-B: The task is the batch BSC interrupt handler.
- BSC-RJE: The task is the BSC MSRJE subsystem.
- BSCEL: The task is the BSCEL subsystem.
- BSC3270: The task is the BSC3270 emulation subsystem.



- CCP: The task is the CCP subsystem.
- CICS: The task is the CICS subsystem.
- CMD-PR: The task is the command processor.
- CSNA: The task is Combined System Network Architecture (SNA).
- DBCS: The task is for IGC (double byte character set).
- EM3270: The task is the BSC interrupt handler for 3270 emulation.
- HELP: The help task is active.
- HELP-T: The help task is ending (in termination).
- IMS: The task is the IMS subsystem.
- INTER: The task is the interactive BSC (BSC SSP-ICF) interrupt handler.
- INTRA: The task is the Intra subsystem.
- JOBQ: The task is being run from the job queue.
- CC-ER: The task is the multiple line communications controller error task.
- MSRJE: The task is the BSC interrupt handler for MSRJE.
- PEER: The task is the SNA peer subsystem.
- REBUILD: The task is file rebuild.
- REORG: The task is the disk reorganization facility (COMPRESS).
- RWS: The task is remote work station SNA.
- SDLC-I: The task is SDLC initialization/termination.
- SDLC-M: The task is SDLC mainline.
- SYS-ERR: The task is the system error task.
- SFS: The task is the SNA finance subsystem.
- SMF: The task is the system measurement facility.
- SNA-RJE: The task is the MSRJE subsystem.
- SNA3270: The task is the SNA3270 emulation subsystem.
- SNUF: The task is the SNA Upline Facility subsystem.
- SPL-ATT: The task is the spool writer attachment.
- SPOOL: The task is the spool writer.

- **SYSTEM:** The task is a miscellaneous system task.
- **TWA REC:** The task is task work area recovery.
- **X.21:** The task is the X.21 function.
- **X.25-I:** The task is X.25 initialization/termination.
- **X.25-M:** The task is X.25 mainline.

**Req Cnt:** The number of work stations or SSP interactive communications feature (ICF) sessions attached to this task (requester count). If yours is an MRT program, the value shown might exceed the maximum MRT value assigned to the program. You should then increase the MRTMAX value or consider having two procedures call the same program to give each program half the number of requesters.

**WS Ops:** The number of I/O operations performed by all work stations currently attached to this task. This number may not be equal to the total number of operator actions because a single activity (such as pressing the Enter key) may cause several display station operations to occur.

**Priority:** The priority of the task.

- **SYSTEM:** The task ran at system priority.

User Priorities:

- **HIGH:** The task ran at high priority.
- **MEDIUM:** The task ran at medium priority.
- **LOW:** The task ran at low priority.

If no priority is specified for the program, the report will show V-LOW or V-MEDIUM. This variable (V) priority changes under system control.

*Notes:*

1. *The tasks are listed on the report in order of decreasing priority.*
2. *The system can assign a priority other than what you have specified. This priority assignment is temporary and is used for special situations, such as the starting or ending of a task.*

**User ID:** The ID of the user at the work station from which the job was started. For a program with multiple requesters (an MRT), the user ID is 8 asterisks (\*\*\*\*\*). A system subtask and some system tasks are listed with a blank user ID.

**Attribute-Exec:** The execution attribute for the program. The execution attribute types are:

- **RENT:** Reentrant. More than one task may use the same copy of the program at the same time.
- **REUS:** Reusable. More than one task may use the same copy of the program at the same time, but only after the current user of the program releases it.
- **RELD:** Reloadable. A new copy of the program is reloaded every time it is requested. All user programs and some system programs are reloadable. For MRT programs, the first request will cause a load of the program. Any subsequent requests for the program will not cause a reload of the program, but will cause an attach to the existing program.

**Attribute-Stor:** The storage attribute for the program. The storage attribute types are:

- **NSW:** Not swappable. The program cannot be swapped out of main storage. See "Prog Size" in this section.
- **NUC:** The program runs in the nucleus.
- **REFR:** Refreshable. The storage for the program does not need to be swapped out but can be released, and then the program can be reloaded in main storage when needed.
- **SWAP:** Swappable. The program may be swapped out so another program can use the same main storage.
- **XNT:** The program runs in the main storage transient area.

**Prog Swaps:** The number of times the program was swapped in or out of main storage during the sample interval.

*Note:* When a program is loaded initially, its Program Swaps counter is set to 1.

**Status-Swap:** The swap status of each program at the time of the sample. Specific swapping conditions that can occur are:

- **IN:** The program is currently in main storage.
- **NSW:** The program is currently in main storage and is not swappable. See "Prog Size" in this section.
- **NUC:** The program runs in the nucleus and cannot be swapped.
- **OUT:** The program does not currently occupy all the storage it requires.

**Status-Wait:** The wait status of each program at the time of the sample. Up to three wait conditions can be shown on the report. If no wait conditions are shown, the program is ready to run.

The wait conditions that can occur are:

- **EC:** The task is waiting for an I/O event completion from disk, a printer, a work station, or some other device.
- **GP:** The task is waiting for a general post. General post or wait conditions are:
  - **AF:** Assign/free area wait
  - **CA:** Communications line allocate wait
  - **DA:** Disk space allocate wait (the program cannot obtain enough disk space)
  - **DE:** Disk record wait (the program cannot read a record from disk because another program has exclusive use of the record)
  - **DR:** Disk resource wait
  - **IA:** Diskette allocate wait
  - **IT:** Interactive communications feature (SSP-ICF) transient wait
  - **OA:** Other devices allocate wait
  - **PA:** Printer allocate wait
  - **QL:** Quick lock wait
  - **TA:** Task work area allocate wait (the program cannot obtain enough space in the task work area)
  - **TS:** Test and set failure
  - **WR:** Work station release wait
- **ID:** The task is waiting for an internal-delayed supervisor call (SVC). The internal-delayed supervisor calls are:
  - **Control storage transient scheduler.** A control storage transient is being loaded. See the description of “Control Storage Transient Calls” and “Control Storage Transient Loads” in the “System Event Counters Information” section later in this chapter.
  - **Task work area access.** The task is accessing the task work area. See the description of “Task Work Area Read Ops” and “Task Work Area Write Ops” in the “System Event Counters Information” section later in this chapter.
  - **Main storage load.** An example of a main storage load is an overlay segment being loaded into main storage. See the description of “Main Storage Loader Requests” in the “System Event Counters Information” section later in this chapter.
- **LW:** The task is in a long wait (usually for the operator to press the Enter key).
- **OS:** The task is waiting for an overlapped SVC request.
- **RE:** The task is waiting for a system resource.

- **EI:** The task is waiting for control storage; a BASIC or FORTRAN scientific instruction set is being emulated in control storage.
- **ST:** The task is waiting for main storage.
- **SU:** The task is suspended. For example:
  - The operator interrupted the program by pressing the Attn key (inquiry).
  - The system operator entered the STOP command.
- **TM:** The task has set the interval timer and is waiting for it to run out. An assembler subroutine is required for COBOL, FORTRAN, and RPG II programs to do this.

**Status-Schd:** The scheduler status of the job at the time of the snapshot. The scheduler is the part of the SSP that performs the following functions:

- **INIT:** The job is being started (initiated) or is running between job steps.
- **INQ:** The job has been suspended while the display station is doing an inquiry.
- **TERM:** The job or job step has ended and termination functions are being performed.
- **Blank:** The task is not being scheduled.

**TWS:** This value plus the program size equals the amount of main storage that is being taken from the system by a certain task at the time of the snapshot. The task may own additional task work space, but only what it is using at the time of the snapshot is listed here.

**TWS Swaps:** The total number of times that task work space was swapped in or swapped out since the last sample.

## I/O and SEC Data by Task

**Job:** See “Job” under “Task Status Information.”

**Proc/Type:** See Procedure in this section. If this is a system task rather than a procedure, the system task type is shown here (see “Type” under “Task Status Information”).

**MSP Usage:** The percentage of main storage processor time used by the task. For performance suggestions regarding the main storage processor, see “Main Storage Processor Considerations” in Chapter 4.

- Disk 1:** The number of read, scan, and write operations on the first disk for each task. See the description of “Read,” “Scan,” and “Write” operations in the “I/O Counter Information” section later in this chapter.
- Disk 2:** The number of read, scan, and write operations on the second disk for each task.
- Disk 3:** The number of read, scan, and write operations on the third disk for each task.
- Disk 4:** The number of read, scan, and write operations on the fourth disk for each task.
- Prntr Ops:** The number of printer operations, or lines printed, by each task. If the task is being spooled, the data to be printed is placed in the spool file while it is being counted.
- Wkstn Count:** The number of low-level aids (Enter key, function keys, command keys) received by each task from any work station attached to it.
- Xient Calls:** The number of times that each task issued a SVC to call a transient. See the description of “Main Storage Transient Calls” in the “System Event Counters Information” section later in this chapter.
- Xxfer Calls:** The number of times that each task issued an SVC to call a translated transient. See the description of “Translated Transfer Calls” in the “System Event Counters Information” section later in this chapter.
- Gen Waits:** The number of general waits for each task. See “Status Waits” under “Task Status Information” for a list of general wait conditions.
- Rec Waits:** The number of times that each task had to wait to read or write a record that was being updated by another task.
- Job Steps:** The number of job steps initiated by each task.
- Res T-Out:** The number of resource timeouts for each task. See the description of “Resource Time-outs” in the “System Event Counters Information” section later in this chapter.
- MSP T-Out:** The number of main storage processor timeouts for each task. See the description of “Main Storage Processor Timeouts” in the “System Event Counters Information” section later in this chapter.

## Terminated Task Data

Terminated task data is also printed for each sample interval if you choose to collect *I/O and SEC data by task* in the SMFSTART procedure and select the ALL option on the SMFPRINT procedure. Information is printed about all tasks (except system subtasks) that ended during the sample interval. Figure 3-6 shows the format of the terminated task data. The description of the data is the same as in the "Task Status Information" section earlier in this chapter.

----- TERMINATED TASK DATA -----														
JOB	PROC/TYP	MSP	DISK 1			DISK 2			DISK 3			DISK 4		
		USAGE	READ	SCAN	WRITE	READ	SCAN	WRITE	READ	SCAN	WRITE	READ	SCAN	WRITE
1	W1111629	DFUXYNPB	5%	30	0	2	7	1	30	0	0	0	0	0

JOB	PROC/TYP	PRNTR	WKSTN	XIENT	XXFER	GEN	REC	JOB	RES	MSP	NOT	
		-DPS-	COUNT	CALLS	CALLS	WAITS	WAITS	STEPS	T-OUT	T-OUT	USED	
1	W1111629	DFUXYNPB	900	0	0	44	0	0	1	11	2	0

Figure 3-6. Terminated Task Data

# User File Access Counters

User file access information is printed for each sample interval if you selected the print option ALL in the SMFPRINT procedure. Figure 3-7 shows this section of a sample report if ALL was specified. A description of the user file access counters follows Figure 3-7.

USER FILE ACCESS COUNTERS																				
FILE LABEL	DATE CREATED	FILE JOBNAME	FILE TYPE	FILE ORG	BLOCK LOC	DISK LENGTH	DATA READ	DATA WRTE	INDEX READ	INDEX SCAN	INDEX WRTE	REC WTS	GET LOG	GET PHYS	UPDATE LOG	UPDATE PHYS	DELETE LOG	DELETE PHYS	ADD LOG	ADD PHYS
PDB1000A	84/09/10		R	D	45013	8 A1	2	5	0	0	0	0	5	2	5	5	0	0	0	0
PDB1010A	84/09/10		R	D	43783	100 A1	31	34	0	0	0	0	34	31	34	34	0	0	0	0
PMB0030A	84/08/30		R	I	126086	324 A2	1	0	0	4	0	0	5	5	0	0	0	0	0	0
PMB0050A	84/08/30		R	I	115455	1057 A2	0	0	0	0	0	0	24	0	0	0	0	0	0	0
PMH0020A	84/08/30		R	I	131830	1084 A2	27	0	0	26	0	0	27	53	0	0	0	0	0	0
PMH0050A	84/08/30		R	I	107824	3960 A2	64	0	0	61	0	0	65	125	0	0	0	0	0	0
PMH0060A	84/08/30		R	I	95941	3 A2	4	0	0	0	0	0	5	4	0	0	0	0	0	0
PMH0150A	84/08/30		R	I	17273	4436 A1	30	0	0	25	0	0	30	55	0	0	0	0	0	0
PXM0010A	84/09/10		R	I	17238	7 A1	0	0	0	0	0	0	5	0	0	0	0	0	0	0
PDB1010C	84/09/10		R	D	43983	100 A1	17	23	0	0	0	0	23	17	23	23	0	0	0	0
PXM0010C	84/09/10		R	I	17252	7 A1	0	0	0	0	0	0	3	0	0	0	0	0	0	0
PDB1000C	84/09/10		R	D	45029	8 A1	1	3	0	0	0	0	3	1	3	3	0	0	0	0
PMH0020C	84/08/30		R	I	129662	1084 A2	3	0	0	3	0	0	3	6	0	0	0	0	0	0
PMB0050C	84/08/30		R	I	113341	1057 A2	0	0	0	0	0	0	18	0	0	0	0	0	0	0
PMH0050C	84/08/30		R	I	99904	3960 A2	18	0	0	16	0	0	18	34	0	0	0	0	0	0
PMH0060C	84/08/30		R	I	95935	3 A2	2	0	0	0	0	0	3	2	0	0	0	0	0	0
PMH0150C	84/08/30		R	I	26145	4436 A1	18	0	0	14	0	0	18	32	0	0	0	0	0	0
PDR3050A	84/09/10		R	D	44183	42 A1	5	18	0	0	0	0	18	5	18	18	0	0	0	0
PDB1010B	84/09/10		R	D	43883	100 A1	23	26	0	0	0	0	26	23	26	26	0	0	0	0
PXM0010B	84/09/10		R	I	17245	7 A1	0	0	0	0	0	0	3	0	0	0	0	0	0	0
PDB1000B	84/09/10		R	D	45021	8 A1	0	3	0	0	0	0	3	0	3	3	0	0	0	0
PMH0020B	84/08/30		R	I	130746	1084 A2	20	0	0	15	0	0	20	35	0	0	0	0	0	0
PMB0050B	84/08/30		R	I	114398	1057 A2	0	0	0	0	0	0	22	0	0	0	0	0	0	0
PMH0050B	84/08/30		R	I	103864	3960 A2	26	0	0	22	0	0	28	48	0	0	0	0	0	0
PMH0060B	84/08/30		R	I	95938	3 A2	3	0	0	0	0	0	3	3	0	0	0	0	0	0
PMH0150B	84/08/30		R	I	21709	4436 A1	26	0	0	21	0	0	27	47	0	0	0	0	0	0
PDR3050B	84/09/10		R	D	44225	42 A1	3	17	0	0	0	0	17	3	17	17	0	0	0	0

Figure 3-7. User File Access Counters

**File Label:** The label of the file being accessed. If the file has been deallocated during this snapshot interval, an asterisk will appear in the column before the file label. The file is listed on the report only if there were I/O counts during the snapshot interval.

**Date Created:** The date the file was created on the disk.

**Job Name:** The name the system assigns to the job that is accessing the file. The job name may be blank if the file is shared.

**File Type:** The file type with regard to the retention attribute as specified on the FILE OCL statement. The file type can be resident (R), job (J), or scratch (S).

**File Organization:** The organization of the file on disk can be sequential-S, direct-D, indexed-I (parent), or indexed alternative-IA.



**Block Location:** The location of the first block the file occupies on the disk.

**Length:** The number of blocks the file occupies on disk.

**Disk Location:** The disk (A1, A2, A3, or A4) the file is located on.

**Data Reads:** The number of read operations performed on the data records in the file.

**Data Writes:** The number of write operations performed on the data records in the file.

**Index Reads:** The number of read operations performed on the index of the file.

**Index Scans:** The number of scan operations performed on the index of the file. Scan operations are used to search for particular key entries in the index.

**Index Writes:** The number of write operations performed on the index of the file.

**Record Waits:** The number of times that this file had more than one concurrent request for delete or update operations for the same record. For more information, see the description of “Disk Record Waits” in the “System Events Counters” later in this chapter or refer to “Record Locking” in the *Concepts and Programmer’s Guide*.

**Get Logical:** The number of read operations that were processed by disk data management.

**Get Physical:** The number of physical I/O operations performed by disk data management to process the get logical operations.

**Update Logical:** The number of update operations that were processed by disk data management.

**Update Physical:** The number of physical I/O operations performed by disk data management to process the update logical operations.

**Delete Logical:** The number of delete operations processed by disk data management.

**Delete Physical:** The number of physical I/O operations performed by disk data management to process the delete logical operations.

**Add Logical:** The number of add operations processed by disk data management.

**Add Physical:** The number of physical I/O operations performed by disk data management to process the add logical operations.

The data reads and writes, as well as the index reads, writes, and scans also appear as physical (PHYS) counts under the disk data management operations of get, update, delete, and add. The total of the physical counts equals the total of the counts listed under DATA and INDEX for the period that the file is allocated (probably several SMF snapshots). Individual snapshots may have unequal totals.

The relationship of the LOG (logical) counts to the PHYS (physical) counts is affected by the following:

- The blocking factor for the file
- Whether or not the file is shared
- Whether or not the file has any alternative indexes defined

One logical operation may result in zero physical operations (blocking) or several physical operations (processing alternative indexes).

On the report, you may see a physical count of zero associated with a non-zero logical count. The physical counts are counted under another operation. For example, the DELETE LOG (logical) count may show 100 and the DELETE PHYS (physical) count may be zero. Since a get can be done first when performing the delete, the physical count for get is updated.

## System File Access Counters

System file access information is printed for each sample interval if you selected the print option ALL in the SMFPRINT procedure. Figure 3-8 shows this section of a sample report if ALL was specified. A description of the system file access counter follows Figure 3-8.

-----S Y S T E M F I L E A C C E S S C O U N T E R S-----										
FILE	DATE	FILE	FILE	BLOCK	DISK -----DATA-----					
LABEL	CREATED	JOBNAME	TYPE	ORG	LOC	LENGTH	LOC	READS	SCANS	WRITES
#SYSTASK					1319	888	A1	17	0	7
#LIBRARY					2207	8500	A1	173	105	0
#SYSWORK					650	419	A1	27	76	28
#SYSHIST					1069	250	A1	9	0	9
CSLIB					0	650	A1	8	0	0
MISCA1					0	78204	A1	4	0	0
##SPOOL1					78204	750	A2	14	0	38
SMF.6209	85/06/11		R	D	84092	200	A2	0	0	2
TESTLIB2			R	L	84292	300	A2	3	3	0
FOLDER#2	85/06/11		R	FD	83173	8	A2	18	5	21
FOLDER#2			R	FD	83184	4	A2	9	1	14
MISCA2					78204	78204	A2	0	0	10
TESTLIB1			R	L	294873	300	A3	7	7	4
*FOLDER#1	85/06/11		R	FD	78991	8	A2	30	13	35
*FOLDER#1			R	FD	85432	500	A2	518	25	158
*\$WORK	85/06/11	W1172332	S	S	293600	64	A3	2	0	0
*\$SOURCE	85/06/11	W1172332	S	S	293664	64	A3	6	0	11

Figure 3-8. System File Access Counters

**File Label:** The label of the file being processed. If the file was deallocated during this snapshot interval, an asterisk appears in the column before the file label.

The following is a list of files for which counts are reported. It is not a complete list. A file is listed on the report only if there were I/O counts during the snapshot interval. Data will be collected for the following files:

- Control storage library
- #LIBRARY
- #SYSWORK – VTOC (disk and diskette), master configuration record
- #SYSHIST – System history file
- #SYSTASK – Task work area
- #SYSTSKX – Task work area extents
- ##SPOOL1 through ##SPOOL6 – Up to 6 spool files
- ##JOBQ – System job queue
- Main trace file
- User libraries
- User and system files that are accessed via system I/O routines

You may also see the files MISCA1 through MISCA4 on your report. These files are a recording of all the miscellaneous accesses for that disk drive that are not otherwise accounted for.

Some of the files in the above list may be listed as user files in other publications. For example, ##SPOOL and ##JOBQ. They are listed under system files in this instance because they are accessed via system I/O routines and not disk data management.

**Date Created:** The date the file was created on disk. This field may be blank for some files.

**Job Name:** The name the system assigned to the job accessing the file. The job name may be blank if the file is shared.

**File Type:** The file type with regard to the retention attribute as specified on the FILE OCL statement. The file type can be resident (R), job (J), or scratch (S).

**File Organization:** The organization of the file can be sequential-S, direct-D, indexed-I (parent), indexed alternative-IA (alternative), library-L, library extent-LX, document folder-FD, data dictionary folder-FT, mail log folder-FL, profile folder-FP, mail folder-FM, or document work folder-FW.

**Block Location:** The location of the first block the file occupies on the disk.

**Length:** The number of blocks the file occupies on disk.

**Disk Location:** The disk (A1, A2, A3, or A4) the file is located on.

**Data Reads:** The number of read operations that occurred for data records in the file.

**Data Scans:** The number of scan operations that occurred for data records in the file.

**Data Writes:** The number of write operations that occurred for data records in the file.

## Storage Totals Information

Storage totals information is printed for each sample interval if the print option **DETAIL** or **ALL** was specified in the **SMFPRINT** procedure. Figure 3-9 shows this section of a sample report when **ALL** was specified. The following paragraphs describe the storage totals information.

SYSTEM WORK						STORAGE TOTALS					
--- SPACE ---	SIZE	SWAP STAT	SWAPS	ACTIVE USERS	DEMAND COUNT						
WORK STATION	16 K	IN	22	1	638	NUCLEUS . . . . .	196 K	USER AREA SPACE AVAILABLE . .	1316 K	ACTUAL STORAGE COMMITMENT . .	74 %
TRACE	16 K	NSW		0	0	NONSWAPPABLE PROGRAM SPACE . .	8 K	ACTIVE STORAGE COMMITMENT . .	99 %	TOTAL STORAGE COMMITMENT . .	77 %
INDEX INSERT	0 K		3	0	6	NONSWAPPABLE WORK SPACE . . .	528 K	TOTAL A/F SPACE SIZE . . .	166.0 K	ASSIGN/FREE SPACE USAGE . . .	88 %
ACTIVE PROCS	2 K	IN		0	6	TOTAL NONSWAPPABLE SPACE . . .	732 K	LARGEST AVAIL A/F SEGMENT . .	2048 BYTES	A/F SEGMENTS AVAILABLE . . .	100
BATCH BSC	0 K			0	0	SYSTEM PROGRAM SPACE . . . . .	94 K				
FORMAT INDEX	8 K	IN		0	203	USER PROGRAM SPACE . . . . .	846 K				
SPELL CHECK	22 K	IN		0	0	SWAPPABLE WORK SPACE . . . . .	78 K				
HELP AREA	4 K	IN		0	0	TOTAL SWAPPABLE SPACE . . . . .	1018 K				
FMS I/O SUBR	6 K	OUT		0	0						
FMS FOLDER	0 K			0	0						
SPELL CHECK	0 K			0	0						
CMD PROCESSOR	0 K			0	0						
WS ID TABLE	0 K			0	0						
DW/36 SUBR	0 K			0	0						
DISK CACHE	512 K	NSW		0	0						

Figure 3-9. Storage Totals Information

### System Work Space

**Work Station:** The system work space used by work station data management (WSDM) for work station operations.

**Trace:** The system work space used by the service aid Trace. You can alter this size by changing, through the TRACE procedure, the number of entries allowed in the Trace table.

**Index Insert:** The system work space used by disk data management for index file key processing.

**Active Procs:** The system work space used by the scheduler to keep a table of all the currently-active procedures.

**Batch BSC:** The system work space (up to 2K bytes) used by batch BSC.

**Format Index:** The system work space used by work station data management (WSDM) for format index entries.

**Spell Check:** The system work space that contains an index to the spell check dictionary on disk. This work space is used for the IBM System/36 Text Management System (TMS/36).

**Help Area:** The system work space used by help support to contain information about help displays. Information about the help displays is not duplicated from one job step to the next job step and is maintained until end of job.

**FMS I/O Subr:** These are common subroutines used for folder management services (FMS) input/output.

**FMS Folder:** The FMS folder contains commonly used FMS data.

**Spell Check:** The system work space that contains an index to the spell check dictionary on disk. This work space is used for IBM DisplayWrite/36 (DW/36).

**Cmd Processor:** The system work space used by the command processor for work station operations.

**WS ID Table:** The system work space that contains a table of current work station IDs.

**DW/36 Subr:** These are common subroutines used by DW/36.

**Disk Cache:** The system work space used for the disk cache.

For each of these buffers, the following information is shown:

- **Size:** The size of the buffer at the time of the snapshot.
- **Swap Stat:** The swapping status of the buffer (IN or OUT or NSW (not swappable)) at the time of the snapshot.
- **Swaps:** The number of times the buffer was swapped in during the last sample interval.
- **Active Users:** The number of active users of the buffer at the time of the snapshot.
- **Demand Count:** The number of requests for the buffer during the last sample interval.

**Nucleus:** The amount of main storage currently being used by the system, including system data areas, the transient area, resident routines, and buffer areas. The system determines how much space is required for the nucleus and adjusts the size accordingly.

**Nonswappable Program Space:** The amount of main storage currently assigned to programs that are not part of the nucleus and that cannot be swapped.

**Nonswappable Work Space:** The amount of main storage currently assigned to task and system work spaces that cannot be swapped.

**Total Nonswappable Space:** The sum of the last three items; the total amount of main storage space that cannot be swapped.

**System Program Space:** The total user area that all active system programs need to run.

**User Program Space:** The total user area that all programs listed in the "Task Status Information" section earlier in this chapter need to run.

**Swappable Work Space:** The total user area needed for all work spaces that are swappable.

**Total Swappable Space:** The sum of the last three items; the total user area needed for all programs and work spaces.

**User Area Space Available:** The total user area available, which equals the total main storage size minus any bad 2K pages of storage minus the Total Nonswappable Space.

**Actual Storage Commitment:** The percentage of the user area currently occupied by swapped-in programs and work spaces. Any programs that are partially swapped in will not be counted in this value: it reflects how much of the user area is active and ready to run in the system.

**Active Storage Commitment:** The percentage of the user area currently occupied or owned by active programs or work spaces, and inactive or partially swapped in programs that own pages of main storage.

**Total Storage Commitment:** The percentage of the user area required if all active programs and work spaces were in main storage at the same time. This value reflects how much demand is being placed on main storage by the user.

**Total A/F Space Size:** The size in K bytes of the assign/free area.

**Assign/Free Space Usage:** The percentage of the assign/free area currently in use.

**Largest Avail A/F Element:** The size in bytes of the largest available segment in the assign/free area.

**A/F Segments Available:** The number of unused segments in the assign/free area.

# System Event Counters Information

System event counters (SECs) maintain a count over the sample interval of various system activities. Figure 3-10 shows the format of this section of a sample report when ALL was specified. The complete section is only available when ALL is specified, but you get selected counters if MINI is specified. See "SMF Prompts and Parameters" in Chapter 2 for more information about MINI reports. The following paragraphs describe the system event counters information.

SYSTEM EVENT COUNTERS					
MAIN STORAGE TRANSIENT CALLS . . .	18	TASK WORK AREA EXTENTS . . . . .	0	L-3 STORAGE RELEASES W/O SWAP . . .	0
TRANSLATED TRANSFER CALLS . . .	917	JOB INITIATIONS . . . . .	6	L-3 STORAGE RELEASES W/ SWAP . . .	0
ASYNCHRONOUS TRANSFER CALLS . . .	17	JOB STEP INITIATIONS . . . . .	6	L-4 STORAGE RELEASES W/O SWAP . . .	0
MAIN STORAGE TRANSIENT LOADS . . .	12	MRT ATTACHES . . . . .	6	L-4 STORAGE RELEASES W/ SWAP . . .	0
TRANSLATED TRANSFER LOADS . . .	0	MRT LOADS . . . . .	0	MEMORY RESIDENT OVERLAY LOADS . . .	0
MAIN STORAGE LOADER REQUESTS . . .	0	JOB TERMINATIONS . . . . .	0	MEMORY RESIDENT OVERLAY MAPS . . .	0
SWAPS IN . . . . .	32	JOB STEP TERMINATIONS . . . . .	0	DISK CACHE HITS . . . . .	661
SWAPS OUT . . . . .	0	ABNORMAL TERMINATIONS . . . . .	0	DISK CACHE MISSES . . . . .	325
SWAPS OUT, FORCED . . . . .	0	DISK LOCKS SATISFIED . . . . .	172	NOT USED . . . . .	0
TASK WORK AREA READ OPS . . . . .	266	DISK LOCKS EXPIRED . . . . .	371	NOT USED . . . . .	0
TASK WORK AREA WRITE OPS . . . . .	50	ASSIGN/FREE EXTENSIONS . . . . .	1	NOT USED . . . . .	0
MAIN STORAGE CLEAR OPS . . . . .	12	ASSIGN/FREE REDUCTIONS . . . . .	0	NOT USED . . . . .	0
CONTROL STORAGE TRANSIENT CALLS	67	PREEMPTIVE TASK DISPATCHES . . .	4106	NOT USED . . . . .	0
CONTROL STORAGE TRANSIENT LOADS	1	RESOURCE TIMEOUTS . . . . .	129	NOT USED . . . . .	0
CONTROL STORAGE LOADER REQUESTS	0	MAIN STORAGE PROCESSOR TIMEOUTS	30	NOT USED . . . . .	0
SPOOL SEGMENTS ALLOCATED . . . . .	4	WKSTN BUFFER READ RETRIES . . . .	0	NOT USED . . . . .	0
SPOOL ENTRIES ALLOCATED . . . . .	0	L-1 STORAGE RELEASES W/O SWAP . .	2	NOT USED . . . . .	0
SPOOL EXTENTS ALLOCATED . . . . .	0	L-1 STORAGE RELEASES W/ SWAP . . .	0	NOT USED . . . . .	0
GENERAL WAITS . . . . .	9	L-2 STORAGE RELEASES W/O SWAP . .	0	NOT USED . . . . .	0
DISK RECORD WAITS . . . . .	0	L-2 STORAGE RELEASES W/ SWAP . . .	0	NOT USED . . . . .	0

Figure 3-10. System Event Counters Information

**Main Storage Transient Calls:** The number of times an SVC was issued to call a system program that runs in the main storage transient area. Examples of such programs are:

- Disk File Open
- Diskette File Open

**Translated Transfer Calls:** The number of times an SVC was issued to call a system program that runs in the user area (translated) instead of the main storage transient area.

**Asynchronous Transfer Calls:** The number of times a system subtask was started and control was immediately returned to the calling program so that both the subtask and the calling program were allowed to run at the same time.

**Main Storage Transient Loads:** The number of times a system program was loaded into the main storage transient area to satisfy a call or to reload a transient after a refresh call.

**Translated Transfer Loads:** The number of times a system program was loaded into the user area instead of the main storage transient area to satisfy a translated transfer call. A system program that runs in translated storage will stay in the user area until that area is required by another program.

**Main Storage Loader Requests:** The number of times a system or user program or an overlay segment was loaded into main storage. This does not include Main Storage Transient Loads or Translated Transfer Loads.

**Swaps In:** The number of swaps in of the system work space, task work space, system programs, and user programs.

**Swaps Out:** The number of swaps out of the system work space, task work space, system programs, and user programs.

**Swaps Out, Forced:** The number of times a task was ready to run but was swapped out for an equal or higher priority task.

**Task Work Area Read Ops:** The number of task work area read operations.

**Task Work Area Write Ops:** The number of task work area write operations.

*Note: Task Work Area Reads Ops and Task Work Area Write Ops do not include every access to the task work area. Only those requests that were made by the task work area facility (a control storage function) are included. Some of the areas and data included in the task work area that can be accessed by system and user programs are:*

- The local data area
- The procedure parameter save area
- Work station configuration data
- Communications configuration data

The task work area facility also reads screen formats from any library on disk. The task work area read ops counter is increased by one when a screen format is read.

**Main Storage Clear Ops:** The number of main storage clear operations. When space is initially allocated for a work space, the control storage supervisor clears that space to hexadecimal zeros.

**Control Storage Transient Calls:** The number of times an SVC was issued to call a control storage transient.

**Control Storage Transient Loads:** The number of times a control storage transient was loaded to satisfy a call or a refresh call.

**Control Storage Loader Requests:** The number of times a control storage program was loaded into the area of control storage where programs can be relocated. Examples of programs loaded directly into control storage are those routines that support BASIC, data communications, and FORTRAN programs.



**Spool Segments Allocated:** The number of times a new spool segment was allocated. See the *Concepts and Programmer's Guide* or the *Changing Your System Configuration* manual for an explanation of spooling.

**Spool Entries Allocated:** The number of entries made in the spool file.

**Spool Extents Allocated:** The number of times a new spool file extent was created.

**General Waits:** The number of general wait conditions. See "Status-Wait" in the "Task Status Information" section earlier in this chapter for a list of general wait conditions.

**Disk Record Waits:** The number of times that each task had to wait to read or write a record that was being updated by another task.

**Task Work Area Extents:** The number of task work area extents. See "Task Work Area Extents" in the "Task Work Area Information" section earlier in this chapter for an explanation of task work area extents created during the sample interval.

**Job Initiations:** The number of jobs that were started.

**Job Step Initiations:** The number of job steps that were started.

**MRT Attaches:** The number of times a work station requested and was attached to an MRT program.

**MRT Loads:** The number of times MRT programs were loaded.

**Job Terminations:** The number of jobs that ended.

**Job Step Terminations:** The number of job steps that ended. This includes the final job step which is counted as a job termination as well (see "Job Terminations" in this section).

**Abnormal Terminations:** The number of jobs that ended abnormally.

**Disk Locks Satisfied:** The number of times a task held the disk arm to read or write another record within a 16-millisecond interval.

**Disk Locks Expired:** The number of times a task held the disk arm but failed to read or write another record within 16 milliseconds; the disk I/O supervisor released the disk arm for use by other tasks.

**Assign/Free Extensions:** The number of times the assign/free area was extended by 2K bytes because it was not large enough to provide the system with needed space.

**Assign/Free Reductions:** The number of times the assign/free area was reduced by 2K bytes because space no longer needed was returned to the user area.

**Preemptive Task Dispatches:** The number of times the current task was forced to stop to switch to another higher priority task.

**Resource Time-outs:** The number of times a task exceeded the time it was allocated to use a resource (such as the main storage processor, disk or diskette drives, or a printer) without going into a long wait. If a time-out occurs, the priority of the task may be lowered by the system. The average time-out interval is 500 milliseconds.

**Main Storage Processor Time-outs:** The number of times a task exceeded the time it was allocated to use the main storage processor.

**Wkstn Buffer Read Retries:** The number of times insufficient work station buffer space caused data from a work station to be read directly into the user's buffer. The user program must be in main storage while the data is being read in.

**Storage Releases W/O and W/ Swap:** Indicates whether the main storage released for the program was swapped out. Without (*W/O Swap*) indicates that the program was not swapped out and the program must be reentrant or reusable. When the program is needed again, it is reloaded from a library. With (*W/*) indicates that it was swapped out. The four levels of storage releases are:

- **L-1 Storage Releases:** Indicates that storage was released from a task in a voluntary long wait, such as a task that is waiting for the Enter key to be pressed at a display station.

The next three levels of storage releases rank in decreasing order the desirability of swapping out the program currently in main storage against swapping in the new program.

- **L-2 Storage Releases:** The priority of the new task is significantly greater than the priority of the task currently in main storage.
- **L-3 Storage Releases:** The priority of the new task is just greater than or equal to the priority of the task currently in main storage.
- **L-4 Storage Releases:** The priority of the new task is less than the priority of the task currently in main storage.

**Memory Resident Overlay Loads:** The number of times a memory resident overlay was loaded into main storage from disk.

**Memory Resident Maps:** The number of times a memory resident overlay was found in main storage and did not need to be loaded from disk.

**Disk Cache Hits:** The number of times the data to be read from disk was found in the cache.

**Disk Cache Misses:** The number of times the data to be read from disk was not found in the cache, meaning that the data must be read from disk into the cache.

## I/O Counter Information

I/O counter information reflects I/O activity over the sample interval for the disk, diskette, tape drives, display stations, and printers supported on the system. Figure 3-11 shows the format of this section of a sample report. The complete section is only available when ALL is specified, but you get selected counters if MINI is specified. See "SMFPRINT Prompts and Parameters" in Chapter 2 for more information about MINI reports. The following paragraphs describe the I/O counter information.

I / O C O U N T E R S			
DISK 1 READ OPS . . . . .	797	DISK 3 READ OPS . . . . . 0	
DISK 1 WRITE OPS . . . . .	380	DISK 3 WRITE OPS . . . . . 0	
DISK 1 SCAN OPS . . . . .	273	DISK 3 SCAN OPS . . . . . 0	
DISK 1 SEEK OPS . . . . .	1325	DISK 3 SEEK OPS . . . . . 0	
DISK 1 SEEK OPS GT 1/3 DISK .	40.0 %	DISK 3 SEEK OPS GT 1/3 DISK .	0.0 %
DISK 1 AVERAGE SEEK LENGTH .	138 CYL	DISK 3 AVERAGE SEEK LENGTH .	0 CYL
DISK 2 READ OPS . . . . .	539	DISK 4 READ OPS . . . . . 0	
DISK 2 WRITE OPS . . . . .	66	DISK 4 WRITE OPS . . . . . 0	
DISK 2 SCAN OPS . . . . .	255	DISK 4 SCAN OPS . . . . . 0	
DISK 2 SEEK OPS . . . . .	775	DISK 4 SEEK OPS . . . . . 0	
DISK 2 SEEK OPS GT 1/3 DISK .	25.7 %	DISK 4 SEEK OPS GT 1/3 DISK .	0.0 %
DISK 2 AVERAGE SEEK LENGTH .	118 CYL	DISK 4 AVERAGE SEEK LENGTH .	0 CYL
TAPE 1 READ BYTES . . . . .	0 K	TAPE 2 READ BYTES . . . . .	0 K
TAPE 1 WRITE BYTES . . . . .	0 K	TAPE 2 WRITE BYTES . . . . .	0 K
TAPE 1 REWIND OPS . . . . .	0	TAPE 2 REWIND OPS . . . . .	0
TAPE 1 HITCHBACK OPS . . . . .	0	TAPE 2 HITCHBACK OPS . . . . .	0
		DISKETTE 1 READ OPS . . . . .	5
		DISKETTE 2D READ OPS . . . . .	1
		DISKETTE 1 WRITE OPS . . . . .	21
		DISKETTE 2D WRITE OPS . . . . .	1626
		DISKETTE SEEK OPS . . . . .	29
		1255 MICR OPS . . . . .	0
		72MD AUTO LOADER OPS . . . . .	1
		DISKETTE HEAD CONTACT REVS . . .	715
		LOCAL DISPLAY STATION OPS . . . .	277
		LOCAL PRINTER OPS . . . . .	513
		REMOTE DISPLAY STATION OPS . . .	105
		REMOTE PRINTER OPS . . . . .	68
		3262 PRINTER OPS . . . . .	0

Figure 3-11. I/O Counter Information

**Disk 1 Read Ops:** The number of disk 1 read operations.

**Disk 1 Write Ops:** The number of disk 1 write operations.

**Disk 1 Scan Ops:** The number of disk 1 scan operations. A scan operation is a search by the disk arm for a record.

**Disk 1 Seek Ops:** The number of disk 1 seek operations. A seek operation is any movement of the disk arm across the disk to read or write a record. Because the arm may not have to move in order to read or write a record at the same place on disk, this counter can be less than or equal to, but not greater than, the sum of the read and write operations counters.

**Disk 1 Seek Ops Gt 1/3 Disk:** The percentage of disk 1 seek operations greater than 1/3 of the disk.

**Disk 1 Average Seek Length:** The average length in number of cylinders of a seek operation for disk 1. A cylinder consists of all the vertical tracks on disk accessible from a given position of the read/write head.

**Disk 2 I/O Information:** The same information for disk 1 reported for disk 2.

**Tape 1 Read Bytes:** The number of bytes read from tape drive 1 expressed in multiples of K bytes.

**Tape 1 Write Bytes:** The number of bytes written to tape drive 1 expressed in multiples of K bytes.

**Tape 1 Rewind Ops:** The number of rewinds for tape drive 1.

**Tape 1 Hitchback Ops:** The number of hitchbacks for tape drive 1.

There are two modes of operation for a tape unit: 1) start/stop at 12.5 inches per second; and 2) streaming at 100 inches per second. In streaming mode, the tape unit does not stop the tape at the gaps between blocks of data to wait for the next input/output command but assumes the next command will arrive at the tape unit on time. If the next command does not arrive (meaning data is not ready to be read or written), the tape unit goes beyond the gap between the blocks of data. The recovery from this condition is called a hitchback.

**Disk 3 I/O Information:** The same information for disk 1 reported for disk 3.

**Disk 4 I/O Information:** The same information for disk 1 reported for disk 4.

**Tape 2 I/O Information:** The same information for tape drive 1 reported for tape drive 2.

**Diskette 1 Read Ops:** The number of 128-byte segments read from a single-density diskette.

**Diskette 2D Read Ops:** The number of 256-byte segments read from a double-density diskette.

**Diskette 1 Write Ops:** The number of 128-byte segments written to a single-density diskette.

**Diskette 2D Write Ops:** The number of 256-byte segments written to a double-density diskette.

**Diskette Seek Ops:** The number of times the diskette head moved to read from or write to a diskette.

**1255 MICR Ops:** The number of documents read by the 1255 Magnetic Character Reader.

**72MD Auto Loader Requests:** The number of times the system selected or ejected a diskette, or moved the diskette carriage.

**Diskette Head Contact Revs:** The number of diskette revolutions with the heads in contact with the diskette.

**Local Display Station Ops:** The number of I/O operations requested by all local display stations.

**Local Printer Ops:** The number of I/O operations requested by all local printers except the 3262 Printer.

**Remote Display Station Ops:** The number of I/O operations requested by all remote display stations.

**Remote Printer Ops:** The number of I/O operations requested by all remote printers.

**3262 Printer Ops:** The number of I/O operations requested by the 3262 Printer. The 3262 Printer is directly attached to the system unit rather than through a work station controller. For the 3262 Printer, the number of I/O operations is the same as the number of lines printed.

## DSA and Tape Usage Information

Data storage attachment (DSA) and tape usage information summarizes the disk, diskette, and tape drive usage of the DSA, and the usage of the DSA buffers, over the sample interval. Figure 3-12 shows the format of this section of a sample report. This section is only available when ALL is specified.

----- DSA AND TAPE USAGE -----		
----- DSA DEVICE USAGE -----	----- DSA BUFFER USAGE -----	----- TAPE USAGE -----
DISK 1. . . . . 77.1 %	ONE BUFFER TO M/C STORAGE . . . 41.5 %	TAPE 1. . . . . 0.0 %
DISK 2. . . . . 43.5 %	ONE BUFFER TO DSC . . . . . 0.0 %	TAPE 2. . . . . 0.0 %
DISK 3. . . . . 0.0 %	TWO BUFFERS TO M/C STORAGE. . . 54.7 %	TAPE 1 DATA TRANSFER. . . . . 0.0 %
DISK 4. . . . . 0.0 %	TWO BUFFERS TO DSC. . . . . 0.0 %	TAPE 2 DATA TRANSFER. . . . . 0.0 %
DISKETTE TO MAIN STORAGE. . . . 30.2 %	TWO BUFFERS TO M/C AND DSC. . . 0.0 %	TAPE 1 START/STOP DATA TRANSFER 0.0 %
DISKETTE TO DSC . . . . . 0.0 %	TOTAL DSA BUFFER USAGE. . . . . 75.5 %	TAPE 2 START/STOP DATA TRANSFER 0.0 %

**Figure 3-12. DSA Usage Information**

**Disk 1:** The percentage of the sample interval that disk 1 had a DSA buffer allocated.

**Disk 2:** The percentage of the sample interval that disk 2 had a DSA buffer allocated.

**Disk 3:** The percentage of the sample interval that disk 3 had a DSA buffer allocated.

**Disk 4:** The percentage of the sample interval that disk 4 had a DSA buffer allocated.

**Diskette to Main Storage:** The percentage of the sample interval that the diskette drive had a DSA buffer allocated for data transfer to main storage or control storage. For the 5362 System Unit, this value is shown only for systems with a 29.1MB disk.

**Diskette to DSC:** The percentage of the sample interval that the diskette drive had a DSA buffer allocated for data transfer to a DSC data buffer.

**One Buffer to M/C Storage:** The percentage of the sample interval that one and only one DSA buffer was used to transfer data from disk or diskette to main storage or control storage.

**One Buffer to DSC:** The percentage of the sample interval that one and only one DSA buffer was used to transfer data from disk or diskette to a DSC buffer.

**Two Buffers to M/C Storage:** The percentage of the sample interval that both DSA buffers were used to transfer data from disk or diskette to main storage or control storage.

**Two Buffers to DSC:** The percentage of the sample interval that both DSA buffers were used to transfer data from disk or diskette to the two DSC buffers.

**Two Buffers to M/C and DSC:** The percentage of the sample interval that both DSA buffers were used for data transfer; one buffer to main storage or control storage, and one to a DSC buffer.

**Total DSA Buffer Usage:** The sum of *One Buffer to M/C Storage*, *One Buffer to DSC*, *Two Buffers to M/C Storage*, *Two Buffers to DSC*, and *Two Buffers to M/C and DSC*. Since the DSA has two buffers, SMF divides in half the usage when only one buffer is allocated (*One Buffer to M/C Storage* and *One Buffer to DSC*) before computing the total value.

**Tape 1:** The percentage of the sample interval during which tape drive 1 was busy. This value includes time for data transfer, as well as rewinding, unloading, and setting tape modes.

**Tape 2:** The percentage of the sample interval during which tape drive 2 was busy. This value includes time for data transfer, as well as rewinding, unloading, and setting tape modes.

**Tape 1 Data Transfer:** The percentage of the sample interval that tape drive 1 was busy transferring data.

**Tape 2 Data Transfer:** The percentage of the sample interval that tape drive 2 was busy transferring data.

*Note: Tape 1, Tape 2, Tape 1 Data Transfer, and Tape 2 Data Transfer apply to tape to disk and disk to tape transfer for both start/stop and streaming modes.*

**Tape 1 Start/Stop Data Transfer:** The percentage of the sample interval that tape drive 1 was busy transferring data between a DSC buffer and main storage or control storage in start/stop mode.

**Tape 2 Start/Stop Data Transfer:** The percentage of the sample interval that tape drive 2 was busy transferring data between a DSC buffer and main storage or control storage in start/stop mode.

## Communications Line Usage Information

Communications line usage information is printed, if the print option ALL was selected on the SMFPRINT procedure, for each active communications line specified for data collection on the SMFSTART procedure display. The communications data collection routine collects information about the communications line from its input/output block (IOB) when the IOB is issued and again when it is posted complete. This information is stored in a set of counters for each communications line. The data collection program then picks up these counters at each sample interval and writes the information to the data collection file. Figure 3-13 shows the format of a sample report for the communications line usage information. The following paragraphs describe the communications line usage information.

COMMUNICATION LINE USAGE				
LINE NUMBER. . . . .	3	4	6	7
LINE PROTOCOL. . . . .	ASNC	ASNC	SDLC	BSC
LINE USER. . . . .	ASNC	ASNC	SDLC-P	BSC-B
PRODUCTIVE LINE TURNAROUNDS. . . . .	0	0	88	869
AVERAGE PRODUCTIVE T/A TIME (MS). . . . .	0.00	0.00	439.50	81.91
NONPRODUCTIVE LINE TURNAROUNDS. . . . .	0	0	683	18
AVG NONPRODUCTIVE T/A TIME (MS). . . . .	0.00	0.00	11.13	1531.11
BYTES TRANSMITTED. . . . .	17096	771	133988	1738
SDLC I-FRAMES TRANSMITTED. . . . .	0	0	532	0
ERROR BYTES TRANSMITTED. . . . .	0	0	0	0
TRANSMIT LINE ERRORS. . . . .	0	0	0	0
BYTES RECEIVED. . . . .	771	17096	1364	71258
SDLC I-FRAMES RECEIVED. . . . .	0	0	76	0
RECEIVE LINE ERRORS. . . . .	0	0	0	0
RECEIVING SYSTEM TURNAROUND. . . . .	0.0 %	0.0 %	20.9 %	0.0 %*
LINE TURNAROUNDS. . . . .	0.0 %	0.0 %	0.5 %	39.5 %
ERRORS. . . . .	0.0 %	0.0 %	0.0 %	0.0 %
TRANSMITTED DATA. . . . .	63.3 %	2.9 %	62.0 %	0.8 %
RECEIVED DATA. . . . .	2.9 %	63.3 %	0.6 %	33.0 %
TOTAL LINE USAGE. . . . .	66.2 %	66.2 %	84.0 %	73.3 %
LINE NUMBER. . . . .	8			
LINE PROTOCOL. . . . .	BSC			
LINE USER. . . . .	BSC-B			
PRODUCTIVE LINE TURNAROUNDS. . . . .	879			
AVERAGE PRODUCTIVE T/A TIME (MS). . . . .	69.73			
NONPRODUCTIVE LINE TURNAROUNDS. . . . .	18			
AVG NONPRODUCTIVE T/A TIME (MS). . . . .	46.11			
BYTES TRANSMITTED. . . . .	72219			
SDLC I-FRAMES TRANSMITTED. . . . .	0			
ERROR BYTES TRANSMITTED. . . . .	0			
TRANSMIT LINE ERRORS. . . . .	0			
BYTES RECEIVED. . . . .	1740			
SDLC I-FRAMES RECEIVED. . . . .	0			
RECEIVE LINE ERRORS. . . . .	0			
RECEIVING SYSTEM TURNAROUND. . . . .	11.5 %			
LINE TURNAROUNDS. . . . .	22.5 %			
ERRORS. . . . .	0.0 %			
TRANSMITTED DATA. . . . .	33.4 %			
RECEIVED DATA. . . . .	0.8 %			
TOTAL LINE USAGE. . . . .	68.2 %			

Figure 3-13. Communications Line Usage Information



The definitions are allowed for both BSC and SDLC lines unless otherwise noted.

**Line Number:** The line number of an active communications line that was selected for communications line usage data.

**Line Protocol:** The communications link control, either BSC or SDLC, that you are using.

**Line User:** The possible uses of the line specified for Line Number. See "Line User" in the "Communications Configuration Information" section earlier in this chapter.

**Productive Line Turnarounds:** The number of productive turnarounds during the sample interval. A turnaround occurs when a communications line changes from transmitting data to receiving data and vice versa. The turnaround is productive when user data rather than only control information is transferred.

**Average Productive T/A Time (MS):** The average time in milliseconds to complete a turnaround when productive data was being transferred. Line propagation time, CSP processing time, multiple line communications controller processing time, modem delay time, and the time the system controller at the other end of the line requires to process data are included in this value. Data transmission and data reception times are not included.

*Note: If the T/A time is negative, the line speed entered may be incorrect (for example, the line speed specified in the SMFSTART procedure is less than the actual line speed).*

**Nonproductive Line Turnarounds:** The number of nonproductive turnarounds during the sample interval. The turnaround is non-productive if only control information and no user data is transferred.

**Avg Nonproductive T/A Time (MS):** The average time in milliseconds to complete a nonproductive turnaround. The same values that make up the Average Productive T/A Time are counted for nonproductive turnarounds.

*Notes:*

- 1. By subtracting the nonproductive time from the productive time you can determine the average time required by the system at the other end of the line to process the data being transmitted or received. SMF assumes that, when only control bytes are being transmitted, the system at the other end of the line requires an insignificant amount of processing time. This assumption is wrong, however, if that system is inserting time delays in the polling sequence (see "Receiving System Turnaround" in this section).*
- 2. If the T/A time is negative, the line speed entered may be incorrect (for example, the line speed specified in the SMFSTART procedure is less than the actual line speed).*

**Bytes Transmitted:** The number of control bytes and bytes of data that were transmitted during productive turnarounds.

*Note: For asynchronous communications lines, this counter is the total number of bytes transmitted.*

**SDLC I-Frames Transmitted:** The number of SDLC I-frames transmitted during the sample interval.

**Error Bytes Transmitted:** The number of control bytes and bytes of data that were transmitted during productive turnarounds that had to be transmitted again because of line errors.

**Transmit Line Errors:** The number of times during the sample interval that the system had to transmit data again because of line errors.

**Bytes Received:** The number of control bytes and bytes of data that were received during productive turnarounds.

*Notes:*

- 1. For asynchronous communications lines, this counter is to total number of bytes received.*
- 2. For SDLC lines, this counter also includes the number of bytes of productive data that were received when in polling mode.*

**SDLC I-Frames Received:** The number of SDLC I-frames received during the sample interval.

**Receive Line Errors:** The number of line errors that occurred while the system was receiving productive data.

**Receiving System Turnaround:** The percentage of the sample interval during which the receiving system was processing productive data, assuming that it takes the receiving system longer to complete a line turnaround when it has data to process than when it does not (see "Avg Nonproductive T/A Time (MS)" in this section).

When an asterisk (\*) appears beside a value of zero on the report, it indicates one of the following conditions:

- The number of Productive Line Turnarounds was zero.
- The number of Nonproductive Line Turnarounds was zero.
- The calculated Receiving System Turnaround was negative.

*Note: The Receiving System Turnaround is calculated by subtracting the average nonproductive turnaround time from the average productive turnaround time and multiplying the difference by the productive line turnarounds. If the receiving system inserts time delays into the polling sequence, they are included as part of the Ave Nonproductive T/A Time MS. If delays cause the average nonproductive turnaround time to exceed the Ave Productive T/A Time MS, the calculated receiving system turnaround percentage is negative. If time delays are being inserted but the average productive turnaround time is still more than the average nonproductive turnaround time, the receiving system turnaround percentage will be less than the actual time taken by the receiving system. The remainder of the time will be included in the Line Turnarounds percentage.*

**Line Turnarounds:** The percentage of the sample interval during which the line was completing turnarounds, consisting of:

- Line propagation time
- Modem delay time
- Processing time (multiple line communications controller, control storage processor)

The line turnarounds percentage is calculated by subtracting the receiving system turnaround value from the product of the productive line turnarounds value and the average productive turnaround time (MS) value considered as a percentage (divided by 60,000 milliseconds per minute of the sample interval).

**Errors:** The percentage of the sample interval during which line errors or line error recovery were occurring.

**Transmitted Data:** The percentage of the sample interval during which the line was transmitting data: the total number of bytes transmitted divided by the maximum number of bytes possible to be transmitted as determined by the line speed.

**Received Data:** The percentage of the sample interval during which the line was receiving data.

**Total Line Usage:** The sum of the five previous percentages.

*Note: When a sample interval ends during a line turnaround, the data for that turnaround will not be logged until the next snapshot. Because it then reflects more than a single sample, this value may be over 100 when the line is heavily used and the time interval is small.*

# MINI Report Snapshot

Figure 3-14 shows the format of two consecutive snapshots of the mini report.

```

SNAPSHOT TIME - 12.38.30.320  SAMPLE INTERVAL - 1.00.473

----- DEVICE USAGE RATES -----
MAIN STORAGE PROCESSOR . . . . 70 %
CONTROL STORAGE PROCESSOR. . . 75 %
WORKSTATION CONTROLLER QUEUE . 76 %
WORKSTATION CONTROLLER . . . . 71 %
WORKSTATION CONTROLLER 2 QUEUE 7 %
WORKSTATION CONTROLLER 2 . . . 0 %
PC PROCESSOR . . . . . . . . . 0 %
DATA STORAGE CONTROLLER. . . . 10 %
DATA STORAGE ATTACHMENT. . . . 31 %
DISK 1 . . . . . . . . . . . . . 22 %
DISK 2 . . . . . . . . . . . . . 28 %
DISK 3 . . . . . . . . . . . . . 57 %
DISK 4 . . . . . . . . . . . . . 46 %

----- COMMUNICATION LINE USAGE -----
COMMUNICATION LINE 1 . . . . 85 %
COMMUNICATION LINE 2 . . . . 97 %
COMMUNICATION LINE 3 . . . . 3 %
COMMUNICATION LINE 4 . . . . 0 %
COMMUNICATION LINE 5 . . . . ** %
COMMUNICATION LINE 6 . . . . ** %
COMMUNICATION LINE 7 . . . . ** %
COMMUNICATION LINE 8 . . . . ** %

----- TASK WORK AREA -----
TASK WORK AREA SIZE . . . 3100
TASK WORK AREA USAGE. . . 46 %
TASK WORK AREA EXTENTS. . 0

--- SYSTEM EVENT AND I/O COUNTERS ---
TRANSLATED TRANSFER CALLS . . . 1274
TRANSLATED TRANSFER LOADS . . . 18
SWAPS IN. . . . . . . . . . . . . 16
SWAPS OUT . . . . . . . . . . . . 2
DISK RECORD WAITS . . . . . . . . 0
L-3 STORAGE RELEASES W/O SWAP . 0
L-3 STORAGE RELEASES W/ SWAP. . 0
L-4 STORAGE RELEASES W/O SWAP . 0
L-4 STORAGE RELEASES W/ SWAP. . 0
DISK 1 SEEK OPS GT 1/3 DISK . 0.0 %
DISK 2 SEEK OPS GT 1/3 DISK . 40.7 %
DISK 3 SEEK OPS GT 1/3 DISK . 16.1 %
DISK 4 SEEK OPS GT 1/3 DISK . 30.9 %

NUMBER OF ACTIVE TASKS . . . . 41

SNAPSHOT TIME - 12.39.30.851  SAMPLE INTERVAL - 1.00.531

----- DEVICE USAGE RATES -----
MAIN STORAGE PROCESSOR . . . . 72 %
CONTROL STORAGE PROCESSOR. . . 76 %
WORKSTATION CONTROLLER QUEUE . 72 %
WORKSTATION CONTROLLER . . . . 65 %
WORKSTATION CONTROLLER 2 QUEUE 7 %
WORKSTATION CONTROLLER 2 . . . 0 %
PC PROCESSOR . . . . . . . . . 0 %
DATA STORAGE CONTROLLER. . . . 11 %
DATA STORAGE ATTACHMENT. . . . 31 %
DISK 1 . . . . . . . . . . . . . 25 %
DISK 2 . . . . . . . . . . . . . 26 %
DISK 3 . . . . . . . . . . . . . 62 %
DISK 4 . . . . . . . . . . . . . 40 %

----- COMMUNICATION LINE USAGE -----
COMMUNICATION LINE 1 . . . . 87 %
COMMUNICATION LINE 2 . . . . 94 %
COMMUNICATION LINE 3 . . . . 15 %
COMMUNICATION LINE 4 . . . . 16 %
COMMUNICATION LINE 5 . . . . ** %
COMMUNICATION LINE 6 . . . . ** %
COMMUNICATION LINE 7 . . . . ** %
COMMUNICATION LINE 8 . . . . ** %

----- TASK WORK AREA -----
TASK WORK AREA SIZE . . . 3100
TASK WORK AREA USAGE. . . 47 %
TASK WORK AREA EXTENTS. . 0

--- SYSTEM EVENT AND I/O COUNTERS ---
TRANSLATED TRANSFER CALLS . . . 1415
TRANSLATED TRANSFER LOADS . . . 18
SWAPS IN. . . . . . . . . . . . . 32
SWAPS OUT . . . . . . . . . . . . 3
DISK RECORD WAITS . . . . . . . . 0
L-3 STORAGE RELEASES W/O SWAP . 0
L-3 STORAGE RELEASES W/ SWAP. . 0
L-4 STORAGE RELEASES W/O SWAP . 0
L-4 STORAGE RELEASES W/ SWAP. . 0
DISK 1 SEEK OPS GT 1/3 DISK . 0.0 %
DISK 2 SEEK OPS GT 1/3 DISK . 35.8 %
DISK 3 SEEK OPS GT 1/3 DISK . 32.3 %
DISK 4 SEEK OPS GT 1/3 DISK . 40.7 %

NUMBER OF ACTIVE TASKS . . . . 41

```

Figure 3-14. Mini Report Snapshot

**Number of Active Tasks:** The number of active tasks at the time of the snapshot.

# SMF Summary Information

A summary of the information collected by SMF is printed at the end of all SMF reports. Figure 3-15 shows the format of this section of a sample report. The summary includes:

REPORT DATE - 6/11/85	DATA COLLECTION FILE - PMSMFLOG	SYSTEM/36 MEASUREMENT FACILITY	
----- SMF SUMMARY -----			
START TIME	12.36.29.734		
STOP TIME	13.02.18.702		
ELAPSED TIME	00.25.48.968		
SNAPSHOT INTERVAL	1.00.000		
----- S U M M A R Y U S A G E -----			
	AVERAGE	MAXIMUM	TIME MAXIMUM OCCURRED
MAIN STORAGE PROCESSOR. . . .	71 %	78 %	12.48.35.930
CONTROL STORAGE PROCESSOR . .	76 %	80 %	12.51.37.506
WORKSTATION CONTROLLER QUEUE.	73 %	80 %	12.37.29.847
WORKSTATION CONTROLLER. . . .	67 %	75 %	12.44.33.324
WORKSTATION CONTROLLER 2 QUEUE	7 %	9 %	12.48.35.930
WORKSTATION CONTROLLER 2. . . .	0 %	0 %	00.00.00.000
PC PROCESSOR. . . . .	0 %	0 %	00.00.00.000
DATA STORAGE CONTROLLER . . .	10 %	12 %	13.00.41.962
DATA STORAGE ATTACHMENT . . .	32 %	38 %	12.46.34.705
DISK 1. . . . .	24 %	37 %	12.45.34.182
DISK 2. . . . .	29 %	33 %	12.46.34.705
DISK 3. . . . .	58 %	79 %	12.59.41.546
DISK 4. . . . .	42 %	47 %	12.57.40.649
COMMUNICATION LINE 1. . . . .	87 %	96 %	12.50.37.024
COMMUNICATION LINE 2. . . . .	86 %	97 %	12.38.30.320
COMMUNICATION LINE 3. . . . .	12 %	19 %	12.58.41.065
COMMUNICATION LINE 4. . . . .	17 %	22 %	12.58.41.065
COMMUNICATION LINE 5. . . . .	** %	** %	NOT ACTIVE/COLLECTED
COMMUNICATION LINE 6. . . . .	** %	** %	NOT ACTIVE/COLLECTED
COMMUNICATION LINE 7. . . . .	** %	** %	NOT ACTIVE/COLLECTED
COMMUNICATION LINE 8. . . . .	** %	** %	NOT ACTIVE/COLLECTED
TASK WORK AREA. . . . .	46 %	51 %	12.52.38.020
DISK CACHE. . . . .	55 %	67 %	12.59.41.546
ASSIGN/FREE SPACE . . . . .	86 %	95 %	12.38.30.320
TOTAL STORAGE COMMITMENT. . .	76 %	83 %	12.51.37.506
ACTIVE STORAGE COMMITMENT . .	96 %	100 %	12.38.30.320
ACTUAL STORAGE COMMITMENT . .	73 %	80 %	12.51.37.506

Figure 3-15 (Part 1 of 3). SMF Summary Information

SUMMARY SYSTEM EVENT COUNTERS					
	TOTAL	PER MINUTE	MAXIMUM	TIME	MAXIMUM OCCURRED
MAIN STORAGE TRANSIENT CALLS. .	824	31.9	55	12.55.39.481	
TRANSLATED TRANSFER CALLS . . .	35185	1362.7	2109	12.45.34.182	
ASYNCHRONOUS TRANSFER CALLS . .	751	29.1	52	12.45.34.182	
MAIN STORAGE TRANSIENT LOADS. .	409	15.8	34	12.57.40.649	
TRANSLATED TRANSFER LOADS . . .	314	12.2	30	12.46.34.705	
MAIN STORAGE LOADER REQUESTS. .	326	12.6	40	12.50.37.024	
SWAPS IN. . . . .	544	21.1	38	12.49.36.535	
SWAPS OUT . . . . .	34	1.3	11	12.37.29.847	
SWAPS OUT, FORCED . . . . .	0	0.0	0	00.00.00.000	
TASK WORK AREA READ OPS . . . .	7929	307.1	364	12.38.30.320	
TASK WORK AREA WRITE OPS. . . .	1757	68.0	115	12.56.39.954	
MAIN STORAGE CLEAR OPS. . . . .	1449	56.1	99	12.45.34.182	
CONTROL STORAGE TRANSIENT CALLS	3504	135.7	238	12.45.34.182	
CONTROL STORAGE TRANSIENT LOADS	34	1.3	3	12.44.33.324	
CONTROL STORAGE LOADER REQUESTS	0	0.0	0	00.00.00.000	
SPOOL SEGMENTS ALLOCATED. . . .	49	1.9	5	12.52.38.020	
SPOOL ENTRIES ALLOCATED . . . .	5	0.2	1	12.37.29.847	
SPOOL EXTENTS ALLOCATED . . . .	0	0.0	0	00.00.00.000	
GENERAL WAITS . . . . .	128	5.0	24	12.54.39.000	
DISK RECORD WAITS . . . . .	2	0.1	1	12.54.39.000	
TASK WORK AREA EXTENTS. . . . .	0	0.0	0	00.00.00.000	
JOB INITIATIONS . . . . .	225	8.7	16	12.45.34.182	
JOB STEP INITIATIONS. . . . .	329	12.7	22	12.45.34.182	
MRT ATTACHES. . . . .	161	6.2	11	12.51.37.506	
MRT LOADS . . . . .	12	0.5	2	12.38.30.320	
JOB TERMINATIONS. . . . .	79	3.1	8	12.53.38.477	
JOB STEP TERMINATIONS . . . . .	89	3.4	8	12.53.38.477	
ABNORMAL TERMINATIONS . . . . .	1	0.0	1	13.01.42.387	
DISK LOCKS SATISFIED. . . . .	4473	173.2	230	12.58.41.065	
DISK LOCKS EXPIRED. . . . .	5611	217.3	371	12.59.41.546	
ASSIGN/FREE EXTENSIONS. . . . .	40	1.5	6	12.37.29.847	
ASSIGN/FREE REDUCTIONS. . . . .	21	0.8	4	12.55.39.481	
PREEMPTIVE TASK DISPATCHES. . .	112606	4361.2	6547	12.49.36.535	
RESOURCE TIMEOUTS . . . . .	3476	134.6	154	12.50.37.024	
MAIN STORAGE PROCESSOR TIMEOUTS	1047	40.5	69	12.48.35.930	
WKSTN BUFFER READ RETRIES . . .	10	0.4	3	12.53.38.477	
L-1 STORAGE RELEASES W/O SWAP .	114	4.4	24	12.38.30.320	
L-1 STORAGE RELEASES W/ SWAP. .	34	1.3	11	12.37.29.847	
L-2 STORAGE RELEASES W/O SWAP .	0	0.0	0	00.00.00.000	
L-2 STORAGE RELEASES W/ SWAP. .	0	0.0	0	00.00.00.000	
L-3 STORAGE RELEASES W/O SWAP .	0	0.0	0	00.00.00.000	
L-3 STORAGE RELEASES W/ SWAP. .	0	0.0	0	00.00.00.000	
L-4 STORAGE RELEASES W/O SWAP .	0	0.0	0	00.00.00.000	
L-4 STORAGE RELEASES W/ SWAP. .	0	0.0	0	00.00.00.000	
MEMORY RESIDENT OVERLAY LOADS .	0	0.0	0	00.00.00.000	
MEMORY RESIDENT OVERLAY MAPS. .	0	0.0	0	00.00.00.000	
DISK CACHE HITS . . . . .	13522	523.7	701	13.00.41.962	
DISK CACHE MISSES . . . . .	10891	421.8	518	12.46.34.705	
NOT USED. . . . .	0	0.0	0	00.00.00.000	
NOT USED. . . . .	0	0.0	0	00.00.00.000	
NOT USED. . . . .	0	0.0	0	00.00.00.000	
NOT USED. . . . .	0	0.0	0	00.00.00.000	
NOT USED. . . . .	0	0.0	0	00.00.00.000	
NOT USED. . . . .	0	0.0	0	00.00.00.000	
NOT USED. . . . .	0	0.0	0	00.00.00.000	
NOT USED. . . . .	0	0.0	0	00.00.00.000	
NOT USED. . . . .	0	0.0	0	00.00.00.000	
NOT USED. . . . .	0	0.0	0	00.00.00.000	
NOT USED. . . . .	0	0.0	0	00.00.00.000	
NOT USED. . . . .	0	0.0	0	00.00.00.000	
NOT USED. . . . .	0	0.0	0	00.00.00.000	

Figure 3-15 (Part 2 of 3). SMF Summary Information

SUMMARY I/O COUNTERS					
	TOTAL	PER MINUTE	MAXIMUM	TIME	MAXIMUM OCCURRED
DISK 1 READ OPS. . . . .	8276	320.5	419	12.55.39.481	
DISK 1 WRITE OPS. . . . .	3058	118.4	189	12.54.39.000	
DISK 1 SCAN OPS. . . . .	702	27.2	68	12.45.34.182	
DISK 1 SEEK OPS. . . . .	9366	362.7	522	12.54.39.000	
DISK 2 READ OPS. . . . .	4680	181.3	276	12.43.32.916	
DISK 2 WRITE OPS. . . . .	2293	88.8	127	12.50.37.024	
DISK 2 SCAN OPS. . . . .	2296	88.9	126	12.45.34.182	
DISK 2 SEEK OPS. . . . .	7961	308.3	382	12.44.33.324	
DISK 3 READ OPS. . . . .	2922	113.2	166	12.52.38.020	
DISK 3 WRITE OPS. . . . .	1872	72.5	94	13.00.41.962	
DISK 3 SCAN OPS. . . . .	6859	265.6	430	13.00.41.962	
DISK 3 SEEK OPS. . . . .	9400	364.1	454	13.00.41.962	
DISK 4 READ OPS. . . . .	3317	128.5	170	12.50.37.024	
DISK 4 WRITE OPS. . . . .	3471	134.4	192	12.52.38.020	
DISK 4 SCAN OPS. . . . .	3355	129.9	169	12.50.37.024	
DISK 4 SEEK OPS. . . . .	8332	322.7	431	12.50.37.024	
DISKETTE 1 READ OPS. . . . .	0	0.0	0	00.00.00.000	
DISKETTE 2D READ OPS. . . . .	0	0.0	0	00.00.00.000	
DISKETTE 1 WRITE OPS. . . . .	0	0.0	0	00.00.00.000	
DISKETTE 2D WRITE OPS. . . . .	0	0.0	0	00.00.00.000	
DISKETTE SEEK OPS. . . . .	0	0.0	0	00.00.00.000	
72ND AUTO LOADER REQUESTS. . .	0	0.0	0	00.00.00.000	
DISKETTE HEAD CONTACT REVS. . .	0	0.0	0	00.00.00.000	
LOCAL DISPLAY STATION OPS. . .	9616	372.4	455	12.44.33.324	
LOCAL PRINTER OPS. . . . .	4309	166.9	228	13.00.41.962	
REMOTE DISPLAY STATION OPS. . .	2872	111.2	126	13.00.41.962	
REMOTE PRINTER OPS. . . . .	1219	47.2	57	13.00.41.962	
3262 PRINTER OPS. . . . .	0	0.0	0	00.00.00.000	
1255 MICR OPS. . . . .	0	0.0	0	00.00.00.000	
TAPE 1 READ BYTES. . . . .	0 K	0.0 K	0 K	00.00.00.000	
TAPE 1 WRITE BYTES. . . . .	0 K	0.0 K	0 K	00.00.00.000	
TAPE 1 REWIND OPS. . . . .	0	0.0	0	00.00.00.000	
TAPE 1 HITCHBACK OPS. . . . .	0	0.0	0	00.00.00.000	
TAPE 2 READ BYTES. . . . .	0 K	0.0 K	0 K	00.00.00.000	
TAPE 2 WRITE BYTES. . . . .	0 K	0.0 K	0 K	00.00.00.000	
TAPE 2 REWIND OPS. . . . .	0	0.0	0	00.00.00.000	
TAPE 2 HITCHBACK OPS. . . . .	0	0.0	0	00.00.00.000	
DISK 1 SEEK OPS GT 1/3 DISK. . .	0.0 %	****	0.0 %	00.00.00.000	
DISK 2 SEEK OPS GT 1/3 DISK. . .	32.4 %	****	40.7 %	12.38.30.320	
DISK 3 SEEK OPS GT 1/3 DISK. . .	25.8 %	****	39.7 %	12.49.36.535	
DISK 4 SEEK OPS GT 1/3 DISK. . .	34.1 %	****	42.4 %	12.43.32.916	
DISK 1 AVERAGE SEEK LENGTH. . .	48 CYL	****	55 CYL	12.42.32.451	
DISK 2 AVERAGE SEEK LENGTH. . .	134 CYL	****	154 CYL	12.47.35.195	
DISK 3 AVERAGE SEEK LENGTH. . .	126 CYL	****	176 CYL	12.49.36.535	
DISK 4 AVERAGE SEEK LENGTH. . .	138 CYL	****	161 CYL	12.47.35.195	

----- SUMMARY DSA AND TAPE USAGE -----

	AVERAGE	MAXIMUM	TIME	MAXIMUM OCCURRED
DISK 1 . . . . .	19.2 %	30.1 %	12.46.34.705	
DISK 2 . . . . .	13.8 %	17.3 %	12.37.29.847	
DISK 3 . . . . .	18.3 %	25.1 %	13.00.41.962	
DISK 4 . . . . .	13.4 %	17.6 %	12.50.37.024	
DISKETTE TO MAIN STORAGE. . . . .	0.0 %	0.0 %	00.00.00.000	
DISKETTE TO DSC. . . . .	0.0 %	0.0 %	00.00.00.000	
ONE BUFFER TO M/C STORAGE. . . . .	42.4 %	46.4 %	12.54.39.000	
ONE BUFFER TO DSC. . . . .	0.1 %	0.4 %	12.42.32.451	
TWO BUFFERS TO M/C STORAGE. . . . .	11.1 %	14.6 %	12.46.34.705	
TWO BUFFERS TO DSC. . . . .	0.0 %	0.0 %	00.00.00.000	
ONE BUFFER EACH TO M/C AND DSC. . .	0.0 %	0.2 %	12.48.35.930	
TAPE 1 . . . . .	0.0 %	0.0 %	00.00.00.000	
TAPE 2 . . . . .	0.0 %	0.0 %	00.00.00.000	
TAPE 1 DATA TRANSFER. . . . .	0.0 %	0.0 %	00.00.00.000	
TAPE 2 DATA TRANSFER. . . . .	0.0 %	0.0 %	00.00.00.000	
TAPE 1 START/STOP DATA TRANSFER. .	0.0 %	0.0 %	00.00.00.000	
TAPE 2 START/STOP DATA TRANSFER. .	0.0 %	0.0 %	00.00.00.000	

Figure 3-15 (Part 3 of 3). SMF Summary Information

**Report Date:** The date the report was printed.

**Data Collection File:** The data collection file used as input to the report writer.

**SMF Summary:** The start time, stop time, elapsed time, and the snapshot interval for the period covered by the report.

**Summary Usage:** A summary of the device, task work area, disk cache, assign/free area usages, and storage commitments. For each counter, the following values are reported:

- The average value of all the sample intervals
- The maximum value of all the sample intervals
- The time at which the maximum value first occurred

*Note: The entry **not active/collected** for a communications line means either that the line was not active or that SMF did not collect information for that line.*

**Summary System Event Counters and Summary I/O Counters:** For each counter, the following values are reported:

- The total value of all the sample intervals
- The rate per minute
- The maximum value of all the sample intervals
- The time at which the maximum value first occurred

**Summary DSA and Tape Usage:** The same values are recorded for each counter as are recorded for “Summary Usage” in this section.





## Chapter 4. Suggestions for Using SMF

Many factors in your own environment contribute to system performance. Most of these factors are not within the control of IBM. This manual, and especially this chapter, are intended to help you determine those factors, and to suggest possible improvements. This does not mean or imply that your particular system will necessarily show such improvement.

### Standard Practices and Procedures

Most likely, you will choose to run SMF when you suspect that your System/36 can perform at a higher level. In order to have a set of values to compare to, however, also run SMF when you are satisfied with the performance of your system during a representative workload. (For further comparison, you should also collect data before a new release is installed and before any hardware or programming changes.) Keep these various SMF runs for reference by saving printed copies of the SMF report (preferably the report produced by the print option ALL), or, within a release, by copying the data collection file to diskette. Include with the report or diskette a description of the jobs that were running along with SMF. You can use such information to establish the peak workload time and Counter usage and counter values.

Look for symptoms of performance problems in:

- Display station response time during interactive jobs
- Printer throughput (the number of lines printed within a given time period)
- Batch throughput (the number of batch jobs processed within a given time period)

For example, you might notice that the response time at your display stations increases noticeably during a peak period of system activity. Run SMF with a long sample interval (5 minutes, for example) specified for the majority of the day, and a shorter interval (say 1 minute) during the problem period. The report produced with the SUMMARY print option lists the maximum values of various system counters and the time at which the maximum value occurred. To determine which counters might indicate a performance problem, look for those maximum values that occurred during the problem period. Also consider those values that differ greatly from the typical values you obtained through your analysis of previous SMF runs. Then use the DETAIL or ALL print option to list in more detail those portions of the data collection file that you have identified as most important.

## Significant Counters

The following counters can tell you the most about the performance of your system. Chapter 3, “SMF Reports,” describes what these counters measure; this section explains what those measurements mean and how you might use this information to improve performance. The counters are listed in the order they appear on the report. No attempt is made to rank these counters in order of importance. The importance of each counter depends on the nature of the problem being analyzed.

Remember that, in analyzing particular problem periods, you should have a base of SMF runs available for comparison. These values should be collected when system response times and throughput are acceptable. In collecting these values, you may notice that usages and other counters increase significantly during certain runs without affecting response time or throughput. This may indicate better use of system resources, not a performance problem.

## Device Usage Rates Counters

### Main Storage Processor

A *Main Storage Processor* usage that is significantly higher than normal may indicate a processor-bound job, which could be increasing response time at your work stations.

Processor-bound jobs may be:

- Programs that perform many calculations, such as sorts and program compilations. Consider rescheduling these jobs.
- Batch programs running with high priority. Consider rescheduling these jobs, or lowering their priority.
- Batch programs running with other batch programs. Consider rescheduling some of the batch programs or sequencing them using the job queue.

To determine which jobs are using the main storage processor more than others, specify that you want to collect I/O and SEC data by task in the SMFSTART procedure. The “MSP Usage” counter in the “Task Status Information” section in Chapter 3 shows this information for each job.

## Control Storage Processor

The following are common system functions that use the control storage processor extensively:

- Certain BASIC and FORTRAN subroutines, intrinsic functions, and mathematical calculations. You may want to reschedule programs that use these functions.
- Disk operations. Each disk operation requires control storage processing. Some batch programs use the disk extensively.
- Nucleus supervisor. The amount of work done by the nucleus supervisor depends on the number of tasks running in main storage and the amount of work they give to control storage.
- Trace service aid. Collecting unnecessary trace events, or increasing the size of the Trace buffer, may degrade system performance.
- Operations on an SLCA (single line communications attachment) system. If you have SLCA on your system, communications operations issued from main storage are processed only within control storage. On a multiple line communications controller system, however, these operations are sent through the control storage processor to the multiple line communications controller. Thus, more control storage processor time is required for each operation on an SLCA system than on a multiple line communications controller system.
- Work station operations (if you do not have a work station controller).

## Disk Usage

Most system activity, such as reading or writing to the history file, task work area, volume table of contents (VTOC), and system library (#LIBRARY), occurs on disk A1. Your I/O requests must compete with this system activity for the disk. If the *Disk 1* counter is significantly higher than normal, system and user I/O activity is keeping the drive busier for a greater percentage of the sample interval, and overall system performance may go down.

Adding main storage will reduce swapping (reads from and writes to the task work area) and program loads (reads from user libraries or #LIBRARY on disk A1) and thus lower disk 1 usage.

If your system has only one disk drive, adding other drives and moving some files to those disks will reduce activity on disk A1.

The placement of your files on disk greatly affects system performance. The system will automatically determine file placement unless you specify a disk location when you create a file. If your system has only one disk, you should place the files and libraries that you use most often closest to the system library at the beginning of the disk. If your system has more than one disk, you should try to balance the usage between them, while keeping the percentage of seek operations greater than one-third of the disk as small as possible (see "I/O Counter Information" in Chapter 3 and "I/O Counters" later in this chapter). If the difference between disk usage on the disks is greater than 15%, you may want to move a few files and review the usage figures over a period of time and a variety of jobs. Repeat this process until the disk drives are balanced to your satisfaction over the majority of your programs.

On the 5364, there is no overlapping of the I/O operations between the spindles. Therefore, balancing of the spindle usage may not show noticeable performance improvements as on the 5360 and 5362. Reducing the seek operations greater than 1/3 of the disk will help more.

Use the CATALOG procedure with the LOCATION parameter specified to list where your files are located. Use the COPYDATA procedure to move files from one disk to another. For programming guidelines on placing your files and libraries on disk, see "Placing User Files and User Libraries on Disk" in the *Concepts and Programmers Guide*.

## **Task Work Area Counters**

### **Task Work Area Extents**

As a program is started, space is assigned to it from the task work area for control information and swapping. If not enough space has been configured, the system creates a *Task Work Area Extent*, which remains on disk until the next IPL. An extent may degrade system performance by contributing to the percentage of *Seek Ops > 1/3 Disk*.

### **Task Work Area Size**

Each extent takes approximately 150 blocks and is included in the *Task Work Area Size* figure. To reduce or eliminate extents, you may want to increase the task work area to the value reported with extents. If you later need more disk space, you can reduce the task work area, but the potential for creating an extent is then increased.

## Task Status Counters

### Work Station Operations : Program Swaps

This ratio is the number of work station operations for a program versus the number of times the program was swapped in or out. If the ratio is low (for example, 1:1 or 1:2) too much swapping may be taking place, and work station response time may increase. A heavily loaded system, not enough main storage, or poor program design can all increase swapping. For example, if a display is designed with several input fields, and if each field requires several disk operations, the program could be swapped out several times before all the disk operations are complete. On a lightly loaded system, response time may still be acceptable. As the workload increases, however, the demand for system resources increases, especially that for disk A1 (swapping and program loading, for example). This increased demand will cause response time to go up.

To determine if increased swapping is causing your response time problem, run SMF and compare the *WS Ops* and *Prog Swaps* values for the program against your base values. If the *WS Ops* are close to the same number, but the *Prog Swaps* are considerably higher, adding main storage or redistributing the workload may reduce swapping. Similarly, you may want to evaluate the number of fields per display that must be processed with each *WS Op*. Refer to the *Creating Displays* manual for more information on display design considerations.

## I/O and SEC Data by Task Counters

### Disk Record Waits

When one task has read a record in order to update it, any other tasks that want to read that record must wait until it is updated. The duration of these *Disk Record Waits* depends on the amount of system activity and the number of tasks wanting the same record. If several tasks show *Disk Record Waits*, locate the disk file and specific record that they are all waiting for. An example may be a master control record for an application. To minimize the wait time, make sure that these records are always updated and released as soon as possible. See the *Concepts and Programmer's Guide* for more information on releasing locked records. Rescheduling jobs may be another way to shorten or eliminate *Disk Record Waits*.

## System Event Counters

### Translated Transfer Calls : Translated Transfer Loads

A system program is called by a task through a *Translated Transfer Call*. A *Translated Transfer Load* is required to load the system program into the user area of main storage unless it already resides there. As more *Translated Transfer Loads* are required to satisfy calls, more swapping activity is taking place, and the calls/loads ratio approaches 1:1. Swapping takes time away from the running of your programs, so this ratio should preferably be larger (two or more calls per load, for example). Additional main storage may be necessary to keep a system program called by more than one task in main storage, and to thereby reduce the number of loads.

## Swaps In and Swaps Out

*Swaps In*, *Swaps Out*, and *Translated Transfer Loads* counts that are higher than your base values will also be reflected in a higher *Disk I Usage*. To reduce swapping or loading activity, you may want to add main storage or change the scheduling of some of your jobs. See the *Concepts and Programmer's Guide* for more information on swapping.

## L-3 and L-4 Storage Releases W/ or W/O Swap

L-3 storage releases indicate that tasks of equal priority are exchanging main storage. L-4 storage releases occur when a higher priority task currently in main storage wants a system resource owned by a lower priority task currently not in storage. The higher priority task releases its storage to allow the lower priority task to run. If not released, the tasks would interlock, because the lower priority task cannot give up the resource when not in storage. A significant number of L-3 and L-4 storage releases can lower your system performance. The number of L-4 storage releases should preferably be zero.

You may want to add more main storage or reschedule jobs to reduce the number of L-3 and L-4 storage releases. For a description of storage releases in general, see "System Event Counters Information" in Chapter 3.

## Communications Line Counters

"Total Line Usage" in "Communications Line Usage Information" of Chapter 3 is the sum of the five previous communication line percentages.

- Receiving system turnaround
- Line turnarounds
- Errors
- Transmitted data
- Received data

Apart from the time taken up by *Errors* or error recovery, the line usage percentage consists of data transfer and line turnarounds.

1. **Data transfer.** Your communications line is being used more productively the closer the sum of Transmitted Data and Received Data is to the Total Line Usage. To improve this ratio for batch programs (and to therefore improve your line response time), you may want to send larger blocks of data. For interactive users like RWS (remote work stations), however, large block sizes will only tie up the communications line. You can determine the relative size of your blocks of data by dividing the number of Productive Line Turnarounds by the sum of the number of Bytes Transmitted and Bytes Received: The smaller the ratio, the larger the blocks of data being communicated.
2. **Line turnarounds consist of Receiving System Turnarounds and Line Turnarounds.** The percentage of total line usage spent on line turnarounds depends upon both your own system's turnaround and that of the receiving system. If the receiving system is taking the most time in turnarounds, you must understand why it is doing so before you can decide whether sending larger blocks of data will improve your line response time.

A faster line speed may also reduce line usage and shorten line response time.

The Errors percentage (see "Communications Line Usage Information" in Chapter 3) is an indication of the extent to which errors are affecting your line usage. If your error rate is a large percentage of your total line usage, find the cause of the line errors by running the ERAP service aid procedure.



## I/O Counters

### Seek Ops Gt 1/3 Disk

The farther the disk arm has to move to read or write a record, the longer the I/O operation will take to complete. To keep the seek distance as short as possible, group the most heavily used files for your programs together. In addition, place the files as shown in Figure 4-1. For information about how to determine which files are the most heavily used, see "File Access Counters" later in this chapter.

*Note: Scratch and job files, as well as any transaction files created, will be allocated by the system in the free space on disk.*

#### Disk A1

System Areas -#LIBRARY -Task work area -VTOC	Most Used Files and libraries	Least Used Files and libraries	Free Space
---	----------------------------------	-----------------------------------	------------

#### Disk A2

Free Space	Most used Files and Libraries	Least Used Files and Libraries
------------	----------------------------------	-----------------------------------

#### Disk A3

Least Used Files and Libraries	Most Used Files and Libraries	Free Space
-----------------------------------	----------------------------------	------------

#### Disk A4

Free Space	Most Used Files and Libraries	Least Used Files and Libraries
------------	----------------------------------	-----------------------------------

**Figure 4-1. File Placement over Four Disks**

## File Access Counters

Proper file placement can be crucial to having acceptable system performance. By knowing which files are used the most, you can move those files to provide optimum (shortest) seek spans for user files and some system files. An example of a system file that can be moved is ##SPOOL. Refer to “SMFSTART Prompts and Parameters,” “User File Access Counters,” and “I/O Counters” for more information.

### User Files

By analyzing user file data, you can identify the most heavily used files during each snapshot. By analyzing several snapshots for your applications, you can judge if the heavily accessed files are close to each other. If they are not, you can move them closer together. This should help your performance by reducing the seek span. The location of the files is given under the BLOCK LOC heading in the “File Access Counters” section.

### System Files

Analyzing system file data will identify the most heavily accessed user libraries during each snapshot. These libraries can be moved if necessary to provide optimum seek spans with other heavily used files. The disk and the file placement of the master spool file (#SPOOL1) is listed. #SPOOL1 should be placed on the least used disk next to the most active files. The task work area extents (#SYSTSKX) will be listed. You can judge how much to increase your task work area size by determining which extents have the most disk accesses. You can then increase the task work area (TWA) by the amount specified under the LENGTH heading in the “File Access Counters” section.

#### *Notes:*

- 1. Before moving any files, make sure all applications have been evaluated. Although seek spans could be shortened for some applications, they could be increased for others thus degrading their performance.*
- 2. Some files may not have much activity for long periods of time (for example, end-of-month files and end-of-year files). However, there will be times when these files are heavily accessed. During these heavy use periods, it may be advantageous to move these files close to the files they use to reduce the seek span and get better performance.*

# How the Significant Counters Can Help Identify Problems

## MAPICS Test Runs

The following information was obtained from the results of several test runs for the IBM MAPICS (Manufacturing and Accounting Production Information Control System) application programs on a System/36. The results of the tests are shown in Figure 4-2, and the test conditions are at the end of this chapter. These results are not meant to be compared to the SMF data, response time, and throughput produced by your programs, but to show the effect that a change in hardware configuration has on system performance, and how the significant counters previously defined can help identify performance problems.

In Configuration A, the amount of main storage is only enough to run one program at a time, but the system still provides acceptable response times and throughput for four display stations. In Configuration B, three more display stations place an even greater load on the same amount of main storage and swapping therefore increases. Figure 4-2 shows that the amount of swapping activity for Configuration B (B24, B25) is more than two and one-half times that of Configuration A (A24, A25).

The increased swapping and loading activity for Configuration B causes a significant increase in *Disk 1 Usage* (A03–30%; B03–58%). The *Translated Transfer Calls* rate (21) increases by 40% but the *Loads* (22) rate increases by 85% from Configuration A to B, meaning that, because of the greater demand for main storage, fewer system programs remain resident and must be reloaded as needed. Similarly, the ratio of *WS Ops* to *Prog Swaps* rises from A to B (A11–2:1; B11–1:3). More swapping is being done for each *WS Op* in Configuration B.

*L-3 and L-4 Storage Releases* should always be as low as possible. Even though the values for Configuration A are high in comparison, acceptable response time is achieved. Configuration B, however, shows a significant increase in these values, indicating a significant increase in the number of long delays for memory. This also contributed to the greater swapping in Configuration B.

Configuration B has a longer response time (B50–7.48; A50–2.63) and fewer transactions/hour/display station (B52–184; A52–217). (For MAPICS runs, a transaction is defined as pressing the Enter key.) The number of transactions/hour is higher for B (B51–1286; A51–869), but this is only because of the greater number of display stations.

The unfavorable values reported by these counters suggest that Configuration B does not have enough main storage to handle its increased workload. The values reported for Configuration C verify this. Adding 128K bytes of main storage again improves response time and throughput results (C50, C51, and C52). Transactions/hour/display station (C52) increased by 40% over the Configuration B value. The L-3 and L-4 storage releases have been reduced or eliminated. Swapping and loading activity (C22, C24, and C25) has decreased significantly, which is in turn reflected in the decrease in *Disk I Usage* (C03). The percentage of *Seek Ops > 1/3 Disk* (C41, C42) has doubled, but for Configuration C this is a positive result. In Configuration B, the disk arm is moving between the task work area (swapping) and #LIBRARY (translated transfer loading) more frequently than in Configuration C. The task work area and #LIBRARY are less than one-third of the disk apart. In Configuration C, however, the lower swapping and loading values mean that files used directly by the program can be read or written to more often. Those on disk A1 are farther than one-third of the disk away from the system areas.

The *MSP Usage* count has doubled between Configurations B and C because more programs can run with more main storage. The main storage processor, which processes program instructions, requests control storage processor services through a supervisor call (SVC). When performing I/O operations, the program must remain in main storage until the SVC is completed. In Configuration B, only one program can be in main storage at a time. Thus, the main storage processor is idle while that program waits for an I/O operation to complete. Only then can the program be swapped out and another program run, which is an inefficient, serial use of main storage. In contrast, Configuration C allows three to four programs to stay in main storage together and share the use of the main storage processor.

In Configuration D, the dual 30 megabyte disk drives are replaced by one 200 megabyte disk drive but response time increases (C50—2.49; D50—3.04). In Configurations A, B, and C, the number of I/O operations can be split between two disks, but Configuration D restricts them to one. This is the primary reason that *Disk I Usage* rises from C to D, but the increased swapping activity contributes to the higher value. The percentage of *Seek Ops > 1/3 Disk* for disk A1 also goes up, but not significantly considering all the application files reside on disk A1. 200 megabyte disks have a greater density in bytes/cylinder than 30 megabyte disks, so the disk arm does not have to move as far between records.

Response times and throughput improve when 256K bytes of main storage is added in Configuration E. The decrease in swapping (E24, E25) and translated transfer loads (E22) are mainly responsible for this.

A second 200 megabyte disk drive is added in Configuration F and, although main storage was reduced to 256K bytes, response times and throughput improve again. Like Configurations A, B, and C, Configuration F can split I/O operations between two disks, and, like Configurations D and E, it benefits from the higher performance of the 200 megabyte disks. (The average seek time of these disks is faster and, because the density in bytes/cylinder is greater, the average seek distance is shorter.)

Configurations G and H show that acceptable response times and throughput can still be achieved with a heavier work load (15 display stations) if enough main storage is added.

Configuration	A	B	C	D	E	F	G	H
<b>Number of Display Stations</b>	<b>4</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>15</b>	<b>15</b>
<b>IPL CONFIGURATION</b>								
Main Storage Size (K)	128	128	256	256	512	256	384	512
Disk Capacity (MB)	60	60	60	200	200	400	400	400
<b>DEVICE USAGE RATES (%)</b>								
01 Main Storage Processor	6	8	16	15	17	19	34	36
02 Control Storage Processor	14	25	30	30	29	33	53	55
03 Disk 1	30	58	42	75	68	34	54	46
04 Disk 2	12	21	39	*	*	35	59	68
<b>TASK STATUS INFORMATION</b>								
11 WS Ops: Prog Swaps (ratio)	2:1	1:3	2:1	2:1	--	2:1	3:1	6:1
<b>SYSTEM EVENT COUNTERS (1 MINUTE SAMPLE INTERVAL)</b>								
21 Translated Transfer Calls	181	253	404	391	432	430	670	684
22 Translated Transfer Loads	76	140	85	89	31	87	97	71
23 Calls: Loads (ratio)	2.4	1.8	4.8	4.4	13.6	5.0	6.9	9.6
24 Swaps In	99	274	80	91	37	87	120	83
25 Swaps Out	71	198	42	53	4	49	90	43
26 Disk Record Waits	--	--	--	--	--	--	--	--
27 L-3 Storage Releases W/O Swap	31	48	18	27	0	24	12	0
28 L-3 Storage Releases W Swap	43	136	7	11	0	11	4	0
29 L-4 Storage Releases W/O Swap	37	117	0	0	0	0	0	0
30 L-4 Storage Releases W Swap	5	25	0	0	0	0	0	0
<b>I/O COUNTERS (%)</b>								
41 Disk 1 Seek Ops Gt 1/3 Disk	15	12	24	33	33	0	0	0
42 Disk 2 Seek Ops Gt 1/3 Disk	23	22	27	*	*	0	2	2
<b>RESULTS</b>								
50 Average Response Time (seconds)	2.63	7.48	2.49	3.04	2.24	1.95	2.82	2.61
51 Transactions/Hour	869	1286	1823	1778	1885	1954	4020	4074
52 Transactions/Hour/Display Station	217	184	260	254	269	279	268	272
<b>Legend:</b>								
-- Not Significant								
* Not Meaningful								

Figure 4-2. MAPICS Test Runs

## MAPICS Test Conditions

The data reported in Figure 4-2 and explained in the previous section should be looked at to see the effect of adding main storage, disk space, and display stations to various System/36 configurations. The tests are conducted in an artificial environment. For example, the test equipment enters data at a constant rate, eliminating the interruptions that may slow down your operators. You may not, therefore, be able to maintain the throughput achieved in these measurements, and you should not compare them directly to your own results.

The tests are run with different mixes of applications. Each test takes two hours. The MAPICS applications consist of accounts receivable, inventory management, material requirements planning, order entry and invoicing, payroll, production control and costing, and product data management. General ledger files are updated by the other applications, but no general ledger menu options are run. Batch programs and spooling are included in the test results.

The following chart shows the number of display stations assigned to each application to make up the totals of 4, 7, and 15 for the various test runs:

Applications	Number of Display Stations		
Order entry and invoicing	1	3	4
Accounts receivable			1
Inventory management	1	1	2
Product data management	1	1	2
Product control and costing	1	2	3
Payroll			1
Material requirements planning			2
Total	4	7	15

## File Group Sizes

Two groups of files for MAPICS were used in the measurements: Group A for the runs with 4 and 7 display stations, and Group B for the runs with 15 display stations. The groups of files were obtained from customers and converted using the Data File Conversion feature. The number of records for each group of files are as follows:

<b>File</b>	<b>Group A (4/7 Displays) Number of Records</b>	<b>Group B (15 Displays) Number of Records</b>
Requirements	56,362	61,249
Item balance	6,221	11,294
Work center master	63	47
Open payables	632	1,872
Customer order summary	1,248	2,042
Item master	12,513	13,695
Open miscellaneous charges	800	2,000
Open operation	6,400	12,000
Open material detail	20,000	28,000
Customer master	5,526	1,193
Purchase order summary	668	2,700
Manufacturing order summary	1,200	1,104
Open accounts receivable	13,504	29,904
Product structure	8,000	20,000
Routing	10,000	20,000

## Run Configurations

The following configurations were used in the MAPICS test runs:

<b>Configuration</b>	<b>Main Memory (K Bytes)</b>	<b>Disk Capacity (M Bytes)</b>	<b>5251 Displays</b>	<b>Group</b>
A	128	60	4	A
B	128	60	7	A
C	256	60	7	A
D	256	200	7	A
E	512	200	7	A
F	256	400	7	A
G	384	400	15	B
H	512	400	15	B





## Appendix A. How SMF Affects System Performance

The extent to which SMF may degrade the performance of your System/36 is determined by:

- The user area size
- The sample interval you specify for the data collection program

Running SMF may add as much as 5% to the *Main Storage Processor* usage (see “Device Usage Information” in Chapter 2).

### User Area Size

The amount of user area that is available for your programs determines the amount of swapping activity on your system. SMF takes up space in the user area depending on your communications hardware configuration and whether you decide to collect communications data and data by file. The following chart shows the SMFSTART option and the amount of main storage SMF will use.

SMF has the greatest effect on your system when you have selected communications data to be collected. This 2K-byte increase may cause more swapping.

SMF Option	SMF Program Size
No communications and no data by file	6K bytes
Collect communications and data by file	8K bytes

## Sample Interval

The data collection program takes approximately 400 milliseconds of main storage processing time to record the data at each snapshot. (The actual time depends on the options chosen and the number of active tasks and files.) An additional 100 microseconds is required to move counters to the SMF data collection file for each sample interval selected. For the smallest sample interval (10 seconds), approximately 2% will be added to the main storage processor usage. More demand will be placed on system resources if you select the smallest sample interval than if you select the maximum sample interval (5 minutes). You should select a sample interval that satisfies your data collection requirements, yet has the least effect on your system performance.

## Appendix B. Differences between System/34 and System/36 SMF

You are advised not to make comparisons between a System/34 and System/36 SMF report without considering the following additions, deletions, and changes. Refer to either the *IBM System/34 System Measurement Facility Reference Manual*, SC21-7828, or this manual for an explanation of the counters added or deleted. Also noted are the counters renamed from the System/34 to System/36 report.

### IPL Configuration Information

Add	Delete
Configuration Member Name	Control Storage Size
X.21 Lines Supported	Nucleus Size
X.25 Lines Supported	User Area Size
File Subsystem Processor	System Assign/Free Size (A/F)
Work Station Controller	Work Station Buffer Size (WSB)
Tape Drives Supported	Trace Buffer Size
Disk Drives Attached	Spool Intercept Buffer Size
System Model Number	Spool Writer Buffer Size
5 to 8 Communications Lines	IPL Date
5360 Stage 2 Processor	Workstation Data Management
	High Priority Spool Writer
	Resident Spool Writer
	Number of Printers
	Number of Workstations

### Changes

*Line Printer Supported* changes to *3262 Printer Supported*.

## Communications Configuration Information

Add	Delete
None	SDLC Polling Interval (Sec)

## Device Usage Information

Add	Delete
Data Storage Controller Work Station Controller Queue Work Station Controller Communications Lines (lines 5 through 8) PC Processor Work Station Controller 2 Queue Work Station Controller 2	A/F [assign/free area] WSB [work station buffer]

## Changes

The method of calculating *Main Storage Processor* usage has changed from System/34 to System/36. Do not compare the two values.

*IOC* (I/O channel) changes to *Data Storage Attachment*.

*Task Work Area* moves to the *Task Work Area* section of the SMF report.

## Task Work Area Information

This is a new section on the System/36 SMF report.

## Disk Cache Information

This is a new section on the System/36 SMF report.

## User File Access Counters

This is a new section on the System/36 SMF report.

## System File Access Counters

This is a new section on the System/36 SMF report.

## Task Status Information

Add	Delete
Job Attribute Exec Stor [execution and storage attributes] Prog Swaps TWS [task work space] TWS Swaps	WSID

## Changes

A System/34 program recompiled to run on System/36 may be listed as larger on an SMF report, because I/O buffers are attached to the end of the program after compilation and counted in the *Prog Size*. On System/34, the size of a program after compilation was always the size of the program run.

*Priority:* On System/34, user priorities could be *batch* or *interactive*. See “Task Status Information” in Chapter 3 for System/36 priority values.

*Swap Status:* System/36 reports five new wait conditions: LW, OS, RE, SI, and ST. Several new general post conditions will also be reported; see “Task Status Information” in Chapter 3 for a list of the conditions.

## Storage Totals Information

Add	Delete
System Work Space:	None
Trace	
Index Insert	
Active Procs	
Batch BSC	
Format Index	
Spell Check (TMS/36)	
Help Area	
FMS I/O Subroutines	
FMS Folder	
Spell Check (IBM DisplayWrite/36)	
Cmd Processor	
WS ID Table	
DW/36 Subr	
Disk Cache	
Nucleus	
Nonswappable Program Space	
Nonswappable Work Space	
Total Nonswappable Space	
System Program Space	
User Program Space	
Swappable Work Space	
Active Storage Commitment	

## Changes

The *System Work Spaces* are listed with five new counters: *Size*, *Swap Stat* (swapping status), *Swaps*, *Active Users*, and *Demand Count*. See "Storage Totals Information" in Chapter 3 for a description of these counters.

*Nucleus* is listed under the *Storage Totals* section of the System/36 SMF report as part of the *Total Nonswappable Space*; on the System/34 report it is listed in the *IPL Configuration* section.

*Used* changes to *Total Swappable Space*.

*Available* changes to *User Area Space Available* but the difference remains between the *Main Storage Size* and *Total Nonswappable Space*.

The method of calculating *Actual* and *Total Storage Commitment* has changed from System/34 to System/36. Do not compare the two values.

## Detailed System Information

A separate section on the System/34 SMF report, *Detailed System Information* has been reorganized on the System/36 report. *System Assign/Free Data* has been included at the end of the *Storage Totals* section; *Workstation Buffer Data* has been inserted under *System Work Space* of the same; and *Task Work Area Data* has been given a separate section. In addition, instead of reporting the space *Available* in these areas in bytes, a *Usage* percentage is now reported for the task work and assign/free areas.

## System Event Counters Information

Add	Delete
Translated Transfer Calls	Inter/Bch Time/Outs
Asynchronous Transfer Calls	Spool Buffer Splits
Translated Transfer Loads	Swaps Out, Net
Main Storage Loader Requests	Task Switches
Task Work Area Read Ops	Transient Preempts
Task Work Area Write Ops	WSB Retries
Main Storage Clear Ops	WSB Write Retries
Control Storage Transient Calls	
Control Storage Transient Loads	
Control Storage Loader Requests	
Spool Segments Allocated	
Job Initiations	
Job Step Initiations	
MRT Attaches	
MRT Loads	
Job Terminations	
Job Step Terminations	
Abnormal Terminations	
Disk Locks Satisfied	
Disk Locks Expired	
Assign/Free Reductions	
L-1 to L-4 Storage Releases W/O and	
W/ Swap	
Memory Resident Overlay Loads	
Memory Resident Overlay Maps	
Disk Cache Hits	
Disk Cache Misses	



## Changes

*Transient Loads* changes to *Main Store Transient Loads*.

*Transient Calls* changes to *Main Store Transient Calls*.

*Task Dispatches* changes to *Preemptive Task Dispatches*.

*Sector Enqueue Retries* changes to *Disk Record Waits*. Instead of waiting for sectors before updating, disk data management now waits at the record level.

*A/F Assign Retries* changes to *Assign/Free Extensions*. On System/34, the assign/free area was always retried before buffer space was taken from the user area. On System/36, the assign/free area is automatically extended into the user area without retries, and the space returned when no longer needed.

## I/O Counter Information

Add	Delete
Scan Operations (for each disk) Average Seek Length (for each disk) Tape Read Bytes Tape Write Bytes Tape Rewind Ops Tape Hitchback Ops	Rd Verifies Swap-in/Minute (Seeks) LT 1/3 Disk (for each disk)

## Changes

On System/34, both read and scan operations were included in the *Disk Reads* counter. On System/36, the counts for read and scan operations have been separated.

Both types of *Diskette Read Ops* and *Write Ops* (1 and 2D) have been given a separate counter on System/36. In addition, these diskette counters now measure the number of 128- or 256-byte groups of data read or written; on System/34, the counters measured the number of operations.

On System/34, both display station and printer operations were included in the *Workstation Ops* counter. On System/36, the counts for display stations and printers have been separated. *Local* and *Remote* counts have been further distinguished for the above on System/36.

*Line Printer Ops* changes to *3262 Printer Ops*.

## Data Storage Attachment and Tape Usage Information

Add	Delete
DSA Device Usage Diskette to DSC DSA Buffer Usage One Buffer To M/C Storage One Buffer To DSC Two Buffers to M/C Storage Two Buffers To DSC Two Buffers To M/C Storage and DSC Total DSA Buffer Usage Tape Usage Tape 1 Tape 2 Tape 1 Data Transfer Tape 2 Data Transfer Tape 1 Start/Stop Data Transfer Tape 2 Start/Stop Data Transfer	Data Channel

### Changes

Because of its two buffers, the System/36 data storage attachment (DSA) can be used by two devices at the same time. Counters therefore measure the percentage of the sample interval when the DSA was allocated to only one and to two buffers, and a total usage is also reported. On System/34, only one device at a time could use the I/O channel.

## Communications Line Usage Information

Add	Delete
None	Error Bytes Received

### Changes

Communications line usage information is collected in control storage on System/36. It was collected by a main storage task on System/34.

## SMF Summary Information

Add	Delete
Active Storage Commitment Data Storage Controller Work Station Controller Queue Work Station Controller Snapshot Interval Communications Line Usage Lines 5-8 PC Processor Work Station Controller 2 Queue Work Station Controller 2 Disk Cache Utilization	Work Station Buffer (WSB) Swap-in/Minute Number of Available A/F Segments Number of Available WSB Segments Available A/F Space Largest Available A/F Segment Available WSB Space Largest Available WSB Segment

## Summary SEC and I/O Counter Information

In addition to the changes already listed, *Per Minute*, *Maximum*, and *Time Maximum Occurred* summary values have been added on the System/36 SMF report.

## Summary DSA and Tape Usage

In addition to the changes already listed, *Maximum* and *Time Maximum Occurred* values have been added on the System/36 SMF report.

## Appendix C. Record Layout of File Created by the SMFDATA Procedure

### IPL Configuration Record (AAA-AAB)

Field Description	From	To	Length	Decimal Places
Record type (AA)	1	2	2	
Sequence ID within type (A)	3	3	1	
Report file identifier (SMF.DATA)	4	11	8	
Report date (same format as system date)	12	17	6	
Main storage size (in K bytes)	18	21	4	
SMF data collection date (YYMMDD)	22	27	6	
Disk size (in megabytes)	28	33	6	2
Release number (nn)	34	35	2	
Modification number (nn)	36	37	2	
Task work area size (in blocks)	38	42	5	
Configuration member name	43	50	8	
3262 Printer supported (y/n)	51	51	1	
Communications lines supported (1,2,3,4,5,6,7,8)	52	55	4	
Spooling supported (y/n)	56	56	1	
Autocall lines supported (1,2,3,4,5,6,7,8)	57	60	4	
Remote work stations supported (y/n)	61	61	1	
X.21 lines supported (1,2,3,4,5,6,7,8)	62	65	4	
Communications controller attached (y/n)	66	66	1	
X.25 lines supported (1,2,3,4,5,6,7,8)	67	70	4	
DSC attached (y/n)	71	71	1	
Tape drives supported (1, 2)	72	72	1	
WSC attached (y/n)	73	73	1	
Disk drives attached	74	74	1	
System model number	75	78	4	
Stage 2 processor	79	79	1	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AA)	1	2	2	
Sequence ID within type (B)	3	3	1	
Communications lines supported (1,2,3,4,5,6,7,8)	4	7	4	
X.21 lines supported (1,2,3,4,5,6,7,8)	8	11	4	
Not used	12	79	68	
End of record type (E)	80	80	1	

**Communications Configuration Record (ABA-ABD)**

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AB)	1	2	2	
Sequence ID within type (A)	3	3	1	
Communications line 1 active (1)	4	4	1	
Communications line 2 active (2)	5	5	1	
Communications line 3 active (3)	6	6	1	
Communications line 4 active (4)	7	7	1	
Communications line 1 user	8	13	6	
Communications line 2 user	14	19	6	
Communications line 3 user	20	25	6	
Communications line 4 user	26	31	6	
Communications line 1 priority	32	35	4	
Communications line 2 priority	36	39	4	
Communications line 3 priority	40	43	4	
Communications line 4 priority	44	47	4	
Communications line 1 type	48	55	8	
Communications line 2 type	56	63	8	
Communications line 3 type	64	71	8	
Not used	72	79	8	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AB)	1	2	2	
Sequence ID within type (B)	3	3	1	
Communications line 4 type	4	11	8	
Communications line 1 rate	12	15	4	
Communications line 2 rate	16	19	4	
Communications line 3 rate	20	23	4	
Communications line 4 rate	24	27	4	
Communications line 1 speed (bits/second)	28	33	6	
Communications line 2 speed (bits/second)	34	39	6	
Communications line 3 speed (bits/second)	40	45	6	
Communications line 4 speed (bits/second)	46	51	6	
Communications line 5 active (5)	52	52	1	
Communications line 6 active (6)	53	53	1	
Communications line 7 active (7)	54	54	1	
Communications line 8 active (8)	55	55	1	
Communications line 5 user	56	61	6	
Communications line 6 user	62	67	6	
Communications line 7 user	68	73	6	
Communications line 8 user	74	79	6	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AB)	1	2	2	
Sequence ID within type (C)	3	3	1	
Communications line 5 priority	4	7	4	
Communications line 6 priority	8	11	4	
Communications line 7 priority	12	15	4	
Communications line 8 priority	16	19	4	
Communications line 5 type	20	27	8	
Communications line 6 type	28	35	8	
Communications line 7 type	36	43	8	
Communications line 8 type	44	51	8	
Communications line 5 rate	52	55	4	
Communications line 6 rate	56	59	4	
Communications line 7 rate	60	63	4	
Communications line 8 rate	64	67	4	
Communications line 5 speed (bits/second)	68	73	6	
Communications line 6 speed (bits/second)	74	79	6	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AB)	1	2	2	
Sequence ID within type (D)	3	3	1	
Communications line 7 speed (bits/second)	4	9	6	
Communications line 8 speed (bits/second)	10	15	6	
Not used	16	79	64	
End of record type (E)	80	80	1	

**Device Usage Rates Record (ACA-ACB)**

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AC)	1	2	2	
Sequence ID within type (A)	3	3	1	
Snapshot time (hhmmss.sss)	4	12	9	
Elapsed time (mss.sss)	13	18	6	
Main storage processor usage (in %)	19	21	3	
Control storage processor usage (in %)	22	24	3	
Communications line 1 usage (in %)	25	27	3	
Communications line 2 usage (in %)	28	30	3	
Communications line 3 usage (in %)	31	33	3	
Communications line 4 usage (in %)	34	36	3	
Disk 1 usage (in %)	37	39	3	
Disk 2 usage (in %)	40	42	3	
Disk 3 usage (in %)	43	45	3	
Disk 4 usage (in %)	46	48	3	
Data storage controller usage (in %)	49	51	3	
Data storage attachment usage (in %)	52	54	3	
WSC queue usage (in %)	55	57	3	
Work station controller usage (in %)	58	60	3	
Task work area usage (in %)	61	63	3	
Task work area size (in blocks)	64	68	5	
Number of task work area extents	69	73	5	
Not used	74	79	6	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AC)	1	2	2	
Sequence ID within type (B)	3	3	1	
Communications line 5 usage (in %)	4	6	3	
Communications line 6 usage (in %)	7	9	3	
Communications line 7 usage (in %)	10	12	3	
Communications line 8 usage (in %)	13	15	3	
PC Processor Usage (in %)	16	18	3	
WSC 2 Queue Usage(in %)	19	21	3	
WSC 2 Usage (in %)	22	24	3	
Disk Cache Utilization (in %)	25	27	3	
Disk Cache size (in K bytes)	28	32	5	
Disk Cache page size (in K bytes)	33	35	3	
Not used	36	79	44	
End of record type (E)	80	80	1	



**Task Status Record (ADA-ADB)<sup>1</sup>**

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AD)	1	2	2	
Sequence ID within type (A)	3	3	1	
Task number	4	6	3	
Job name	7	14	8	
Procedure name	15	22	8	
Program name	23	30	8	
Program size (in K bytes)	31	33	3	
Subtask (* or blank only)	34	34	1	
Program type	35	41	7	
Requester count	42	44	3	
Number of work station operations	45	48	4	
Priority of program	49	54	6	
User identification	55	62	8	
Execution attribute	63	66	4	
Storage attribute	67	70	4	
Not used	71	79	9	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AD)	1	2	2	
Sequence ID within type (B)	3	3	1	
Number of program swaps	4	7	4	
Swap status	8	10	3	
Wait 1 status	11	12	2	
Wait 2 status	13	14	2	
Wait 3 status	15	16	2	
Scheduler status	17	20	4	
Task work space (in K bytes)	21	23	3	
Number of task work space swaps	24	27	4	
Not used	28	79	52	
End of record type (E)	80	80	1	

---

<sup>1</sup> These records can occur multiple times in a snapshot.

**Extended Task Status Record (AEA-AEB)<sup>2</sup>**

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AE)	1	2	2	
Sequence ID within type (A)	3	3	1	
Job name	4	11	8	
Procedure name	12	19	8	
Main storage processor usage (in %)	20	22	3	
Number of disk 1 reads	23	27	5	
Number of disk 1 scans	28	32	5	
Number of disk 1 writes	33	37	5	
Number of disk 2 reads	38	42	5	
Number of disk 2 scans	43	47	5	
Number of disk 2 writes	48	52	5	
Number of disk 3 reads	53	57	5	
Number of disk 3 scans	58	62	5	
Number of disk 3 writes	63	67	5	
Number of disk 4 reads	68	72	5	
Number of disk 4 scans	73	77	5	
Not used	78	79	2	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AE)	1	2	2	
Sequence ID within type (B)	3	3	1	
Number of disk 4 writes	4	8	5	
Number of printer operations	9	13	5	
Work station count	14	18	5	
Number of transient calls	19	23	5	
Translate transfer calls	24	28	5	
Number of general waits	29	33	5	
Number of record waits	34	38	5	
Number of job steps	39	43	5	
Number of resource time-outs	44	48	5	
Number of MSP time-outs	49	53	5	
Not used	54	58	5	
Not used	59	79	21	
End of record type (E)	80	80	1	

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<sup>2</sup> These records can occur multiple times in a snapshot.

**Terminated Task Data Record (AGA-AGB)<sup>3</sup>**

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AG)	1	2	2	
Sequence ID within type (A)	3	3	1	
Name of job terminated	4	11	8	
Name of procedure terminated	12	19	8	
Main storage processor usage (in %)	20	22	3	
Number of disk 1 reads	23	27	5	
Number of disk 1 scans	28	32	5	
Number of disk 1 writes	33	37	5	
Number of disk 2 reads	38	42	5	
Number of disk 2 scans	43	47	5	
Number of disk 2 writes	48	52	5	
Number of disk 3 reads	53	57	5	
Number of disk 3 scans	58	62	5	
Number of disk 3 writes	63	67	5	
Number of disk 4 reads	68	72	5	
Number of disk 4 scans	73	77	5	
Not used	78	79	2	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AG)	1	2	2	
Sequence ID within type (B)	3	3	1	
Number of disk 4 writes	4	8	5	
Number of printer operations	9	13	5	
Work station count	14	18	5	
Number of transient calls	19	23	5	
Translate transfer calls	24	28	5	
Number of general waits	29	33	5	
Number of record waits	34	38	5	
Number of job steps	39	43	5	
Number of resource time-outs	44	48	5	
Number of MSP time-outs	49	53	5	
Not used	54	58	5	
Not used	59	79	21	
End of record type (E)	80	80	1	

---

<sup>3</sup> These records can occur multiple times in a snapshot.

**User File Access Counters Record (AHA-AHB)**

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AH)	1	2	2	
Sequence ID within type (A)	3	3	1	
File deallocated (* if yes)	4	4	1	
File label	5	12	8	
Date created	13	18	6	
Job name	19	26	8	
File type	27	27	1	
File organization	28	29	2	
Block location of file	30	36	7	
File length	37	43	7	
Disk location	44	45	2	
Data reads	46	50	5	
Data writes	51	55	5	
Index reads	56	60	5	
Index scans	61	65	5	
Index writes	66	70	5	
Disk record waits	71	75	5	
Not used	76	79	4	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AH)	1	2	2	
Sequence ID within type (B)	3	3	1	
Get logical	4	8	5	
Get physical	9	13	5	
Update logical	14	18	5	
Update physical	19	23	5	
Delete logical	24	28	5	
Delete physical	29	33	5	
Add logical	34	38	5	
Add physical	39	43	5	
Not used	44	79	36	
End of record type (E)	80	80	1	

### System File Access Counters Record (AIA)

Field Description	From	To	Length	Decimal Places
Record type (AI)	1	2	2	
Sequence ID within type (A)	3	3	1	
File deallocated (* if yes)	4	4	1	
File label	5	12	8	
Date created	13	18	6	
Job name	19	26	8	
File type	27	27	1	
File organization	28	29	2	
File location	30	36	7	
File length	37	43	7	
Disk location	44	45	2	
Data reads	46	50	5	
Data scans	51	55	5	
Data writes	56	60	5	
Not used	61	79	19	
End of record type (E)	80	80	1	

**Storage Totals Record (AJA-AJE)**

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AJ)	1	2	2	
Sequence ID within type (A)	3	3	1	
Work station buffer size (in K bytes)	4	7	4	
Trace buffer size (in K bytes)	8	11	4	
Index insert buffer size (in K bytes)	12	15	4	
Active procs buffer size (in K bytes)	16	19	4	
Batch BSC buffer size (in K bytes)	20	23	4	
Format index buffer size (in K bytes)	24	27	4	
Spell check buffer size (in K bytes)	28	31	4	
Not used	32	35	4	
Help area buffer size (in K bytes)	36	39	4	
Work station swap status	40	42	3	
Trace buffer swap status	43	45	3	
Index insert swap status	46	48	3	
Active procs swap status	49	51	3	
Batch BSC swap status	52	54	3	
Format index swap status	55	57	3	
Spell check swap status	58	60	3	
Not used	61	63	3	
Help area swap status	64	66	3	
Work stations swaps in	67	70	4	
Trace swaps in	71	74	4	
Index insert swaps in	75	78	4	
Not used	79	79	1	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AJ)	1	2	2	
Sequence ID within type (B)	3	3	1	
Active procs swaps in	4	7	4	
Batch BSC swaps in	8	11	4	
Format index swaps in	12	15	4	
Spell check swaps in	16	19	4	
Not used	20	23	4	
Help area swaps in	24	27	4	
Active work station users	28	30	3	
Active trace users	31	33	3	
Active index insert users	34	36	3	
Active procedures users	37	39	3	
Active batch BSC users	40	42	3	
Active format index users	43	45	3	
Active spell check users	46	48	3	
Not used	49	51	3	
Active help area users	52	54	3	
Work station demand count	55	59	5	
Trace demand count	60	64	5	
Index insert demand count	65	69	5	
Active procs demand count	70	74	5	
Batch BSC demand count	75	79	5	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AJ)	1	2	2	
Sequence ID within type (C)	3	3	1	
Format index demand count	4	8	5	
Spell check demand count	9	13	5	
Not used	14	18	5	
Help area demand count	19	23	5	
Nucleus (in K bytes)	24	28	5	
Nonswappable program space (K bytes)	29	32	4	
Nonswappable work space (in K bytes)	33	36	4	
Total nonswappable space (in K bytes)	37	40	4	
System program space (in K bytes)	41	45	5	
User program space (in K bytes)	46	50	5	
Swappable work space (in K bytes)	51	54	4	
Total swappable space (in K bytes)	55	59	5	
User area space available (K bytes)	60	63	4	
Actual storage commitment (in %)	64	67	4	
Active storage commitment (in %)	68	71	4	
Total storage commitment (in %)	72	75	4	
Total assign/free space size (K bytes)	76	79	4	1
Record type continued (+)	80	80	1	



Field Description	From	To	Length	Decimal Places
Record type (AJ)	1	2	2	
Sequence ID within type (D)	3	3	1	
Assign/free space usage (in %)	4	6	3	
Largest available A/F segment (bytes)	7	11	5	
Number of A/F segments available	12	16	5	
FMS I/O subroutine buffer size	17	20	4	
FMS folder buffer size	21	24	4	
FMS I/O subroutine swap status	25	27	3	
FMS folder swap status	28	30	3	
FMS I/O subroutine swaps in	31	34	4	
FMS folder swaps in	35	38	4	
FMS I/O subroutine active users	39	41	3	
FMS folder active users	42	44	3	
FMS I/O subroutine demand count	45	49	5	
FMS folder demand count	50	54	5	
Spell check buffer size	55	58	4	
Spell check swap status	59	61	3	
Spell check swaps in	62	65	4	
Spell check active user	66	68	3	
Spell check demand count	69	73	5	
Cmd processor buffer size	74	77	4	
Not used	78	79	2	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AJ)	1	2	2	
Sequence ID within type (E)	3	3	1	
WS ID table buffer size	4	7	4	
DW/36 subr buffer size	8	11	4	
Disk cache buffer size	12	15	4	
Cmd processor swap status	16	18	3	
WS ID table swap status	19	21	3	
DW/36 subr swap status	22	24	3	
Disk cache swap status	25	27	3	
Cmd processor swaps in	28	31	4	
WS ID table swaps in	32	35	4	
DW/36 subr swaps in	36	39	4	
Disk cache swaps in	40	43	4	
Cmd processor active users	44	46	3	
WS ID table active users	47	49	3	
DW/36 subr active users	50	52	3	
Disk cache active users	53	55	3	
Cmd processor demand count	56	60	5	
WS ID table demand count	61	65	5	
DW/36 subr demand count	66	70	5	
Disk cache demand count	71	75	5	
Not used	76	79	4	
End of record type (E)	80	80	1	

### System Event and I/O Counters Record (AKA-AKH)

Field Description	From	To	Length	Decimal Places
Record type (AK)	1	2	2	
Sequence ID within type (A)	3	3	1	
Main storage transient calls	4	8	5	
Number of translated transfer calls	9	13	5	
Asynchronous transfer calls	14	18	5	
Main storage transient loads	19	23	5	
Number of translated transfer loads	24	28	5	
Main storage loader requests	29	33	5	
Number of swaps in	34	38	5	
Number of swaps out	39	43	5	
Number of swaps out, forced	44	48	5	
Task work area read operations	49	53	5	
Task work area write operations	54	58	5	
Main storage clear operations	59	63	5	
Control storage transient calls	64	68	5	
Control storage transient loads	69	73	5	
Control storage loader requests	74	78	5	
Not used	79	79	1	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AK)	1	2	2	
Sequence ID within type (B)	3	3	1	
Spool segments allocated	4	8	5	
Spool entries allocated	9	13	5	
Spool extents allocated	14	18	5	
General waits	19	23	5	
Disk record waits	24	28	5	
Task work area extents	29	33	5	
Job initiations	34	38	5	
Job step initiations	39	43	5	
Multiple requestor terminal attaches	44	48	5	
Multiple requestor terminal loads	49	53	5	
Job terminations	54	58	5	
Job step terminations	59	63	5	
Abnormal terminations	64	68	5	
Disk locks satisfied	69	73	5	
Disk locks expired	74	78	5	
Not used	79	79	1	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AK)	1	2	2	
Sequence ID within type (C)	3	3	1	
Assign/free extensions	4	8	5	
Assign/free reductions	9	13	5	
Preemptive task dispatches	14	18	5	
Resource timeouts	19	23	5	
Main storage processor time-outs	24	28	5	
Work station buffer read retries	29	33	5	
L-1 storage release without swap	34	38	5	
L-1 storage release with swap	39	43	5	
L-2 storage release without swap	44	48	5	
L-2 storage release with swap	49	53	5	
L-3 storage release without swap	54	58	5	
L-3 storage release with swap	59	63	5	
L-4 storage release without swap	64	68	5	
L-4 storage release with swap	69	73	5	
Memory Resident Overlay Loads	74	78	5	
Not used	79	79	1	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AK)	1	2	2	
Sequence ID within type (D)	3	3	1	
Memory resident overlay maps	4	8	5	
Disk cache hits	9	13	5	
Disk cache misses	14	18	5	
Not used	19	23	5	
Not used	24	28	5	
Not used	29	33	5	
Not used	34	38	5	
Not used	39	43	5	
Not used	44	48	5	
Not used	49	53	5	
Not used	54	58	5	
Not used	59	63	5	
Not used	64	68	5	
Not used	69	79	11	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AK)	1	2	2	
Sequence ID within type (E)	3	3	1	
Disk 1 read operations	4	8	5	
Disk 1 write operations	9	13	5	
Disk 1 scan operations	14	18	5	
Disk 1 seek operations	19	23	5	
Not used	24	28	5	
Disk 2 read operations	29	33	5	
Disk 2 write operations	34	38	5	
Disk 2 scan operations	39	43	5	
Disk 2 seek operations	44	48	5	
Not used	49	53	5	
Disk 3 read operations	54	58	5	
Disk 3 write operations	59	63	5	
Disk 3 scan operations	64	68	5	
Disk 3 seek operations	69	73	5	
Not used	74	78	5	
Not used	79	79	1	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AK)	1	2	2	
Sequence ID within type (F)	3	3	1	
Disk 4 read operations	4	8	5	
Disk 4 write operations	9	13	5	
Disk 4 scan operations	14	18	5	
Disk 4 seek operations	19	23	5	
Not used	24	28	5	
Diskette 1 read operations	29	33	5	
Diskette 2D read operations	34	38	5	
Diskette 1 write operations	39	43	5	
Diskette 2D write operations	44	48	5	
Diskette seek operations	49	53	5	
72MD auto loader operations	54	58	5	
Diskette head contact revolutions	59	63	5	
Local display station operations	64	68	5	
Local printer operations	69	73	5	
Remote display station operations	74	78	5	
Not used	79	79	1	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AK)	1	2	2	
Sequence ID within type (G)	3	3	1	
Remote printer operations	4	8	5	
3262 Printer operations	9	13	5	
1255 MICR operations	14	18	5	
Tape 1 read bytes	19	23	5	
Tape 1 write bytes	24	28	5	
Tape 1 rewind operations	29	33	5	
Tape 1 hitchback operations	34	38	5	
Tape 2 read bytes	39	43	5	
Tape 2 write bytes	44	48	5	
Tape 2 rewind operations	49	53	5	
Tape 2 hitchback operations	54	58	5	
Disk 1 seek ops GT 1/3 of disk (in %)	59	62	4	1
Disk 2 seek ops GT 1/3 of disk (in %)	63	66	4	1
Disk 3 seek ops GT 1/3 of disk (in %)	67	70	4	1
Disk 4 seek ops GT 1/3 of disk (in %)	71	74	4	1
Disk 1 average seek length	75	77	3	
Not used	78	79	2	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AK)	1	2	2	
Sequence ID within type (H)	3	3	1	
Disk 2 average seek length	4	6	3	
Disk 3 average seek length	7	9	3	
Disk 4 average seek length	10	12	3	
Not used	13	79	67	
End of record type (E)	80	80	1	

**Data Storage Attachment (DSA) and Tape Usage (ALA)**

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AL)	1	2	2	
Sequence ID within type (A)	3	3	1	
Disk 1	4	7	4	1
Disk 2	8	11	4	1
Disk 3	12	15	4	1
Disk 4	16	19	4	1
Diskette to data storage controller	20	23	4	1
Diskette to main storage	24	27	4	1
One buffer to main/control storage	28	31	4	1
One buffer to data storage controller	32	35	4	1
Two buffers to main/control storage	36	39	4	1
Two buffers to DSC	40	43	4	1
Two buffers to M/C storage and DSC	44	47	4	1
Total DSA buffer usage	48	51	4	1
Tape 1	52	55	4	1
Tape 2	56	59	4	1
Tape 1 data transfer	60	63	4	1
Tape 2 data transfer	64	67	4	1
Tape 1 start/stop data transfer	68	71	4	1
Tape 2 start/stop data transfer	72	75	4	1
Not used	76	79	4	
End of record type (E)	80	80	1	



**Communications Line Usage Record (AMA-AMB)<sup>4</sup>**

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AM)	1	2	2	
Sequence ID within type (A)	3	3	1	
Active line number (1,2,3,4,5,6,7,8)	4	4	1	
Line protocol	5	10	6	
Line user	11	16	6	
Productive line turnarounds	17	23	7	
Average productive T/A time (in MS) <sup>5</sup>	24	30	7	2
Nonproductive line turnarounds	31	37	7	
Average nonproductive T/A time (in MS) <sup>5</sup>	38	44	7	2
Bytes transmitted	45	51	7	
SDLC I-Frames transmitted	52	58	7	
Error bytes transmitted	59	65	7	
Transmit line errors	66	72	7	
Bytes received	73	79	7	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AM)	1	2	2	
Sequence ID within type (B)	3	3	1	
SDLC I-Frames Received	4	10	7	
Receive line errors	11	17	7	
Receiving system turnaround <sup>5</sup>	18	21	4	1
Line turnaround	22	25	4	1
Errors	26	29	4	1
Transmitted data	30	33	4	1
Received data	34	37	4	1
Total line usage	38	41	4	1
Communications error	42	42	1	
Not used	43	79	37	
End of record type (E)	80	80	1	

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<sup>4</sup> These records occur once for each communications line in a snapshot.

<sup>5</sup> These numbers appear in a zoned decimal format. For more information, see the *Concepts and Programmer's Guide*.

### Summary Usage Record (ANA-ANH)

Field Description	From	To	Length	Decimal Places
Record type (AN)	1	2	2	
Sequence ID within type (A)	3	3	1	
Start time of this run (hhmmss.sss)	4	12	9	
Stop time of this run (hhmmss.sss)	13	21	9	
Elapsed time of the run (hhmmss.sss)	22	30	9	
Snapshot interval of the run (mss.sss)	31	36	6	
Summary average of MSP usage (in %)	37	41	5	
Summary average of CSP usage (in %)	42	46	5	
Summary average of line 1 usage (in %)	47	51	5	
Summary average of line 2 usage (in %)	52	56	5	
Summary average of line 3 usage (in %)	57	61	5	
Summary average of line 4 usage (in %)	62	66	5	
Summary average of disk 1 usage (in %)	67	71	5	
Summary average of disk 2 usage (in %)	72	76	5	
Not used	77	79	3	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AN)	1	2	2	
Sequence ID within type (B)	3	3	1	
Summary average of disk 3 usage (in %)	4	8	5	
Summary average of disk 4 usage (in %)	9	13	5	
Summary average of DSC usage (in %)	14	18	5	
Summary average of DSA usage (in %)	19	23	5	
Summary average of WSC queue usage (in %)	24	28	5	
Summary average of WSC usage (in %)	29	33	5	
Summary average of TWA usage (in %)	34	38	5	
Summary average of A/F usage (in %)	39	43	5	
Summary average total storage commit (in %)	44	48	5	
Summary average active storage commit (in %)	49	53	5	
Summary average actual storage commit (in %)	54	58	5	
Summary maximum MSP usage (in %)	59	63	5	
Summary maximum of CSP usage (in %)	64	68	5	
Summary maximum of line 1 usage (in %)	69	73	5	
Summary maximum of line 2 usage (in %)	74	78	5	
Not used	79	79	1	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AN)	1	2	2	
Sequence ID within type (C)	3	3	1	
Summary maximum of line 3 usage (in %)	4	8	5	
Summary maximum of line 4 usage (in %)	9	13	5	
Summary maximum of disk 1 usage (in %)	14	18	5	
Summary maximum of disk 2 usage (in %)	19	23	5	
Summary maximum of disk 3 usage (in %)	24	28	5	
Summary maximum of disk 4 usage (in %)	29	33	5	
Summary maximum of DSC usage (in %)	34	38	5	
Summary maximum of DSA usage (in %)	39	43	5	
Summary maximum of WSC queue usage (in %)	44	48	5	
Summary maximum of WSC usage (in %)	49	53	5	
Summary maximum of TWA usage (in %)	54	58	5	
Summary maximum of A/F usage (in %)	59	63	5	
Summary maximum total storage commit (in %)	64	68	5	
Summary maximum active storage commit (in %)	69	73	5	
Summary maximum actual storage commit (in %)	74	78	5	
Not used	79	79	1	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AN)	1	2	2	
Sequence ID within type (D)	3	3	1	
Time of maximum MSP usage (hhmmss.sss)	4	12	9	
Time of maximum CSP usage (hhmmss.sss)	13	21	9	
Time of maximum line 1 usage (hhmmss.sss)	22	30	9	
Time of maximum line 2 usage (hhmmss.sss)	31	39	9	
Time of maximum line 3 usage (hhmmss.sss)	40	48	9	
Time of maximum line 4 usage (hhmmss.sss)	49	57	9	
Time of maximum disk 1 usage (hhmmss.sss)	58	66	9	
Time of maximum disk 2 usage (hhmmss.sss)	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AN)	1	2	2	
Sequence ID within type (E)	3	3	1	
Time of maximum disk 3 usage (hhmmss.sss)	4	12	9	
Time of maximum disk 4 usage (hhmmss.sss)	13	21	9	
Time of maximum DSC usage (hhmmss.sss)	22	30	9	
Time of maximum DSA usage (hhmmss.sss)	31	39	9	
Time of maximum WSC queue usage (hhmmss.sss)	40	48	9	
Time of maximum WSC usage (hhmmss.sss)	49	57	9	
Time of maximum TWA usage (hhmmss.sss)	58	66	9	
Time of maximum A/F usage (hhmmss.sss)	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AN)	1	2	2	
Sequence ID within type (F)	3	3	1	
Time of maximum total storage commit	4	12	9	
Time maximum active storage commit	13	21	9	
Time maximum active storage commit	22	30	9	
Summary average of line 5 usage (in %)	31	35	5	
Summary average of line 6 usage (in %)	36	40	5	
Summary average of line 7 usage (in %)	41	45	5	
Summary average of line 8 usage (in %)	46	50	5	
Summary maximum of line 5 usage (in %)	51	55	5	
Summary maximum of line 6 usage (in %)	56	60	5	
Summary maximum of line 7 usage (in %)	61	65	5	
Summary maximum of line 8 usage (in %)	66	70	5	
Time of maximum line 5 usage (hhmmss.sss)	71	79	9	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AN)	1	2	2	
Sequence ID within type (G)	3	3	1	
Time of maximum line 6 usage (hhmmss.sss)	4	12	9	
Time of maximum line 7 usage (hhmmss.sss)	13	21	9	
Time of maximum line 8 usage (hhmmss.sss)	22	30	9	
Summary average of PC processor usage (in %)	31	35	5	
Summary maximum of PC processor usage (in %)	36	40	5	
Time of maximum PC processor usage (hhmmss.sss)	41	49	9	
Summary average of WSC 2 queue usage (in %)	50	54	5	
Summary average of WSC 2 usage (in %)	55	59	5	
Summary maximum of WSC 2 queue usage (in %)	60	64	5	
Summary maximum of WSC 2 usage (in %)	65	69	5	
Time of maximum WSC 2 queue usage (hhmmss.sss)	70	78	9	
Not used	79	79	1	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AN)	1	2	2	
Sequence ID within type (H)	3	3	1	
Time of maximum WSC 2 usage (hhmmss.sss)	4	12	9	
Summary average of disk cache utilization (in %)	13	17	5	
Summary maximum of disk cache utilization (in %)	18	22	5	
Time of maximum disk cache utilization (hhmmss.sss)	23	31	9	
Not used	32	79	48	
End of record type (E)	80	80	1	

**Summary System Event Counters Record (APA-APX)**

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AP)	1	2	2	
Sequence ID within type (A)	3	3	1	
Total main storage transient calls	4	12	9	
Total translated transfer calls	13	21	9	
Total asynchronous transfer calls	22	30	9	
Total main storage transient loads	31	39	9	
Total translated transfer loads	40	48	9	
Total main storage loader requests	49	57	9	
Total swaps in	58	66	9	
Total swaps out	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AP)	1	2	2	
Sequence ID within type (B)	3	3	1	
Total swaps out, forced	4	12	9	
Total TWA read operations	13	21	9	
Total TWA write operations	22	30	9	
Total main storage clear operations	31	39	9	
Total control storage transient calls	40	48	9	
Total control storage transient loads	49	57	9	
Total control storage loader requests	58	66	9	
Total spool segments allocated	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (C)	3	3	1	
Total spool entries allocated	4	12	9	
Total spool extents allocated	13	21	9	
Total general waits	22	30	9	
Total disk record waits	31	39	9	
Total task work area extents	40	48	9	
Total job initiations	49	57	9	
Total job step initiations	58	66	9	
Total MRT attaches	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (D)	3	3	1	
Total MRT loads	4	12	9	
Total job terminations	13	21	9	
Total job step terminations	22	30	9	
Total abnormal terminations	31	39	9	
Total disk locks satisfied	40	48	9	
Total disk locks expired	49	57	9	
Total assign/free extensions	58	66	9	
Total assign/free reductions	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AP)	1	2	2	
Sequence ID within type (E)	3	3	1	
Total preemptive task dispatches	4	12	9	
Total resource time-outs	13	21	9	
Total main store processor time-outs	22	30	9	
Total work station buffer read retries	31	39	9	
Total L1 storage releases without swap	40	48	9	
Total L1 storage releases with swap	49	57	9	
Total L2 storage releases without swap	58	66	9	
Total L2 storage releases with swap	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AP)	1	2	2	
Sequence ID within type (F)	3	3	1	
Total L3 storage releases without swap	4	12	9	
Total L3 storage releases with swap	13	21	9	
Total L4 storage releases without swap	22	30	9	
Total L4 storage releases with swap	31	39	9	
Total memory resident overlay loads	40	48	9	
Total memory resident overlay maps	49	57	9	
Total disk cache hits	58	66	9	
Total disk cache misses	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	



Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (G)	3	3	1	
Not used	4	12	9	
Not used	13	21	9	
Not used	22	30	9	
Not used	31	39	9	
Not used	40	48	9	
Not used	49	57	9	
Not used	58	66	9	
Not used	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (H)	3	3	1	
Not used	4	12	9	
Not used	13	21	9	
Not used	22	30	9	
Not used	31	39	9	
Main storage transient calls/minute	40	45	6	1
Translated transfer calls/minute	46	51	6	1
Asynchronous transfer calls/minute	52	57	6	1
Main storage transient loads/minute	58	63	6	1
Translated transfer loads/minute	64	69	6	1
Main storage loader requests/minute	70	75	6	1
Not used	76	79	4	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AP)	1	2	2	
Sequence ID within type (I)	3	3	1	
Swaps in/minute	4	9	6	1
Swaps out/minute	10	15	6	1
Swaps out, forced/minute	16	21	6	1
TWA read operations/minute	22	27	6	1
TWA write operations/minute	28	33	6	1
Main storage clear operations/minute	34	39	6	1
Control storage transient calls/minute	40	45	6	1
Control storage transient loads/minute	46	51	6	1
Control storage loader requests/minute	52	57	6	1
Spool segments allocated/minute	58	63	6	1
Spool entries allocated/minute	64	69	6	1
Spool extents allocated/minute	70	75	6	1
Not used	76	79	4	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AP)	1	2	2	
Sequence ID within type (J)	3	3	1	
General waits/minute	4	9	6	1
Disk record waits/minute	10	15	6	1
Task work area extents/minute	16	21	6	1
Job initiations/minute	22	27	6	1
Job step initiations/minute	28	33	6	1
MRT attaches/minute	34	39	6	1
MRT loads/minute	40	45	6	1
Job terminations/minute	46	51	6	1
Job step terminations/minute	52	57	6	1
Abnormal terminations/minute	58	63	6	1
Disk locks satisfied/minute	64	69	6	1
Disk locks expired/minute	70	75	6	1
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (K)	3	3	1	
Assign/free extensions/minute	4	9	6	1
Assign/free reductions/minute	10	15	6	1
Preemptive task dispatches/minute	16	21	6	1
Resource time-outs/minute	22	27	6	1
Main storage processor time-outs/minute	28	33	6	1
Work station buffer read retries/minute	34	39	6	1
L1 storage releases/minute without swap	40	45	6	1
L1 storage releases/minute with swap	46	51	6	1
L2 storage releases/minute without swap	52	57	6	1
L2 storage releases/minute with swap	58	63	6	1
L3 storage releases/minute without swap	64	69	6	1
L3 storage releases/minute with swap	70	75	6	1
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (L)	3	3	1	
L4 storage releases/minute without swap	4	9	6	1
L4 storage releases/minute with swap	10	15	6	1
Memory resident overlay loads/minute	16	21	6	1
Memory resident overlay maps/minute	22	27	6	1
Disk cache hits/minute	28	33	6	1
Disk cache misses/minute	34	39	6	1
Not used	40	45	6	
Not used	46	51	6	
Not used	52	57	6	
Not used	58	63	6	
Not used	64	69	6	
Not used	70	75	6	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (M)	3	3	1	
Not used	4	9	6	
Not used	10	15	6	
Not used	16	21	6	
Not used	22	27	6	
Not used	28	33	6	
Not used	34	39	6	
Maximum main storage transient calls	40	44	5	
Maximum translated transfer calls	45	49	5	
Maximum asynchronous transfer calls	50	54	5	
Maximum main storage transient loads	55	59	5	
Maximum translated transfer loads	60	64	5	
Maximum main storage loader requests	65	69	5	
Maximum swaps in	70	74	5	
Maximum swaps out	75	79	5	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (N)	3	3	1	
Maximum swaps out, forced	4	8	5	
Maximum TWA read operations	9	13	5	
Maximum TWA write operations	14	18	5	
Maximum main storage clear operations	19	23	5	
Maximum control store transient calls	24	28	5	
Maximum control store transient loads	29	33	5	
Maximum control store loader requests	34	38	5	
Maximum spool segments allocated	39	43	5	
Maximum spool entries allocated	44	48	5	
Maximum spool extents allocated	49	53	5	
Maximum general waits	54	58	5	
Maximum disk record waits	59	63	5	
Maximum task work area extents	64	68	5	
Maximum job initiations	69	73	5	
Maximum job step initiations	74	78	5	
Not used	79	79	1	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (O)	3	3	1	
Maximum MRT attaches	4	8	5	
Maximum MRT loads	9	13	5	
Maximum job terminations	14	18	5	
Maximum job step terminations	19	23	5	
Maximum abnormal terminations	24	28	5	
Maximum disk locks satisfied	29	33	5	
Maximum disk locks expired	34	38	5	
Maximum assign/free extensions	39	43	5	
Maximum assign/free reductions	44	48	5	
Maximum preemptive task dispatches	49	53	5	
Maximum resource time-outs	54	58	5	
Maximum main store processor time-outs	59	63	5	
Maximum WS buffer read retries	64	68	5	
Maximum L1 storage releases without swap	69	73	5	
Maximum L1 storage releases with swap	74	78	5	
Not used	79	79	1	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (P)	3	3	1	
Maximum L2 storage releases without swap	4	8	5	
Maximum L2 storage releases with swap	9	13	5	
Maximum L3 storage releases without swap	14	18	5	
Maximum L3 storage releases with swap	19	23	5	
Maximum L4 storage releases without swap	24	28	5	
Maximum L4 storage releases with swap	29	33	5	
Maximum memory resident overlay loads	34	38	5	
Maximum memory resident overlay maps	39	43	5	
Maximum disk cache hits	44	48	5	
Maximum disk cache misses	49	53	5	
Not used	54	58	5	
Not used	59	63	5	
Not used	64	68	5	
Not used	69	73	5	
Not used	74	78	5	
Not used	79	79	1	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (Q)	3	3	1	
Not used	4	8	5	
Not used	9	13	5	
Not used	14	18	5	
Not used	19	23	5	
Not used	24	28	5	
Not used	29	33	5	
Not used	34	38	5	
Time maximum main storage transient calls	39	47	9	
Time maximum translated transfer calls	48	56	9	
Time maximum asynchronous transfer calls	57	65	9	
Time maximum main storage transient loads	66	74	9	
Not used	75	79	5	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (R)	3	3	1	
Time maximum translated transfer loads	4	12	9	
Time maximum main storage loader requests	13	21	9	
Time maximum swaps in	22	30	9	
Time maximum swaps out	31	39	9	
Time maximum swaps out, forced	40	48	9	
Time maximum TWA read operations	49	57	9	
Time maximum TWA write operations	58	66	9	
Time maximum main storage clear operations	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (S)	3	3	1	
Time maximum control store transient calls	4	12	9	
Time maximum control store transient loads	13	21	9	
Time maximum control store loader requests	22	30	9	
Time maximum spool segments allocated	31	39	9	
Time maximum spool entries allocated	40	48	9	
Time maximum spool extents allocated	49	57	9	
Time maximum general waits	58	66	9	
Time maximum disk record waits	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (T)	3	3	1	
Time maximum task work area extents	4	12	9	
Time maximum job initiations	13	21	9	
Time maximum job step initiations	22	30	9	
Time maximum MRT attaches	31	39	9	
Time maximum MRT loads	40	48	9	
Time maximum job terminations	49	57	9	
Time maximum job step terminations	58	66	9	
Time maximum abnormal terminations	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AP)	1	2	2	
Sequence ID within type (U)	3	3	1	
Time maximum disk locks satisfied	4	12	9	
Time maximum disk locks expired	13	21	9	
Time maximum assign/free extensions	22	30	9	
Time maximum assign/free reductions	31	39	9	
Time maximum preemptive task dispatches	40	48	9	
Time maximum resource time-outs	49	57	9	
Time maximum main store processor time-outs	58	66	9	
Time maximum WS buffer read retries	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AP)	1	2	2	
Sequence ID within type (V)	3	3	1	
Time maximum L1 storage releases W/O swap	4	12	9	
Time maximum L1 storage releases with swap	13	21	9	
Time maximum L2 storage releases W/O swap	22	30	9	
Time maximum L2 storage releases with swap	31	39	9	
Time maximum L3 storage releases W/O swap	40	48	9	
Time maximum L3 storage releases with swap	49	57	9	
Time maximum L4 storage releases W/O swap	58	66	9	
Time maximum L4 storage releases with swap	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	



Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (W)	3	3	1	
Time maximum memory resident overlay loads	4	12	9	
Time maximum memory resident overlay maps	13	21	9	
Time maximum disk cache hits	22	30	9	
Time maximum disk cache misses	31	39	9	
Not used	40	48	9	
Not used	49	57	9	
Not used	58	66	9	
Not used	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AP)	1	2	2	
Sequence ID within type (X)	3	3	1	
Not used	4	12	9	
Not used	13	21	9	
Not used	22	30	9	
Not used	31	39	9	
Not used	40	48	9	
Not used	49	57	9	
Not used	58	66	9	
Not used	67	75	9	
Not used	76	79	4	
End of record type (E)	80	80	1	

### Summary I/O Counters Record (ARA-ARQ)

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (A)	3	3	1	
Total disk 1 read operations	4	12	9	
Total disk 1 write operations	13	21	9	
Total disk 1 scan operations	22	30	9	
Total disk 1 seek operations	31	39	9	
Total disk 2 read operations	40	48	9	
Total disk 2 write operations	49	57	9	
Total disk 2 scan operations	58	66	9	
Total disk 2 seek operations	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (B)	3	3	1	
Total disk 3 read operations	4	12	9	
Total disk 3 write operations	13	21	9	
Total disk 3 scan operations	22	30	9	
Total disk 3 seek operations	31	39	9	
Total disk 4 read operations	40	48	9	
Total disk 4 write operations	49	57	9	
Total disk 4 scan operations	58	66	9	
Total disk 4 seek operations	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (C)	3	3	1	
Total diskette 1 read operations	4	12	9	
Total diskette 2D read operations	13	21	9	
Total diskette 1 write operations	22	30	9	
Total diskette 2D write operations	31	39	9	
Total diskette seek operations	40	48	9	
Total 72MD auto loader operations	49	57	9	
Total diskette head contact revolutions	58	66	9	
Total local display station operations	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (D)	3	3	1	
Total local printer operations	4	12	9	
Total remote display station operations	13	21	9	
Total remote printer operations	22	30	9	
Total 3262 Printer operations	31	39	9	
Total 1255 MICR operations	40	48	9	
Total tape 1 read bytes	49	57	9	
Total tape 1 write bytes	58	66	9	
Total tape 1 rewind operations	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (E)	3	3	1	
Total tape 1 hitchback operations	4	12	9	
Total tape 2 read bytes	13	21	9	
Total tape 2 write bytes	22	30	9	
Total tape 2 rewind operations	31	39	9	
Total tape 2 hitchback operations	40	48	9	
Disk 1 seek ops GT 1/3 of disk (in %)	49	52	4	1
Disk 2 seek ops GT 1/3 of disk (in %)	53	56	4	1
Disk 3 seek ops GT 1/3 of disk (in %)	57	60	4	1
Disk 4 seek ops GT 1/3 of disk (in %)	61	64	4	1
Disk 1 average seek length	65	67	3	
Disk 2 average seek length	68	70	3	
Disk 3 average seek length	71	73	3	
Disk 4 average seek length	74	76	3	
Not used	77	79	3	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (F)	3	3	1	
Disk 1 read operations/minute	4	9	6	1
Disk 1 write operations/minute	10	15	6	1
Disk 1 scan operations/minute	16	21	6	1
Disk 1 seek operations/minute	22	27	6	1
Disk 2 read operations/minute	28	33	6	1
Disk 2 write operations/minute	34	39	6	1
Disk 2 scan operations/minute	40	45	6	1
Disk 2 seek operations/minute	46	51	6	1
Disk 3 read operations/minute	52	57	6	1
Disk 3 write operations/minute	58	63	6	1
Disk 3 scan operations/minute	64	69	6	1
Disk 3 seek operations/minute	70	75	6	1
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (G)	3	3	1	
Disk 4 read operations/minute	4	9	6	1
Disk 4 write operations/minute	10	15	6	1
Disk 4 scan operations/minute	16	21	6	1
Disk 4 seek operations/minute	22	27	6	1
Diskette 1 read operations/minute	28	33	6	1
Diskette 2D read operations/minute	34	39	6	1
Diskette 1 write operations/minute	40	45	6	1
Diskette 2D write operations/minute	46	51	6	1
Diskette seek operations/minute	52	57	6	1
72MD auto loader operations/minute	58	63	6	1
Diskette head contact revolutions/minute	64	69	6	1
Local display station operations/minute	70	75	6	1
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (H)	3	3	1	
Local printer operations/minute	4	9	6	1
Remote display station operations/minute	10	15	6	1
Remote printer operations/minute	16	21	6	1
3262 Printer operations/minute	22	27	6	1
1255 MICR operations/minute	28	33	6	1
Tape 1 read bytes/minute	34	39	6	1
Tape 1 write bytes/minute	40	45	6	1
Tape 1 rewind operations/minute	46	51	6	1
Tape 1 hitchback operations/minute	52	57	6	1
Tape 2 read bytes/minute	58	63	6	1
Tape 2 write bytes/minute	64	69	6	1
Tape 2 rewind operations/minute	70	75	6	1
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (I)	3	3	1	
Tape 2 hitchback operations/minute	4	9	6	1
Maximum disk 1 read operations	10	14	5	
Maximum disk 1 write operations	15	19	5	
Maximum disk 1 scan operations	20	24	5	
Maximum disk 1 seek operations	25	29	5	
Maximum disk 2 read operations	30	34	5	
Maximum disk 2 write operations	35	39	5	
Maximum disk 2 scan operations	40	44	5	
Maximum disk 2 seek operations	45	49	5	
Maximum disk 3 read operations	50	54	5	
Maximum disk 3 write operations	55	59	5	
Maximum disk 3 scan operations	60	64	5	
Maximum disk 3 seek operations	65	69	5	
Maximum disk 4 read operations	70	74	5	
Maximum disk 4 write operations	75	79	5	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (J)	3	3	1	
Maximum disk 4 scan operations	4	8	5	
Maximum disk 4 seek operations	9	13	5	
Maximum diskette 1 read operations	14	18	5	
Maximum diskette 2D read operations	19	23	5	
Maximum diskette 1 write operations	24	28	5	
Maximum diskette 2D write operations	29	33	5	
Maximum diskette seek operations	34	38	5	
Maximum 72MD auto loader operations	39	43	5	
Maximum diskette head contact revolutions	44	48	5	
Maximum local display station operations	49	53	5	
Maximum local printer operations	54	58	5	
Maximum remote display station operations	59	63	5	
Maximum remote printer operations	64	68	5	
Maximum 3262 Printer operations	69	73	5	
Maximum 1255 MICR operations	74	78	5	
Not used	79	79	1	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (K)	3	3	1	
Maximum tape 1 read bytes	4	8	5	
Maximum tape 1 write bytes	9	13	5	
Maximum tape 1 rewind operations	14	18	5	
Maximum tape 1 hitchback operations	19	23	5	
Maximum tape 2 read bytes	24	28	5	
Maximum tape 2 write bytes	29	33	5	
Maximum tape 2 rewind operations	34	38	5	
Maximum tape 2 hitchback operations	39	43	5	
Maximum % disk 1 seek ops GT 1/3 of disk	44	47	4	1
Maximum % disk 2 seek ops GT 1/3 of disk	48	51	4	1
Maximum % disk 3 seek ops GT 1/3 of disk	52	55	4	1
Maximum % disk 4 seek ops GT 1/3 of disk	56	59	4	1
Maximum disk 1 seek length	60	62	3	
Maximum disk 2 seek length	63	65	3	
Maximum disk 3 seek length	66	68	3	
Maximum disk 4 seek length	69	71	3	
Not used	72	79	8	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (L)	3	3	1	
Time maximum disk 1 read operations	4	12	9	
Time maximum disk 1 write operations	13	21	9	
Time maximum disk 1 scan operations	22	30	9	
Time maximum disk 1 seek operations	31	39	9	
Time maximum disk 2 read operations	40	48	9	
Time maximum disk 2 write operations	49	57	9	
Time maximum disk 2 scan operations	58	66	9	
Time maximum disk 2 seek operations	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AR)	1	2	2	
Sequence ID within type (M)	3	3	1	
Time maximum disk 3 read operations	4	12	9	
Time maximum disk 3 write operations	13	21	9	
Time maximum disk 3 scan operations	22	30	9	
Time maximum disk 3 seek operations	31	39	9	
Time maximum disk 4 read operations	40	48	9	
Time maximum disk 4 write operations	49	57	9	
Time maximum disk 4 scan operations	58	66	9	
Time maximum disk 4 seek operations	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

<b>Field Description</b>	<b>From</b>	<b>To</b>	<b>Length</b>	<b>Decimal Places</b>
Record type (AR)	1	2	2	
Sequence ID within type (N)	3	3	1	
Time maximum diskette 1 read operations	4	12	9	
Time maximum diskette 2D read operations	13	21	9	
Time maximum diskette 1 write operations	22	30	9	
Time maximum diskette 2D write operations	31	39	9	
Time maximum diskette seek operations	40	48	9	
Time maximum 72MD auto loader operations	49	57	9	
Time maximum diskette head contact revolutions	58	66	9	
Time maximum local display station operations	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	



Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (O)	3	3	1	
Time maximum local printer operations	4	12	9	
Time maximum remote display station ops	13	21	9	
Time maximum remote printer operations	22	30	9	
Time maximum 3262 Printer operations	31	39	9	
Time maximum 1255 MICR operations	40	48	9	
Time maximum tape 1 read bytes	49	57	9	
Time maximum tape 1 write bytes	58	66	9	
Time maximum tape 1 rewind operations	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (P)	3	3	1	
Time maximum tape 1 hitchback operations	4	12	9	
Time maximum tape 2 read bytes	13	21	9	
Time maximum tape 2 write bytes	22	30	9	
Time maximum tape 2 rewind operations	31	39	9	
Time maximum tape 2 hitchback operations	40	48	9	
Time maximum % disk 1 seek ops GT 1/3 of disk	49	57	9	
Time maximum % disk 2 seek ops GT 1/3 of disk	58	66	9	
Time maximum % disk 3 seek ops GT 1/3 of disk	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AR)	1	2	2	
Sequence ID within type (Q)	3	3	1	
Time maximum % disk 4 seek ops GT 1/3 of disk	4	12	9	
Time maximum disk 1 seek length	13	21	9	
Time maximum disk 2 seek length	22	30	9	
Time maximum disk 3 seek length	31	39	9	
Time maximum disk 4 seek length	40	48	9	
Not used	49	79	31	
End of record type (E)	80	80	1	

### Summary DSA and Tape Usage Record (ATA-ATD)

Field Description	From	To	Length	Decimal Places
Record type (AT)	1	2	2	
Sequence ID within type (A)	3	3	1	
Average disk 1	4	7	4	1
Average disk 2	8	11	4	1
Average disk 3	12	15	4	1
Average disk 4	16	19	4	1
Average diskette to main storage	20	23	4	1
Average diskette to DSC	24	27	4	1
Average one buffer to main/control storage	28	31	4	1
Average one buffer to DSC	32	35	4	1
Average two buffers to main/control store	36	39	4	1
Average two buffers to DSC	40	43	4	1
Average one buffer each M/C store and DSC	44	47	4	1
Average tape 1	48	51	4	1
Average tape 2	52	55	4	1
Average tape 1 data transfer	56	59	4	1
Average tape 2 data transfer	60	63	4	1
Average tape 1 start/stop data transfer	64	67	4	1
Average tape 2 start/stop data transfer	68	71	4	1
Maximum disk 1	72	75	4	1
Maximum disk 2	76	79	4	1
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AT)	1	2	2	
Sequence ID within type (B)	3	3	1	
Maximum disk 3	4	7	4	1
Maximum disk 4	8	11	4	1
Maximum diskette to main storage	12	15	4	1
Maximum diskette to DSC	16	19	4	1
Maximum one buffer to main/control storage	20	23	4	1
Maximum one buffer to DSC	24	27	4	1
Maximum two buffers to main/control store	28	31	4	1
Maximum two buffers to DSC	32	35	4	1
Maximum one buffer each M/C store and DSC	36	39	4	1
Maximum tape 1	40	43	4	1
Maximum tape 2	44	47	4	1
Maximum tape 1 data transfer	48	51	4	1
Maximum tape 2 data transfer	52	55	4	1
Maximum tape 1 start/stop data transfer	56	59	4	1
Maximum tape 2 start/stop data transfer	60	63	4	1
Time maximum disk 1	64	72	9	
Not used	73	79	7	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AT)	1	2	2	
Sequence ID within type (C)	3	3	1	
Time maximum disk 2	4	12	9	
Time maximum disk 3	13	21	9	
Time maximum disk 4	22	30	9	
Time maximum diskette to main storage	31	39	9	
Time maximum diskette to DSC	40	48	9	
Time maximum one buffer to M/C storage	49	57	9	
Time maximum one buffer to DSC	58	66	9	
Time maximum two buffers to M/C store	67	75	9	
Not used	76	79	4	
Record type continued (+)	80	80	1	

Field Description	From	To	Length	Decimal Places
Record type (AT)	1	2	2	
Sequence ID within type (D)	3	3	1	
Time maximum two buffers to DSC	4	12	9	
Time maximum 1 buf each M/C store and DSC	13	21	9	
Time maximum tape 1	22	30	9	
Time maximum tape 2	31	39	9	
Time maximum tape 1 data transfer	40	48	9	
Time maximum tape 2 data transfer	49	57	9	
Time maximum tape 1 start/stop data transfer	58	66	9	
Time maximum tape 2 start/stop data transfer	67	75	9	
Not used	76	79	4	
End of record type (E)	80	80	1	



## Appendix D. Data By File Sample Program

This sample program can help you determine which files and libraries on your system have the most activity. Then you can place your files so the seek span is at a minimum, thus giving you better performance.

Refer to the *System Reference* manual for information on the procedures to use when moving files and libraries.

Figure D-1 shows the output data produced by this sample program.

LABEL	DATE	TYPE	ORG	LOCATION	LENGTH	DISK	TOTAL OPS	GET	UPDATE	DELETE	ADD	READ	SCAN	WRITE
FILEB1	84/08/08	R	I	11497	2355	A1	9650	7725	1925	0	0	0	0	0
FILEB2	84/08/08	R	I	152545	2355	A2	8805	7063	1742	0	0	0	0	0
#SYSTASK				967	1500	A1	7362	0	0	0	0	4340	0	3022
FILEB3	84/08/08	R	I	145480	2355	A2	7126	5659	1467	0	0	0	0	0
FILEB4	84/08/08	R	I	136388	2355	A2	6917	5490	1427	0	0	0	0	0
D457RAMP		R	L	9997	1500	A1	3968	0	0	0	0	3356	612	0
#LIBRARY				2467	7500	A1	2346	0	0	0	0	2216	130	0
CSLIB				0	650	A1	1875	0	0	0	0	1853	0	22
FILEC1	84/08/09	R	S	48521	59	A1	1686	0	0	0	1686	0	0	0
FILEB5	84/08/08	R	I	129651	2355	A2	1413	1116	297	0	0	0	0	0
FILEC2	84/08/09	R	S	110037	59	A2	1388	0	0	0	1388	0	0	0
FILEC3	84/08/09	R	S	48580	59	A1	1301	0	0	0	1301	0	0	0
FILEA1	84/08/08	R	I	110096	2027	A2	1043	1043	0	0	0	0	0	0
FILEA2	84/08/08	R	I	37074	2027	A1	972	972	0	0	0	0	0	0
#SYSHIST				717	250	A1	965	0	0	0	0	482	0	483
FILED3	84/08/08	R	I	143125	2355	A2	746	746	0	0	0	0	0	0
FILED4	84/08/08	R	I	23272	2355	A1	744	744	0	0	0	0	0	0
FILED1	84/08/08	R	I	150190	2355	A2	724	724	0	0	0	0	0	0
FILED2	84/08/08	R	I	30009	2355	A1	717	717	0	0	0	0	0	0
FILEA3	84/08/08	R	I	27982	2027	A1	622	622	0	0	0	0	0	0
FILEA4	84/08/08	R	I	138743	2027	A2	612	612	0	0	0	0	0	0
FILEC4	84/08/09	R	S	109978	59	A2	433	0	0	0	433	0	0	0
FILEE1	84/08/08	R	I	41456	2355	A1	360	360	0	0	0	0	0	0
MISCA2				78204	78204	A2	360	0	0	0	0	360	0	0
FILEE2	84/08/08	R	I	147835	2355	A2	347	347	0	0	0	0	0	0
#SYSWORK				650	67	A1	300	0	0	0	0	181	68	51
FILEE3	84/08/08	R	I	140770	2355	A2	270	270	0	0	0	0	0	0
FILEE4	84/08/08	R	I	32364	2355	A1	269	269	0	0	0	0	0	0
FILEA5	84/08/08	R	I	132006	2027	A2	95	95	0	0	0	0	0	0
SMF.8091	84/08/09	R	D	109778	200	A2	60	0	0	0	0	0	0	60
FILED5	84/08/08	R	I	43811	2355	A1	54	54	0	0	0	0	0	0
FILEE5	84/08/08	R	I	127296	2355	A2	54	54	0	0	0	0	0	0
MISCA1				0	78204	A1	48	0	0	0	0	48	0	0

Figure D-1. Output from Data by File Sample Program

This sample program output includes:

- File label
- Creation date
- File type
- File organization
- File location
- File length
- Disk location
- Total physical operations
- Individual physical counts

The individual physical counts contain data for user files and system files. For user files, these counts include gets, updates, deletes, and adds. For system files, these counts include reads, writes, and scans.

The sample program described in the following figures is one example of an application using the SMFDATA output. This program is presented as an example only.

*Note: This sample program creates several temporary files which you may want to delete when you no longer need them.*

The program step described in Figure D-2 reads the file created by the SMFDATA procedure, reformats the file access counter records into 160-byte records, and writes these records to a temporary file. The default file name is SMF.DATA. This name can be changed.

Use the following procedure to run the program step described in Figure D-2:

```
// LOAD FILE1
// FILE NAME=SMFDATA, LABEL=SMF.DATA
// FILE NAME=REPORT1, DISP=NEW, RECORDS=?F'A, SMF.DATA' ?
// RUN
```

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Program		Keying Instruction	Graphic	Card Electro Number		Page <span style="border: 1px solid black; padding: 0 2px;">1</span> of <span style="border: 1px solid black; padding: 0 2px;">4</span>	Program Identification <span style="border: 1px solid black; padding: 0 2px;">FILE1</span>
Programmer	Date		Key				75 76 77 78 79 80

**Control Specifications**

For the valid entries for a system, refer to the RPG reference manual for that system.

Line	Form Type	Size to Compile	Object Output Listing Options	Size to Execute	Debug	Reserved	Currency Symbol	Date Format	Date Edit	Inverted Print	Reserved	Number of Print Positions	Alternate Collating Sequence	Reserved	Inquiry	Reserved	Sign Handling	IP Forms Position	Indicator Setting	File Translation	Punch MFCU Zeros	Nonprint Characters	Reserved	Table Load Halt	Shared I/O	Formatted Dump	RPG to RPG II Conversion	Number of Formats	S/Z Conversion	Subprogram	CICS/DLI	Transparent Literal	
01	H																																

**File Description Specifications**

For the valid entries for a system, refer to the RPG reference manual for that system.

Line	Form Type	Filename	File Type	File Designation		Mode of Processing		Device	Symbolic Device	Name of Label Exit	Extent Exit for DAM	File Addition/Unordered	
				End of File	Sequence	Length of Key Field or of Record Address Field	Record Address Type					Number of Tracks for Cylinder Overflow	Number of Extents
02	F	SMFDATA	IP					DISK					
03	F	REPORT1	O					DISK					

**Figure D-2 (Part 1 of 4). Sample Program Step 1 (FILE1)**

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Program		Keying Instruction	Graphic	Card Electro Number		Page <span style="border: 1px solid black; padding: 0 2px;">2</span> of <span style="border: 1px solid black; padding: 0 2px;">4</span>	Program Identification <span style="border: 1px solid black; padding: 0 2px;">FILE1</span>
Programmer	Date		Key				75 76 77 78 79 80

**RPG INPUT SPECIFICATIONS**

Line	Form Type	Filename or Record Name	Sequence	External Field Name									Field Location		RPG Field Name	Field Indicators		
				Record Identification Codes			Position			Character			From	To		Plus	Minus	Zero or Blank
01	I	SMFDATA	AA	01	1	CA	2	CH	3	CA								
02	I		OR	02	1	CA	2	CH	3	CB								
03	I		OR	03	1	CA	2	CI	3	CA								
04	I		OR	04														
05	I																	
06	I																	

**Figure D-2 (Part 2 of 4). Sample Program Step 1 (FILE1)**



RPG CALCULATION SPECIFICATIONS

Program	Keying Instruction	Graphic	Card Electro Number
Programmer	Date	Key	

Line	Form Type	Control Level (L-O-L)	Indicators						Factor 1	Operation	Factor 2	Result Field		Resulting Indicators			Comments
			And	And	Not	Not	Not	Not				Name	Length	Plus	Minus	Zero	
01	C							01		MOVE REC	REC1	80					
02	C																

Figure D-2 (Part 3 of 4). Sample Program Step 1 (FILE1)

RPG OUTPUT SPECIFICATIONS

Program	Keying Instruction	Graphic	Card Electro Number
Programmer	Date	Key	

Line	Form Type	Filename or Record Name	Types (H/D/T/E)		Space	Skip	Output Indicators			Field Name or EXCPT Name	End Position in Output Record	Commas				Zero Balances to Print	No Sign	CR	-	X = Remove Plus Sign	Y = Date Field Edit	Z = Zero Suppress	5-9 = User Defined
			Before	After			And	And	Not			Yes	Yes	No	A								
01	O	REPORT1	D							REC1	B	80											
02	O									REC	B	160											
03	O									REC	B	80											
04	O																						
05	O																						
06	O																						

Figure D-2 (Part 4 of 4). Sample Program Step 1 (FILE1)



The program step described in Figure D-4 reads the records from the sorted file, accumulates the totals for each file name, formats a record, and writes this record to a temporary file on disk.

Use the following procedure to run the program step described in Figure D-4:

```
// LOAD FILE2
// FILE NAME-REPORT1,LABEL-REPORT1S
// FILE NAME-REPORT2,DISP-NEW,RECORDS-?F'A,REPORT1'?
// RUN
```



### RPG CONTROL AND FILE DESCRIPTION SPECIFICATIONS

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Program		Keying Instruction	Graphic								Card Electro Number
Programmer			Date	Key							

Page **1** of **7** Program Identification **FILE2**

#### Control Specifications

For the valid entries for a system, refer to the RPG reference manual for that system.

Line	Form Type	Size to Compile	Object Output Listing Options	Size to Execute	Debug	Reserved	Currency Symbol	Date Format	Date Edit	Inverted Print	Reserved	Number of Print Positions	Alternate Collating Sequence	Reserved	Inquiry	Reserved	Sign Handling	IP Forms Position	Indicator Setting	File Translation	Punch MFCU Zeros	Nonprint Characters	Reserved	Table Load Halt	Shared I/O	Field Print	Formatted Dump	RPG to RPG II Conversion	Number of Formats	S/3 Conversion	Subprogram	CIGS/DL/I	Transparent Literal	
01	H			04						Y																								

#### File Description Specifications

For the valid entries for a system, refer to the RPG reference manual for that system.

Line	Form Type	Filename	File Type		Mode of Processing		Device	Symbolic Device	Labels S/N/E/M	Name of Label Exit	Extent Exit for DAM	Storage Index	File Addition/Unordered																												
			File Designation	End of File	Length of Key Field or of Record Address Field	Record Address Type							Number of Tracks for Cylinder Overflow	Number of Extents																											
			I/O/U/C/D	P/S/C/R/T/D/F	A/D	F/V/S/M/D/E	L/R	A/P/I/K	I/X/D/T/R	or 2	Type of File Organization or Additional Area	Overflow Indicator	Key Field Starting Location	Extension Code E/L	Continuation Lines	Option	Entry	A/U	R/U/N	Tape Rewind	File Condition U1-U8, UC																				
02	F	REPORT1	IP	F	800	160												DISK																							
03	F	REPORT2	O	F	720	120												DISK																							
04	F																																								

Figure D-4 (Part 1 of 7). Sample Program Step 3 (FILE2)

**RPG INPUT SPECIFICATIONS**

Program	Date	Keying Instruction	Graphic Key	Card Electro Number
Programmer				

Line	Form Type	Filename or Record Name		Sequence	External Field Name									Field Location		RPG Field Name	Control Level (L1-L9)	Matching Fields or Chaining Fields	Field Record Relation	Field Indicators		
					Record Identification Codes									From	To					Plus	Minus	Zero or Blank
					1			2			3			Data Structure								
Position	Not (N)	C/Z/D	Character	Position	Not (N)	C/Z/D	Character	Position	Not (N)	C/Z/D	Character	Stacker Select P/B/L/R	Occurs n Times	Length	Decimal Positions							
01	I	REPORT1	AA	01	1	CA	2	CH														
02	I		OR	02	1	CA	2	CI														
03	I		OR	03																		
04	I													1	160	REC						
05	I	*																				
06	I			DS																		
07	I													1	160	REC						
08	I													4	45	KEEP						
09	I													4	4	DALOC						
10	I													5	12	LABEL						
11	I													13	18	DATE						
12	I													19	26	JOB						
13	I													27	27	TYPE						
14	I													28	29	ORG						
15	I													30	36	LOC						
16	I													37	43	LEN						
17	I													44	45	DISK						
18	I													46	50	CNT1						
19	I													51	55	CNT2						
20	I													56	60	CNT3						
	I													61	65	CNT4						
	I													66	70	CNT5						
	I													71	75	CNT6						
	I													84	88	CNT7						
	I													89	93	CNT8						

\*Number of sheets per pad may vary slightly.

Figure D-4 (Part 2 of 7). Sample Program Step 3 (FILE2)



RPG CALCULATION SPECIFICATIONS

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Program	Keying Instruction	Graphic	Card Electro Number
Programmer	Date	Key	

Page **4** of **7** Program Identification **FILE2**

Line	C	Form Type	Control Level (LO, LB, LR, SR, AN, OR)	Indicators						Factor 1	Operation	Factor 2	Result Field		Resulting Indicators			Comments
				And		And		Name	Length				Arithmetic	Plus	Minus	Zero		
				Not	Not	Not	Not											
01	C											FLNAME	8					
02	C											Z-ADD	0					
03	C											Z-ADD	0					
04	C											Z-ADD	0					
05	C											Z-ADD	0					
06	C											Z-ADD	0					
07	C											Z-ADD	0					
08	C											Z-ADD	0					
09	C											Z-ADD	0					
10	C											MOVE KEEP						
11	C											SETON						99
12	C											FLNAME						7070
13	C											EXCPT						
14	C											MOVE LABEL	8					
15	C											MOVE KEEP						
16	C																	
17	C											ADD CNT8						
18	C											ADD CNT10						
19	C											ADD CNT12						
20	C											ADD CNT14						
	C																	
	C											ADD CNT1						
	C											ADD CNT2						
	C											ADD CNT3						

\*Number of sheets per pad may vary slightly.

Figure D-4 (Part 4 of 7). Sample Program Step 3 (FILE2)

RPG CALCULATION SPECIFICATIONS

GX21-9093- UM/050\*  
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IBM International Business Machines Corporation

Program	Keying Instruction	Graphic	Card Electro Number
Programmer	Date	Key	

Page **5** of **7** Program Identification **FILE2**

Line	C	Form Type	Control Level (LO, LB, LR, SR, AN, OR)	Indicators						Factor 1	Operation	Factor 2	Result Field		Resulting Indicators			Comments
				And		And		Name	Length				Arithmetic	Plus	Minus	Zero		
				Not	Not	Not	Not											
01	C											Z-ADD	GET	TOTAL	110			
02	C											ADD	UPDATE	TOTAL				
03	C											ADD	DELETE	TOTAL				
04	C											ADD	ADD	TOTAL				
05	C											ADD	READ	TOTAL				
06	C											ADD	SCAN	TOTAL				
07	C											ADD	WRITE	TOTAL				
08	C																	

Figure D-4 (Part 5 of 7). Sample Program Step 3 (FILE2)



**RPG OUTPUT SPECIFICATIONS**

Program		Keying Instruction	Graphic			Card Electro Number
Programmer	Date		Key			

Line	Form Type	Filename or Record Name	Type (H/D/T/E)		Space	Skip		Output Indicators			Field Name or EXCPT Name	Edit Codes	End Position in Output Record	P/B/L/R	Commas		Zero Balances to Print		No Sign		CR		-		X = Remove Plus Sign Y = Date Field Edit Z = Zero Suppress 5 - 9 = User Defined			
			Before	After		Not	Not	Not	Not	Not					Yes	No	Yes	No	A	B	C	D	J	K		L	M	
01	O										DISS	B	33															
02	O										GET	B	42															
03	O										UPDATE	B	51															
04	O										DELETE	B	60															
05	O										ADD	B	69															
06	O										READ	B	78															
07	O										SCAN	B	87															
08	O										WRITE	B	96															
09	O										TOTAL	B	107															
10	O																											

Figure D-4 (Part 7 of 7). Sample Program Step 3 (FILE2)





The program step described in Figure D-6 reads the sorted file and prints the summary information contained in each record.

Use the following procedure to run the program step described in Figure D-6:

```
// LOAD FILE3
// FILE NAME-REPORT2 , LABEL-REPORT2S
// FILE NAME-REPORT3 , DISP-NEW , RECORDS-?F'A , REPORT2'?
// RUN
```



**RPG CONTROL AND FILE DESCRIPTION SPECIFICATIONS**

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Program	Keying Instruction	Graphic	Card Electro Number
Programmer	Date	Key	

Page **1** of **4** Program Identification **FILE3**

**Control Specifications**

For the valid entries for a system, refer to the RPG reference manual for that system.

Line	Form Type	Size to Compile	Object Output Listing Options	Size to Execute	Debug	Reserved	Currency Symbol	Date Format	Date Edit	Inverted Print	Reserved	Number of Print Positions	Alternate Collating Sequence	Reserved	Inquiry	Reserved	Sign Handling	IP Forms Position	Indicator Setting	File Translation	Punch MFCU Zeros	Nonprint Characters	Reserved	Table Load Halt	Shared I/O	Field Print	Formatted Dump	RPG to RPG II Conversion	Number of Formats	S/3 Conversion	Subprogram	CICS/DLI	Transparent Literal	
0 1	H			04			Y																											

**File Description Specifications**

For the valid entries for a system, refer to the RPG reference manual for that system.

Line	Form Type	Filename	File Type				Mode of Processing				Device	Symbolic Device	Label S/N/E/M	Name of Label Exit	Extent Exit for DAM		File Addition/Unordered																				
			File Designation	End of File	Sequence	File Format	Length of Key Field or of Record Address Field	Record Address Type	Type of File Organization or Additional Area	Overflow Indicator					Key Field Starting Location	Extension Code E/L	Continuation Lines	Option	Entry	Number of Tracks for Cylinder Overflow	Number of Extents																
0 2	F	REPORT2	IP																																		
0 3	F	REPORT3	O																																		
0 4	F																																				

Figure D-6 (Part 1 of 4). Sample Program Step 5 (FILE3)

RPG INPUT SPECIFICATIONS

Program	Keying Instruction	Graphic		Card Electro Number
Programmer	Date	Key		

Line	Form Type	Filename or Record Name	Sequence	Number (I/N), E	Option (O), U, S	Record Identifying Indicator, 1 or DS	External Field Name									Field Location		RPG Field Name	Control Level (L1-L9)	Matching Fields or Chaining Fields	Field Record Relation	Field Indicators		
							1			2			3			From	To					Plus	Minus	Zero or Blank
							Position	Not (N) C/Z/D Character		Position	Not (N) C/Z/D Character		Position	Not (N) C/Z/D Character		Occurs in Times	Length					Decimal Positions		
0 1	I	REPORT2	AA												1	8	LABEL							
0 2	I													9	14	DATE								
0 3	I													9	10	DATEMM								
0 4	I													11	12	DATEDD								
0 5	I													13	14	DATEYY								
0 6	I													15	15	TYPE								
0 8	I													16	17	ORG								
0 9	I													18	24	LOC								
1 0	I													25	31	LEN								
1 1	I													32	33	DISK								
1 2	I													34	42	GET								
1 3	I													43	51	UPDATE								
1 4	I													52	60	DELETE								
1 5	I													61	69	ADD								
1 6	I													70	78	READ								
1 7	I													79	87	SCAN								
1 8	I													88	96	WRITE								
1 9	I													97	107	TOTAL								
2 0	I																							

Figure D-6 (Part 2 of 4). Sample Program Step 5 (FILE3)





## Glossary

**#LIBRARY.** The library, provided with the system, that contains the System Support Program Product. See *system library*.

**acquire.** To assign a display station or session to a program.

**advanced program-to-program communications (APPC).** Communications support that allows System/36 to communicate with other systems having the same support. APPC is the way that System/36 puts the IBM SNA LU-6.2 protocol into effect.

**allocate.** To assign a resource, such as a disk file or a diskette file, to perform a specific task.

**application.** (1) A particular business task, such as inventory control or accounts receivable. (2) A group of related programs that apply to a particular business area, such as the Inventory Control or the Accounts Receivable application.

**application program.** A program used to perform an application or part of an application.

**assembler.** A program that converts assembler language statements to machine instructions.

**assign/free area.** An area of main storage that contains control information for all system activity and for each job that is active.

**asynchronous transmission.** In data communications, a method of transmission in which the bits included in a character or block of characters occur during a specific time interval. However, the start of each character or block of characters can occur at any time during this interval. Contrast with *synchronous transmission*.

**attribute.** A characteristic. For example, an attribute for a displayed field could be blinking.

**autocall.** In data communications, the ability of a station to place a call over a switched line without operator action. Contrast with *manual call*.

**autocall unit.** A common carrier device that allows System/36 to automatically call a remote location.

**BASIC (beginner's all-purpose symbolic instruction code).** A programming language designed for interactive systems and originally developed at Dartmouth College to encourage people to use computers for simple problem-solving operations.

**batch.** Pertaining to activity involving little or no operator action. Contrast with *interactive*.

**batch BSC.** The System Support Program Product support that provides data communications with BSC computers and devices via the RPG T specification or the assembler \$DTFB macroinstruction.

**batch compilation.** A method of compiling programs without the continual attention of an operator.

**batch processing.** A processing method in which a program or programs process records with little or no operator action. Contrast with *interactive processing*.

**binary.** (1) Pertaining to a system of numbers to the base two; the binary digits are 0 and 1. (2) Involving a choice of two conditions, such as on-off or yes-no.

**binary synchronous communications (BSC).** A form of communications line control that uses transmission control characters to control the transfer of data over a communications line. Compare with *synchronous data link control (SDLC)*.

**bit.** Either of the binary digits 0 or 1. See also *byte*.

**bps.** Bits per second.

**BSC.** See *binary synchronous communications (BSC)*.

**buffer.** (1) A temporary storage unit, especially one that accepts information at one rate and delivers it at another rate. (2) An area of storage, temporarily reserved for performing input or output, into which data is read or from which data is written.

**byte.** The amount of storage required to represent one character; a byte is 8 bits.

**C & SM.** See *Communications and Systems Management (C & SM)*.

**cache.** A fixed user area of main storage that contains recently accessed disk data.

**cache page.** The smallest amount of contiguous disk data that can be held in a cache.

**call.** (1) To activate a program or procedure at its entry point. Compare with *load*. (2) In data communications, the action necessary in making a connection between two stations on a switched line.

**CCP.** See *communications control program (CCP)*.

**CCP subsystem.** The SSP-ICF subsystem that provides data communications with a System/3 Model 15D.

**channel.** A path along which data passes.

**CICS subsystem.** The SSP-ICF subsystem that allows binary synchronous communications with CICS/VS.

**clocking.** In data communications, a method of controlling the number of data bits sent on a communications line in a given time.

**code.** (1) Instructions for the computer. (2) To write instructions for the computer. Same as *program*. (3) A representation of a condition, such as an error code.

**command.** A request to the system to perform an operation or a procedure.

**command file.** In the MSRJE utility, a disk file, procedure member, or source member that can contain MSRJE utility control statements and records to be transmitted to the host system. Contrast with *data file*.

**command processor.** The part of the System Support Program Product that processes control commands and that passes procedure commands and operation control language statements to the initiator.

**communications adapter.** A hardware feature that enables a computer or device to become a part of a data communications network.

**Communications and Systems Management (C & SM).** A feature of the System Support Program Product that contains the remote management support (also referred to as DHCF), the change management support (referred to as DSNX), and the problem management support (referred to as alerts).

**communications control program (CCP).** An IBM System/3 Model 15 program that allows communications between System/3 and the SSP-ICF CCP subsystem.

**compile.** To translate a program written in a high-level programming language into a machine language program.

**compress.** (1) To move files, libraries, or folders together on disk to create one continuous area of unused space. (2) To replace repetitive characters in a file or folder with control characters so that the file or folder takes up less space when saved on diskette.

**condense.** To move library members together in a library to create one continuous area of unused space in the library.

**configuration.** The group of machines, devices, and programs that make up a data processing system. See also *system configuration*.

**configuration member.** (1) A library member that describes the devices, programming, and characteristics of the system. (2) In data communications, a member that defines the attributes of a communications subsystem or line.

**configure.** (1) To describe (to the system) the devices, optional features, and program products installed on a system. (2) To describe to SSP-ICF both the communications facilities connected to System/36 and the attributes of the subsystem and remote system.

**constant.** A data item with a value that does not change. Contrast with *variable*.

**control block.** A storage area used by a program to hold control information.

**control field.** A field that identifies a record's relationship to other records (such as a part number in an inventory record). In RPG, control fields are compared from record to record to determine when certain operations are to be performed. In sort, control fields determine the order of records in the sorted file.

**control panel.** A panel that contains lights and keys used to observe and operate the status of the operations within the system.

**control station.** The primary or controlling computer on a multipoint line. The control station controls the sending and receiving of data.

**control storage.** Storage in the computer that contains the programs used to control input and output operations and the use of main storage. Contrast with *main storage*.

**control storage initial program load.** The loading of control storage programs from disk or diskette to control storage.

**control storage processor.** The hardware that performs control storage instructions to handle data transfer and main storage, and input/output assignments.

**controller.** Circuitry or a device used to coordinate and control the operation of one or more devices.

**counter.** A register or storage location used to accumulate the number of occurrences of an event.

**cursor.** A movable symbol on a display, used to indicate to the operator where to type the next character.

**data communications.** The transmission of data between computers and/or remote devices (usually over a long distance).

**data file.** In the MSRJE utility, a disk file, procedure member, or source member that can contain only records to be transmitted to the host system. Contrast with *command file*.

**data management.** See *disk data management*.

**deactivate.** To make ineffective. For example, to deactivate security.

**decimal.** (1) Pertaining to a system of numbers to the base ten; decimal digits range from 0 through 9. (2) A proper fraction in which the denominator is a power of 10.

**default prompt.** A field name from a D-specification used to prompt for the field's contents.

**default value.** A value stored in the system that is used when no other value is specified.

**direct file.** A disk file in which records are referenced by the relative record number. Contrast with *indexed file* and *sequential file*.

**disable.** In interactive communications, to end a subsystem and free the area of main storage used by that subsystem. Contrast with *enable*.

**disk.** A storage device made of one or more flat, circular plates with magnetic surfaces on which information can be stored.

**disk data management.** The System Support Program Product support that processes a request to read or write data.

**disk drive.** The mechanism used to read and write information on disk.

**disk file.** A set of related records on disk that is treated as a unit. See also *record file* and *stream file*.

**diskette.** A thin, flexible magnetic plate that is permanently sealed in a protective cover. It can be used to store information copied from the disk or to exchange information with other computers.

**diskette drive.** The mechanism used to read and write information on diskettes.

**diskette magazine drive.** A diskette drive that holds up to two magazines plus three individual diskettes.

**display station.** A device that includes a keyboard from which an operator can send information to the system and a display screen on which an operator can see the information sent to or the information received from the system.

**emulation.** Imitation; for example, the imitation of a computer or device.

**enable.** In interactive communications, to load and start a subsystem. Contrast with *disable*.

**enter.** To type in information from a keyboard and press the Enter key in order to send the information to the computer.

**enter/update mode.** The mode that is used to enter new statements into a source or procedure member, or to change statements that already exist in a source or procedure member.

**invoke.** To start a program or procedure so that it can communicate with your program.

**extent.** A continuous space on disk or diskette that is occupied by, or reserved for, a particular file, library, or folder.

**field.** One or more characters of related information (such as a name or an amount).

**file.** A set of related records treated as a unit.

**file name.** The name used by a program to identify a file. See also *label*.

**folder.** A named area on disk that contains documents, profiles, mail, or data definitions. Compare with *library*.

**format.** (1) A defined arrangement of such things as characters, fields, and lines, usually used for displays, printouts, files, or documents. (2) To arrange such things as characters, fields, and lines. (3) In BASIC, a representation of the correct form of a command or statement. (4) In IDDU, a group of related fields, such as a record, in a file.

**FORTRAN (formula translation).** A high-level programming language used primarily for scientific, engineering, and mathematical applications.

**help support.** See *system help support*.

**hex.** See *hexadecimal*.



**hexadecimal.** Pertaining to a system of numbers to the base sixteen; hexadecimal digits range from 0 (zero) through 9 (nine) and A (ten) through F (fifteen).

**history file.** A file that contains a log of system actions and operator responses.

**host system.** The primary or controlling computer in a communications network. See also *control station*.

**I/O.** See *input/output (I/O)*.

**index.** (1) A table containing the key value and location of each record in an indexed file. (2) A computer storage position or register, the contents of which identify a particular element in a set of elements.

**indexed file.** A file in which the key and the position of each record are recorded in a separate portion of the file called the index. Contrast with *direct file* and *sequential file*.

**initial program load (IPL).** The process of loading the system programs and preparing the system to run jobs.

**initiator.** The part of the System Support Program Product that reads and processes operation control language statements from the system input device.

**input.** Data to be processed.

**input/output (I/O).** Pertaining to either input or output, or both.

**interactive.** Pertaining to activity involving requests and replies as, for example, between an operator and a program or between two programs. Contrast with *batch*.

**Interactive Communications Feature (SSP-ICF).** A feature of the System Support Program Product that allows a program to interactively communicate with another program or system.

**interactive processing.** A processing method in which each operator action causes a response from the program or the system. Contrast with *batch processing*.

**IPL.** See *initial program load (IPL)*.

**job.** (1) A unit of work to be done by a system. (2) One or more related procedures or programs grouped into a procedure.

**job file.** A disk file that exists until the job that uses it ends.

**job queue.** A list of jobs waiting to be processed by the system.

**job step.** A unit of work represented by a single program or a procedure that contains a single program. A job consists of one or more job steps.

**K-byte.** 1024 bytes.

**label.** (1) The name in the disk or diskette volume table of contents or on a tape that identifies a file. See also *file name*. (2) The name that identifies a statement.

**library.** (1) A named area on disk that can contain programs and related information (not files). A library consists of different sections, called library members. Compare with *folder*. (2) The set of publications for a system.

**load.** (1) To move data or programs into storage. (2) To place a diskette into a diskette drive or a diskette magazine into a diskette magazine drive. (3) To insert paper into a printer. (4) To mount a tape or insert a tape cartridge into a tape drive.

**load module.** A program in a form that can be loaded into main storage and run. The load module is the output of the overlay linkage editor.

**local.** Pertaining to a device, file, or system that is accessed directly from your system, without the use of a communications line. Contrast with *remote*.

**local data area.** A 512-byte area on disk that can be used to pass information between jobs and job steps during a session. A separate local data area exists for each command display station.

**logical unit (LU).** The part of a system or device in an SNA network that allows a user or program to use the communications network.

**M-byte.** See *megabyte*.

**machine instruction.** An instruction of the machine language that can be performed by the computer.

**magnetic ink.** An ink that contains particles of a magnetic substance whose presence can be detected by magnetic sensors.

**magnetic ink character recognition.** The identification of characters through the use of magnetic ink.

**magnetic stripe reader.** A device, attached to a display station, that reads data from a magnetic stripe on a badge before allowing an operator to sign on.

**magnetic tape.** See *tape*.

**magnetic tape unit.** A device for reading or writing data from or on magnetic tape.

**main storage.** The part of the processing unit where programs are run. Contrast with *control storage*.

**main storage processor.** Hardware that performs the machine language instructions in main storage.

**manual call.** In data communications, a line type requiring operator actions to place a call over a switched line. Contrast with *autocall*.

**master configuration record.** Information, stored on disk, that describes system devices, programming, and characteristics.

**megabyte.** One million bytes.

**menu.** A displayed list of items from which an operator can make a selection.

**message.** (1) Information sent to one or more users or display stations from a program or another user. A message can be either displayed or printed. (2) An indication of the condition of the system sent by the system. (3) For IMS/IRSS, a unit of data sent over the communications line.

**mode.** A method of operation. For an example, see *enter/update mode*.

**MRT procedure.** See *multiple requester terminal (MRT) procedure*.

**MRT program.** See *multiple requester terminal (MRT) program*.

**MSRJE.** See *Multiple Session Remote Job Entry (MSRJE)*.

**multiple.** More than one.

**multiple requester terminal (MRT) procedure.** A procedure that calls a multiple requester terminal program.

**multiple requester terminal (MRT) program.** A program that can process requests from more than one display station or SSP-ICF session at the same time using a single copy of the program. Contrast with *single requester terminal (SRT) program*.

**Multiple Session Remote Job Entry (MSRJE).** A feature of the System Support Program Product that allows one or more remote job entry sessions to operate on a host system (such as a System/370, or a 30XX or 43XX processor) at the same time.

**multipoint.** In data communications, pertains to a network that allows two or more stations to communicate with a single system on one line.

**NEP.** See *never-ending program (NEP)*.

**network.** A collection of data processing products connected by communications lines for information exchange between stations.

**never-ending program (NEP).** A long-running program that does not share system resources, except for shared files and the spool file.

**nonlabeled tape.** A tape that has no labels. Tape marks are used to indicate the end of the volume and the end of each data file.

**nonrequesting terminal program.** A program that is not associated with a requesting display station.

**nonswitched line.** A connection between computers or devices that does not have to be established by dialing. Contrast with *switched line*.

**nucleus.** That portion of main storage that is used by the System Support Program Product.

**OCL.** See *operation control language (OCL)*.

**operation code.** (1) A code used to represent the operations of a computer. (2) In SSP-ICF, a code used by a System/36 application program to request SSP-ICF data management and/or the subsystem to perform an action. For example, the operation \$\$SEND asks that data be sent.

**operation control language (OCL).** A language used to identify a job and its processing requirements to the System Support Program Product.

**output.** The result of processing data.

**overlay.** (1) To write over (and therefore destroy) an existing file. (2) A program segment that is loaded into main storage and replaces all or part of a previously loaded program segment.

**parameter.** A value supplied to a procedure or program that either is used as input or controls the actions of the procedure or program.

**Peer subsystem.** The SSP-ICF subsystem that allows System/36 to communicate with another System/36 or System/34 using SNA/SDLC.

**physical record.** (1) A group of records that is recorded or processed as a unit. Same as *block*. (2) A unit of data that is moved into or out of the computer.

**point-to-point line.** A communications line that connects a single remote station to a computer.

**polling.** A method for determining whether each of the stations on a communications line has data to send.

**port.** A part of the system unit or remote controller to which cables for display stations and printers are attached.

**post.** (1) To add information in a record to keep that record current. (2) To note the occurrence of an event.

**printout.** Information from the computer that is produced by a printer.

**priority.** The relative ranking of items. For example, a job with high priority will be run before one with regular or low priority.

**procedure.** A set of related operation control language statements (and, possibly, utility control statements and procedure control expressions) that cause a specific program or set of programs to be performed.

**procedure command.** A command that runs a procedure.

**procedure member.** A library member that contains the statements (such as operation control language statements) necessary to perform a program or set of programs.

**processing unit.** The part of the system unit that performs instructions and contains main storage.

**program.** (1) A sequence of instructions for a computer. See *source program* and *load module*. (2) To write a sequence of instructions for a computer. Same as *code*.

**prompt.** A displayed request for information or operator action.

**propagation time.** The time necessary for a signal to travel from one point on a communications line to another.

**protocol.** A set of rules governing the communication and transfer of data between two or more devices in a communications system.

**queue.** A line or list formed by items waiting to be processed.

**record.** A collection of fields that is treated as a unit.

**record file.** A file on disk in which the data is read and written in records. Contrast with *stream file*.

**relative file.** Same as *direct file*.

**remote.** Pertaining to a device, file, or system that is accessed by your system through a communications line. Contrast with *local*.

**remote job entry (RJE).** Sending job instructions and possibly data to a remote system requesting it to run a job.

**requester.** A display station or interactive communications session that requests a program to be run.

**resident file.** A file that exists on disk until it is specifically deleted or changed to a scratch file.

**RJE.** See *remote job entry (RJE)*.

**run.** To cause a program, utility, or other machine function to be performed.

**scratch file.** A file, usually used as a work file, that exists until the program that uses it ends.

**SDLC.** See *synchronous data link control (SDLC)*.

**sector.** (1) An area on a disk track or a diskette track reserved to record information. (2) The smallest amount of information that can be written to or read from a disk or diskette during a single read or write operation.

**sequential file.** A file in which records occur in the order in which they were entered. Contrast with *direct file* and *indexed file*.

**session.** (1) The logical connection by which a System/36 program or device can communicate with a program or device at a remote location. (2) The length of time that starts when an operator signs on the system and ends when the operator signs off the system.

**single line communications adapter/attachment (SLCA).** In data communications, a feature that allows a single communications line to be connected to System/36.

**single requester terminal (SRT) program.** A program that can process requests from only one display station or SSP-ICF session from each copy of the program. Contrast with *multiple requester terminal (MRT) program*.

**SLCA.** See *single line communications adapter/attachment (SLCA)*.

**SMF.** See *system measurement facility (SMF)*.

**SNA.** See *systems network architecture (SNA)*.

**SNA Upline Facility (SNUF).** The SSP-ICF subsystem that allows System/36 to communicate with CICS/VS and IMS/VS application programs on a host system. Also, using this subsystem, DHCF communicates with HCF and DSNX communicates with DSX.

**SNBU.** See *switched network backup (SNBU)*.

**SNUF.** See *SNA Upline Facility (SNUF)*.

**source program.** A set of instructions that are written in a programming language and that must be translated to machine language before the program can be run.

**spool file.** A disk file that contains output that has been saved for later printing.

**spool intercept buffer.** An area of main storage containing printer data that is being written in the spool file.

**spool writer.** The part of the System Support Program Product that prints output that has been saved in the spool file.

**spooling.** The part of the System Support Program Product that saves output on disk for later printing.

**SRT program.** See *single requester terminal (SRT) program*.

**SSP.** See *System Support Program Product (SSP)*.

**SSP-ICF.** See *Interactive Communications Feature (SSP-ICF)*.

**stream file.** A file on disk in which data is read and written in consecutive fields. Contrast with *record file*.

**subroutine.** A group of instructions that can be called by another program or subroutine.

**subsystem.** The part of communications that handles the requirements of the remote system, isolating most system-dependent considerations from the application program.

**swapping.** The process of temporarily removing an active job from main storage, saving it on disk, and processing another job in the area of main storage formerly occupied by the first job.

**switched line.** In data communications, a connection between computers or devices that is established by dialing. Contrast with *nonswitched line*.

**switched network backup (SNBU).** In data communications, a technique that provides a switched line connection when a nonswitched line fails.

**synchronous.** Occurring in a regular or predictable sequence.

**synchronous data link control (SDLC).** A form of communications line control that uses commands to control the transfer of data over a communications line. Compare with *binary synchronous communications (BSC)*.

**system.** The computer and its associated devices and programs.

**system configuration.** A process that specifies the machines, devices, and programs that form a particular data processing system.

**system console.** A display station from which an operator can keep track of and control system operation.

**system help support.** The part of the System Support Program Product that uses menus, prompts, and descriptive text to aid an operator.

**system library.** The library, provided with the system, that contains the System Support Program Product and is named #LIBRARY.

**system measurement facility (SMF).** System Support Program Product routines that, in conjunction with control storage routines, observe system and device activity, observe SSP work area usage, and record this data in a disk file.

**System Support Program Product (SSP).** A group of licensed programs that manage the running of other programs and the operation of associated devices, such as the display station and printer. The SSP also contains utility programs that perform common tasks, such as copying information from diskette to disk.

**systems network architecture (SNA).** A set of rules for controlling the transfer of information in a data communications network.

**tape.** A thin, flexible magnetic strip on which data can be stored. It can be used to store information copied from the disk.

**tape drive.** A mechanism used to read and write information on magnetic tapes.

**tape volume.** A single reel of magnetic tape.

**task.** A unit of work (such as a user program) for the main storage processor.

**task work area.** An area on disk containing control information and work areas related to a specific task.

**terminator.** The part of the System Support Program Product that performs the action necessary to end a job or program.

**transaction file.** A file containing data, such as customer orders, that is usually used only with a master file.

**transient.** Pertaining to a System Support Program Product program that does not reside in main storage or to a temporary storage area for such a program.

**turnaround.** Changing a communications line from transmit mode to receive mode or from receive mode to transmit mode.

**turnaround time.** The time interval required to reverse the direction of transmission over a communication line.

**user area.** The parts of main storage and disk that are available to the user.

**variable.** A name used to represent a data item whose value can change while the program is running. Contrast with *constant*.

**volume label.** An area on a standard label tape used to identify the tape volume and its owner. This area is the first 80 bytes and contains VOL1 in the first four positions.

**volume table of contents (VTOC).** An area on a disk or diskette that describes the location, size, and other characteristics of each file, library, and folder on the disk or diskette.

**VTOC.** See *volume table of contents (VTOC)*.

**work station.** A device that lets people transmit information to or receive information from a computer; for example, a display station or printer.

**X.21.** In data communications, a specification of the CCITT that defines the connection of data terminal equipment to an X.21 (public data) network.

**X.21 feature.** The feature that allows System/36 to be connected to an X.21 network.

**X.21 short hold mode.** An option specified during system configuration that allows a circuit switched line to be disconnected when the line is not active.

**X.25.** In data communications, a specification of the CCITT that defines the interface to an X.25 (packet switching) network.

**X.25 feature.** The feature that allows System/36 to be connected to an X.25 network.

**1255 Magnetic Character Reader.** A device that reads documents printed with magnetic ink characters.

**3270 BSC Support subsystem.** The subsystem that provides program-to-program communications with IMS/VS, CICS/VS, TSO, VM, or system application programs using 3270 BSC protocols, and provides support for the BSC portion of the 3270 Device Emulation feature.

**3270 Device Emulation.** A feature of the System Support Program Product that allows a System/36 local or remote device to appear as a 3270 device to another system.

**3270 SNA Support subsystem.** The subsystem that provides support for the SNA portion of the 3270 Device Emulation feature.

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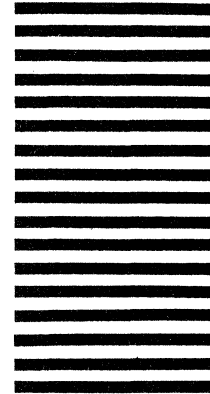


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