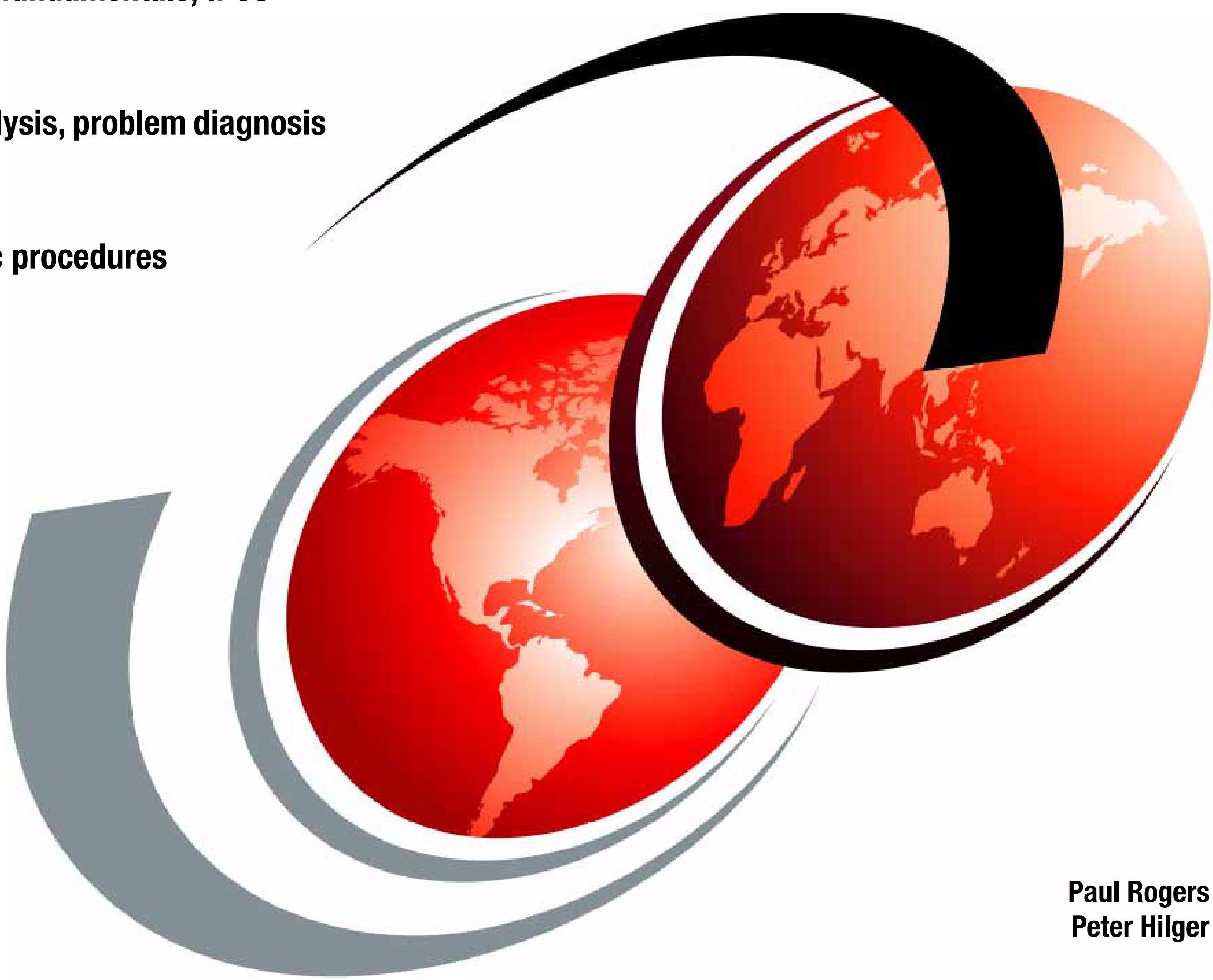
IBM

ABCs of z/OS System Programming Volume 8

Diagnosis fundamentals, IPCS

Dump analysis, problem diagnosis

Diagnostic procedures



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ABCs of z/OS System Programming Volume 8

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Note: Before using this information and the product it supports, read the information in “Notices” on page ix.

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Contents

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Preface

The ABCs of IBM® z/OS® System Programming is a 13-volume collection that provides an introduction to the z/OS operating system and the hardware architecture. Whether you are a beginner or an experienced system programmer, the ABCs collection provides the information you need to start your research into z/OS and related subjects. If you would like to become more familiar with z/OS in your current environment, or if you are evaluating platforms to consolidate your e-business applications, the ABCs collection serves as a powerful technical tool.

This IBM Redbooks® publication, Volume 8, shows you how to:

- Adopt a systematic and thorough approach to dealing with problems and identifying the different types of problems
- Determine where to look for diagnostic information and how to obtain it
- Interpret and analyze the diagnostic data collected
- Escalate problems to the IBM Support Center when necessary
- Collect and analyze diagnostic data—a dynamic and complex process
- Identify and document problems, collect and analyze pertinent diagnostic data and obtain help as needed, to speed you on your way to problem resolution

The content of the volumes is as follows:

Volume 1: Introduction to z/OS and storage concepts, TSO/E, ISPF, JCL, SDSF, and z/OS delivery and installation

Volume 2: z/OS implementation and daily maintenance, defining subsystems, JES2 and JES3, LPA, LNKLST, authorized libraries, SMP/E, Language Environment®

Volume 3: Introduction to DFSMS, data set basics storage management hardware and software, catalogs, and DFSMStvs

Volume 4: Communication Server, TCP/IP, and VTAM®

Volume 5: Base and Parallel Sysplex® , System Logger, Resource Recovery Services (RRS), global resource serialization (GRS), z/OS system operations, automatic restart management (ARM), Geographically Dispersed Parallel Sysplex™ (GDPS®)

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Volume 7: Printing in a z/OS environment, Infoprint® Server and Infoprint Central

Volume 8: An introduction to z/OS problem diagnosis

Volume 9: z/OS UNIX System Services

Volume 10: Introduction to z/Architecture™, zSeries processor design, zSeries connectivity, LPAR concepts, HCD, and HMC

Volume 11: Capacity planning, performance management, WLM, RMF™ , and SMF

The team who wrote this book

This book was produced by a team working at the International Technical Support Organization, Poughkeepsie Center.

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1

z/OS problem diagnosis fundamentals

There should be a staff of people who diagnose software problems that occur while running the operating system. These people are usually system programmers for the installation.

If an installation does not wish to debug the problem or does not have the source code involved in the problem, use a diagnostic procedure to collect the problem data needed for reporting the problem to IBM. IBM will debug the problem and provide a fix.

If an installation wishes to debug the problem and has the source code, use a diagnostic procedure to collect problem data. The installation's diagnostician can use this data to debug the problem. If the problem is in IBM code, the diagnostician should report the problem to IBM.

To perform problem determination in a z/OS system address space, it may become necessary to determine the cause of the problem by searching problem databases, and, if necessary, reporting the problem to the IBM support center. This applies to a customer support person who can troubleshoot problems, such as the system programmer or system administrator, an experienced security administrator, or an experienced storage administrator.

The steps taken to investigate and analyze a problem are as follows:

- Problem determination
- Determining system problem indications
- Analyzing logs and error information
- Looking at dumps and traces

1.1 Problem identification

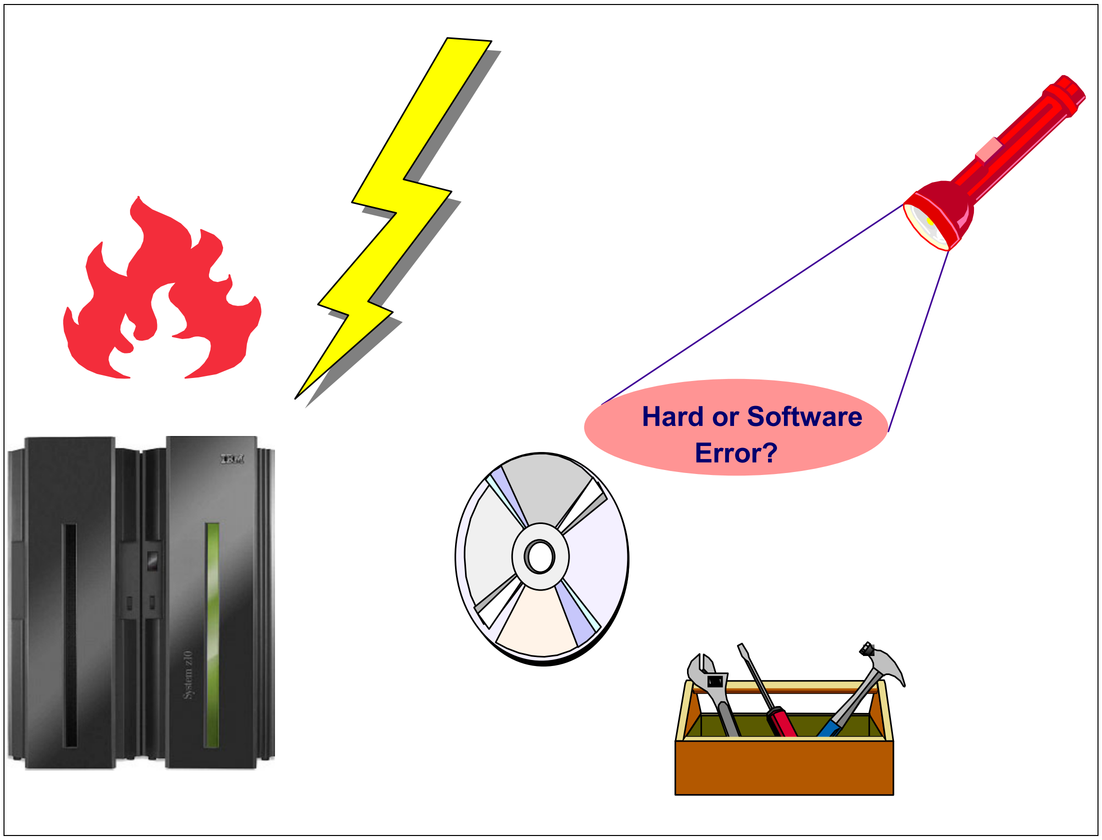

Figure 1-1 Problem determination

Identifying the problem

A system problem can be described as any problem on your system that causes work to be stopped or degraded. The steps involved in diagnosing these problems are different for each type of problem. Before you can begin to diagnose a system problem, however, you have to know what kind of problem you have. It may be either a hardware or software error.

Problem identification is often not a straightforward process, but an investigative exercise that requires a structured method that will enable the correct initial assessment to be made. This initial phase is important because decisions you make now relating to diagnostic data collection will influence the speed of the resolution.

In an ideal world, the programs you write would run perfectly, and never encounter an error, either software or hardware. In the real world, programs do encounter errors that can result in the premature end of the program's processing. These errors could be caused by something your program does, or they could be beyond your program's control.

Software errors

IBM MVS™ allows you to provide something called *recovery* for your programs; that means you can anticipate and possibly recover from software errors that could prematurely end a program. To recover from these errors, you must have one or more user-written routines called recovery routines. The general idea is that, when something goes wrong, you have a recovery routine standing by to take over, fix the problem, and return control to your program so that processing can complete normally; if the problem cannot be fixed, the recovery routine would provide information about what went wrong. If correctly set up, your recovery should, at the very least, provide you with more information about what went wrong with your program than you would have had otherwise.

Hard errors

If, in a multiprocessing system, a failure occurs in one central processor, the system invokes alternate central processor recovery (ACR) on another central processor. The system records the error as a hard failure that does not cause the processor to end.

1.2 What version or release is running

Figure 1-2 What version or release am I running

What release is running

Different platforms use different commands to show you product information. With many environments now comprising combinations of different platforms, operating systems and products all interact with the z/OS operating system in a distributed topology.

This information is vital to ensure that during problem analysis, we know exactly what system and product level we are dealing with and what maintenance has been applied to the product or module that is failing.

The sources of this information vary from the most obvious source, the system and job logs, to far more detailed interrogation using SMP/E and dump interrogation via IPCS.

In this chapter we discuss how to locate this important information.

> **Note:** Do not overlook the most obvious source of release information that is often recorded in the console or job log messages generated during startup of the operating system or product.

How to get version or release information

In z/OS, the job log often shows release information generated during the start sequence for a product. Figure 1-3 shows an example of the CICS (Customer Information Control System) startup message written to the CICS job log.

```
DFHSI1500  TAXPYT01 CICS startup is in progress for CICS Transaction Server
Version 3.2.0
```

Figure 1-3 CICS startup message

IPLINFO command

Very useful is the DISPLAY IPLINFO console command. It will show the following:

```
RESPONSE=SC64
 IEE254I  10.35.52 IPLINFO DISPLAY 953
  SYSTEM IPLED AT 12.40.30 ON 11/02/2011
  RELEASE z/OS 01.13.00    LICENSE = z/OS
  USED LOADS8 IN SYS0.IPLPARM ON 0C730
  ARCHLVL = 2   MTLSHARE = N
  IEASYM LIST = XX
  IEASYS LIST = (R3,64) (OP)
  IODF DEVICE: ORIGINAL(0C730) CURRENT(0C730)
  IPL DEVICE: ORIGINAL(09302) CURRENT(09302) VOLUME(Z1DRB1)
```

ABEND symptom string

The ABEND symptom string that is written to the master console and system log shows relevant release and maintenance information. Figure 1-4 shows an example of a user pgm abend message in the MVS SYSLOG.

```
IEA995I SYMPTOM DUMP OUTPUT 494
SYSTEM COMPLETION CODE=0C4  REASON CODE=00000004
 TIME=15.26.13  SEQ=00528  CPU=0000  ASID=0020
 PSW AT TIME OF ERROR  078D0000   00007026  ILC 4  INTC 04
   ACTIVE LOAD MODULE           ADDRESS=00007000  OFFSET=00000026
   NAME=ABEND0C4
   DATA AT PSW  00007020 - 40404040  40404040  404058F0
   GR 0: 00000001_FD000008   1: 00000000_00006000
      2: 00000000_00000040   3: 00000000_007D19D4
      4: 00000000_007D19B0   5: 00000000_007FF130
      6: 00000000_007BAFC8   7: 00000000_FD000000
      8: 00000000_007FCAC8   9: 00000000_007CF8F0
      A: 00000000_00000000   B: 00000000_007FF130
      C: 00000000_40007006   D: 00000000_00006008
      E: 00000000_80FDCA98   F: 00000000_00007000
 END OF SYMPTOM DUMP
IEF450I PHILGER1 GO - ABEND=S0C4 U0000 REASON=00000004 495
        TIME=15.26.13
```

Figure 1-4 CICS abend message in MVS syslog

This indicates that the GO step ended with ABEND0C4 PIC 4 A program interruption occurred. Protection exception.

WebSphere MQ and IMS releases

Figure 1-5 on page 6 shows how IBM WebSphere IBM MQSeries® for z/OS displays the release level in the MQ MSTR joblog.

```
CSQY000I MQA2 IBM WebSphere MQ for z/OS V7
```

Figure 1-5 WebSphere MQ for z/OS version information

Figure 1-6 displays the IBM IMS™ release information that is written to the IMS CTL joblog.

```
DFS1929I * IMS SYSTEM PARAMETERS INITIAL FOR THIS V11.1 DBDC
```

Figure 1-6 IMS Version information written to the joblog

1.3 Waits, system hangs, and abends

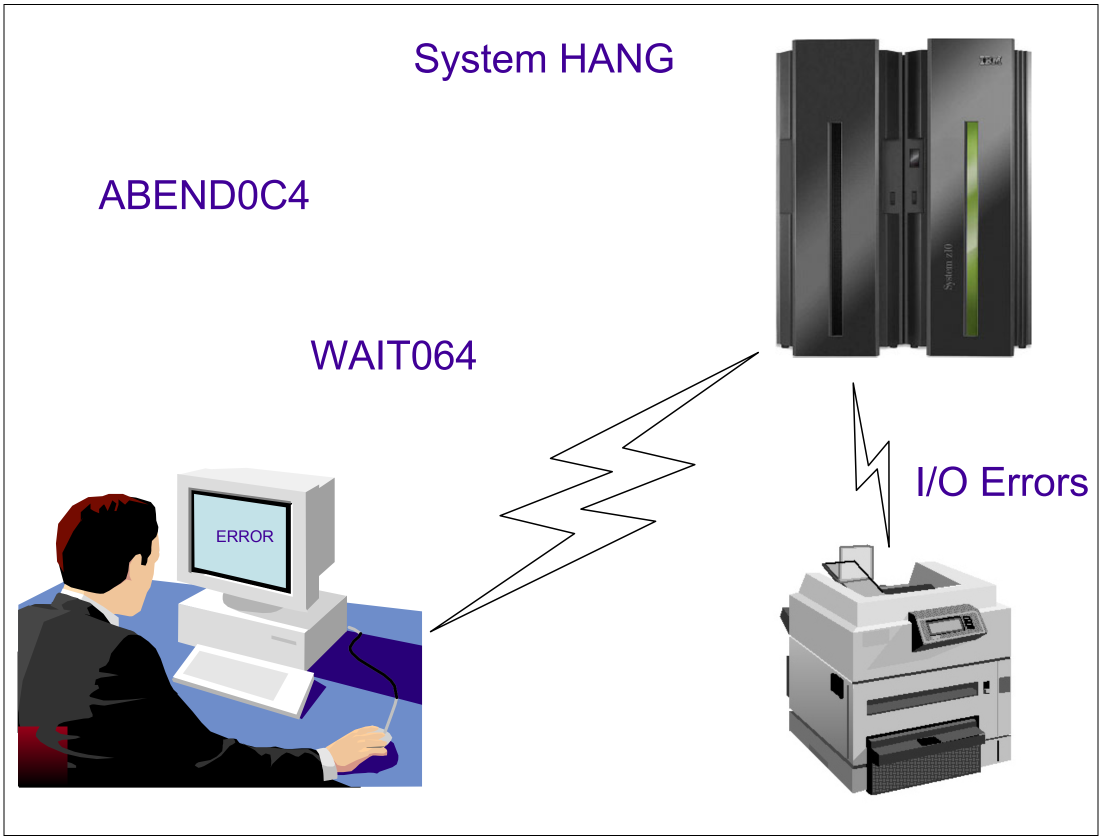

Figure 1-7 Problem determination

System problem indication

For the failure of an application program or program product, the program requests a SYSMDUMP dump.

If the system waits, hangs, or enters a loop, the operator requests a stand-alone dump. If the loop is interruptible you can take a console dump using the dump command.

Stand-alone dumps

The stand-alone dump program produces a high-speed, unformatted dump of main storage and parts of paged-out virtual storage on a tape device or a direct access storage device (DASD). The stand-alone dump program, which you create, must reside on a storage device that can be used to IPL.

Produce a stand-alone dump when the failure symptom is a wait state with a wait state code, a wait state with no processing, an instruction loop, or slow processing.

Use a stand-alone dump when:

- The system stops processing.
- The system enters a wait state with or without a wait state code.
- The system enters an instruction loop.

These dumps show main storage and some paged-out virtual storage occupied by the system or stand-alone dump program that failed. Stand-alone dumps can be analyzed using IPCS.

Note: For additional information, see Appendix A-32, “Flowchart for loops and hangs” on page 335.

Abends

The term that is used most often here in relation to system or application problems is “abend”, which stands for abnormal end. Later we will discuss the different types of abends and also some other key factors that can affect system and application performance. We will also discuss some of the tools that can assist with determining what is occurring at a given point in time of the system. The following shows the different problem areas:

- Application program abends
- System program abends
- I/O errors
- System wait states
- System, subsystem, and application hangs
- System, subsystem, and application loops

1.4 Logging messages

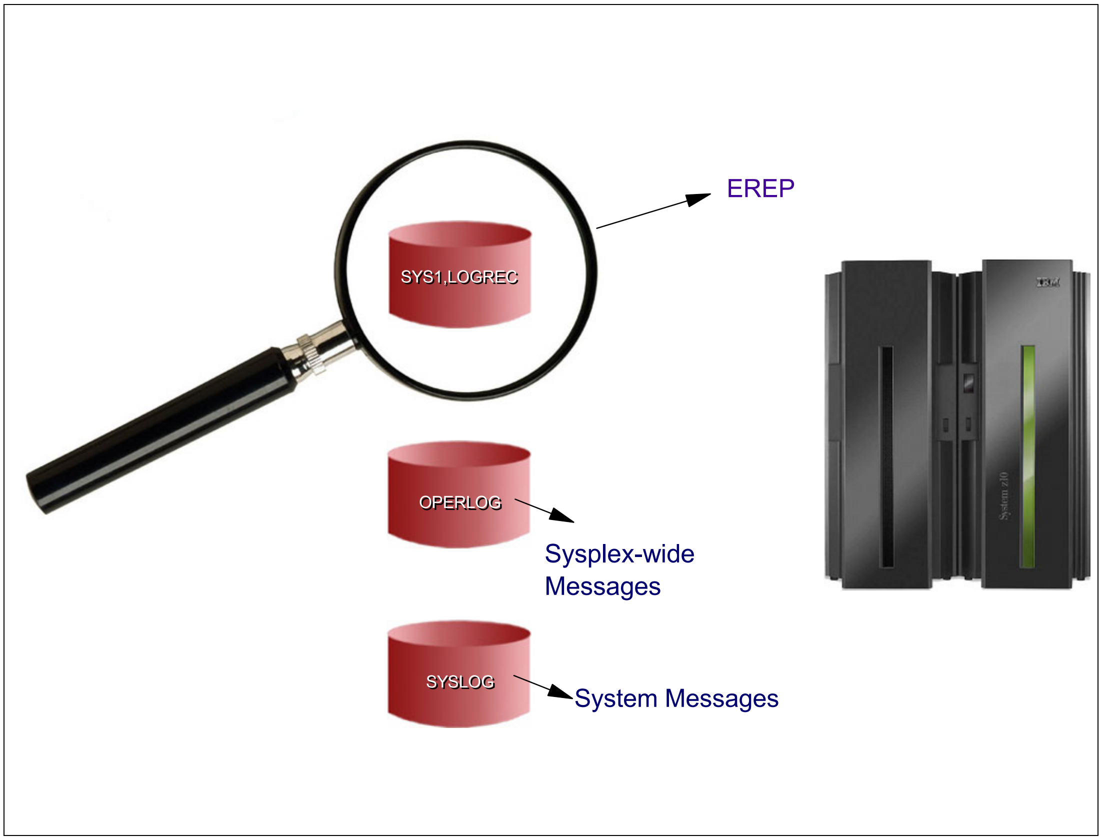

Figure 1-8 Problem determination

Logging messages and error information

On z/OS there are multiple choices to log messages and error related information. It depends on the installation settings and job-related options. The different log scenarios are shown in the following sections.

System log (SYSLOG) or console log

The system log (SYSLOG) is a data set residing in the primary job entry subsystem's spool space. It can be used by application and system programmers to record communications about problem programs and system functions. The operator can use the LOG command to add an entry to the system log.

Operations log (OPERLOG)

The operations log (OPERLOG) is a log stream that uses the system logger to record and merge communications about programs and system functions from each system in a sysplex. Only the systems in a sysplex that have specified and activated the operations log will have their records sent to OPERLOG. For example, if a sysplex has three systems, SYS A, SYS B, and SYS C, but only SYS A and SYS B activate the operations log, then only SYS A and SYS B will have their information recorded in the operations log.

JESMSGLG output data set

The JESMSGLG output data set for each job in the system contains system messages related to that job.

Error log (logrec)

When an error occurs, the system records information about the error in the logrec data set or the logrec log stream. The information provides you with a history of all hardware failures, selected software errors, and selected system conditions. Use the Environmental Record, Editing, and Printing program (EREP):

- To print reports about the system records
- To determine the history of the system
- To learn about a particular error

Use the records in the logrec data set or the logrec log stream as additional information when a dump is produced. The information in the records will point you in the right direction while supplying you with symptom data about the failure.

You clear the logrec data set when it is full or nearly full. To initialize or reinitialize it, use the service aid program IFCDIP00. To clear a full logrec data set, use EREP. IFCDIP00 creates a header record and a time stamp record for the logrec data set.

Note: The logrec data set is an unmovable data set. If you attempt to move it after IPL using a program, such as a defragmentation program, your system will experience difficulty both reading from and writing to the data set.

1.5 Dumps and traces

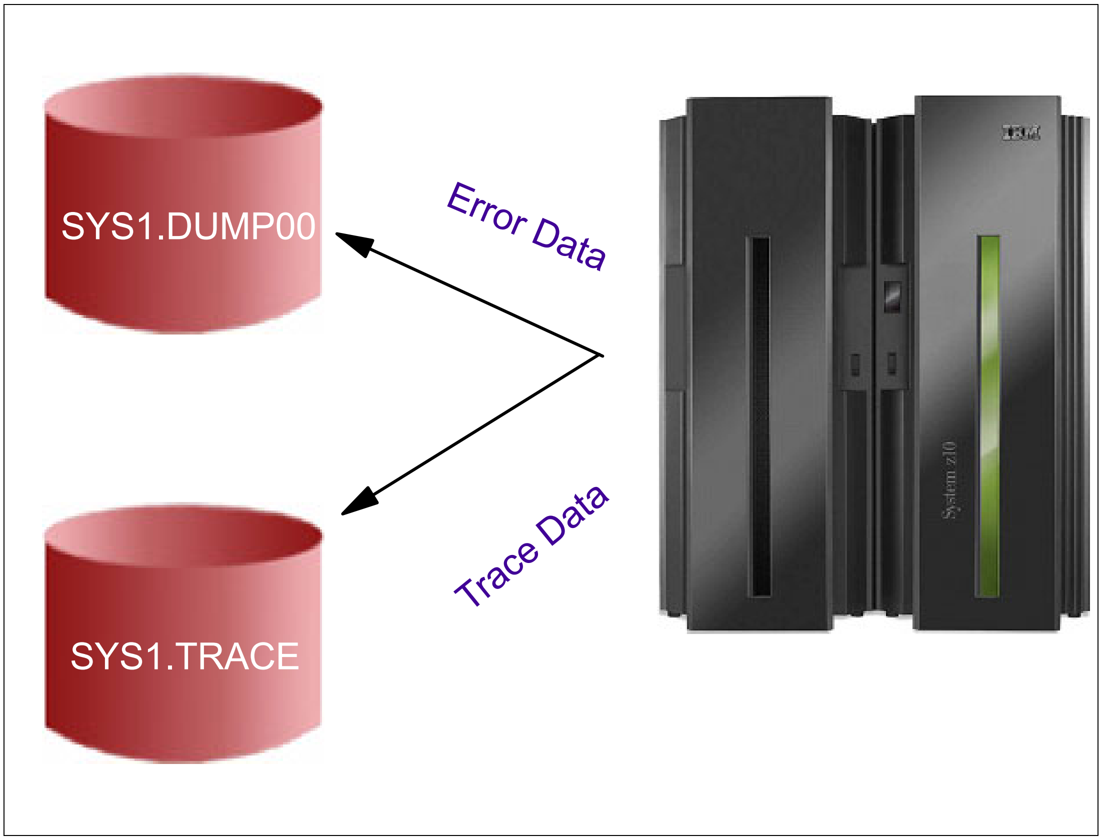

Figure 1-9 Problem determination

System dumps

A system generates a system dump when a severe error occurs if the dump is not suppressed by dump analysis and elimination (DAE). System dumps can also be user-initiated. A system dump creates a picture of an address space memory at the time of an error or after entering the dump command. A stand-alone dump creates a picture of all activities in the system. The following dumps can be initiated or requested by definition:

- Abend dumps
- SNAP dumps
- Stand-alone dumps
- SVC dumps
- Dumps triggered by an SLIP (serviceability level indication processing)

Traces

Another useful source of diagnostic data is the trace. Tracing collects information that identifies ongoing events that occur over a period of time during system initialization and operation. Some traces are running all the time so that trace data will be available in the event of a failure. Other traces must be explicitly started to trace a defined event.

- Component trace (CTRACE)
- Master trace (MTRACE)

- System trace (SYSTRACE)
- Getmain/Freemain trace (GFS)
- SMS trace

There are more traces that can be activated related to different components, such as VIT IBM VTAM® internal trace. Normally the traces are written into a storage buffer, but if you would like to trace a longer time period you may use Generalized Trace Facility (GTF). GTF collects the trace data and stores it on a DASD volume.

1.6 Tools and service aids

- Dumps
  - ABEND dump - SNAP dump - Stand-Alone dump - SVC dump
- Traces
  - Component trace - GFS trace - GTF trace - Master trace - System trace
- Service aids
  - AMBLIST - Common storage tracking - DAE - IPCS - Logrec data set - SLIP traps - SPZAP

Figure 1-10 Tools and service aids

Tools and service aids

The following tools and service aids are provided by MVS for problem diagnosis.

ABEND dump Use an ABEND dump when ending an authorized program or problem program because of an uncorrectable error. The dump shows:

- The virtual storage for the program requesting the dump
- System data associated with the program

The system can produce three types of ABEND dumps, SYSABEND, SYSMDUMP, and SYSUDUMP. Each dumps different areas. Select the dump that gives the areas needed for diagnosing your problem. The IBM-supplied defaults for each dump are:

- SYSABEND dump - The largest of the ABEND dumps, containing a summary dump for the failing program plus many other areas useful for analyzing processing in the failing program.
- SYSMDUMP dump - Contains a summary dump for the failing program, plus some system data for the failing task. SYSMDUMP dumps are the only ABEND dumps that you can format with IPCS.
- SYSUDUMP dump - The smallest of the ABEND dumps, containing data and areas only about the failing program.

SNAP dump Use a SNAP dump when testing a problem program. A SNAP dump shows one or more areas of virtual storage that a program, while running, requests the system to dump. A series of SNAP dumps can show an area at different stages in order to picture a program's processing, dumping one or more fields repeatedly to let the programmer check intermediate steps in calculations. SNAP dumps are preformatted; you cannot use IPCS to format them.

Stand-alone dump Use a stand-alone dump when:

- The system stops processing.
- The system enters a wait state with or without a wait state code.
- The system enters an instruction loop.
- The system is processing slowly.

These dumps show main storage and some paged-out virtual storage occupied by the system or stand-alone dump program that failed. Stand-alone dumps can be analyzed using IPCS.

SVC dump SVC dumps can be used in two different ways:

- Most commonly, a system component requests an SVC dump when an unexpected system error occurs, but the system can continue processing.
- An authorized program or the operator can also request an SVC dump when they need diagnostic data to solve a problem.

SVC dumps contain a summary dump, control blocks, and other system code, but the exact areas dumped depend on whether the dump was requested by a macro, command, or SLIP trap. SVC dumps can be analyzed using IPCS.

Component trace Use a component trace when you need trace data to report an MVS component problem to the IBM Support Center. Component tracing shows processing within an MVS component. Typically, you might use component tracing while recreating a problem. The installation, with advice from the IBM Support Center, controls which events are traced for a component.

GFS trace Use GFS trace to collect information about requests for virtual storage through the GETMAIN, FREEMAIN, and STORAGE macros.

GTF trace Use a GTF trace to show system processing occurring in the system over time. The installation controls which events are traced. GTF tracing uses more resources and processor time than a system trace. Use GTF when you are familiar enough with the problem to pinpoint the one or two events required to diagnose your system problem. GTF can be read to an external data set as well as a buffer.

Master trace Use the master trace to show the messages to and from the master console. Master trace is useful because it provides a log of the most recently issued messages. These can be more pertinent to your problem than the messages accompanying the dump itself.

System trace Use system trace to see system processing occurring in the system over time. System tracing is activated at initialization and, typically, runs continuously. It records many system events, with minimal detail about each. The events traced are predetermined, except for branch tracing. This trace uses fewer resources and is faster than a GTF trace.

AMBLIST Use AMBLIST when you need information about the content of load modules and program objects or when you have a problem related to the modules on your system. AMBLIST is a program that provides lots of data about modules in the system, such as a listing of the load modules, map of the CSECTs in a load module or program object, list of modifications in a CSECT, map of modules in the LPA (link pack area), and a map of the contents of the DAT-on nucleus.

Common storage Use common storage tracking to collect data about requests to obtain or free storage in CSA, ECSA, SQA, and ESQA. This is useful to identify jobs or address spaces using an excessive amount of common storage or ending without freeing storage. Use RMF or the IPCS VERBEXIT VSMDATA subcommand to display common storage tracking data.

DAE Use *dump analysis and elimination* (DAE) to eliminate duplicate or unneeded dumps. This can help save system resources and improve system performance.

IPCS Use IPCS to format and analyze dumps, traces, and other data. IPCS produces reports that can help in diagnosing a problem. Some dumps, such as SNAP and SYSABEND and SYSUDUMP ABEND dumps, are preformatted—they are not formatted using IPCS.

Logrec data set Use the logrec data set as a starting point for problem determination. The system records hardware errors, selected software errors, and selected system conditions in the logrec data set. Logrec information gives you an idea of where to look for a problem, supplies symptom data about the failure, and shows the order in which the errors occurred.

SLIP traps Use *serviceability level indication processing* (SLIP) to set a trap to catch problem data. SLIP can intercept program event recording (PER) or error events. When an event that matches a trap occurs, SLIP performs the problem determination action that you specify:

- Requesting or suppressing a dump.
- Writing a trace or a logrec data set record.
- Giving control to a recovery routine.
- Putting the system in a wait state.

SPZAP Use the SPZAP service aid to dynamically update and maintain programs and data sets. For problem determination, you can use SPZAP to:

- Fix program errors by replacing a few instructions in a load module or member of a partitioned data set (PDS).
- Insert an incorrect instruction into a program to force an abend or make a SLIP trap work.
- Alter instructions in a load module to start component trace.
- Replace data directly on a direct access device to reconstruct a volume table of contents (VTOC) or data records that were damaged by an input/output (I/O) error or program error.

1.7 Tools and service aids

- SPZAP
- SADMP
- SDUMP
- System trace
- External traces (GTF and CTRACE)
- SLIP
- IPCS

Figure 1-11 Diagnostic tools and service aids enhanced in z/OS V1R13

Tools and service aids

Tools include dumps and traces, while service aids include the other facilities provided for diagnosis.

For z/OS V1R7, the following enhancements have been made to the tools and service aids:

SPZAP SPZAP is a service aid program that operates in problem state. It allows you to dynamically update and maintain programs and data sets. SPZAP can be used to apply fixes to modules or programs that need to be at current levels of the operating system.

SPZAP has been enhanced to support DSNTYPE=LARGE data sets. DSNTYPE=LARGE data sets are like conventional sequential data sets except for the fact that they may span more than 64K tracks per volume.

SADMP You need to make several decisions when planning for a stand-alone dump. You implement most of these decisions when you create the stand-alone dump program, either when you code the AMDSADMP macro, when you assemble the macro, or when you use the SADMP option on the IPCS Dialog.

SADMP is the most fundamental diagnostic tool. The focus in z/OS V1R7 is to get SADMPs captured quickly and effectively when they are needed. Installations that are enlarging the sizes of their LPARs should consider the effect on SADMP production and analysis in their planning.

SDUMP An SVC dump provides a representation of the virtual storage for the system when an error occurs. Typically, a system component requests the dump from a recovery routine when an unexpected error occurs. However, an authorized program, or the operator, can also request an SVC dump when diagnostic dump data is needed to solve a problem.

SDUMP is the preferred dumping tool in MVS via its many faces: DUMP command, SYSMDUMP, and transaction dump. SDUMP is improved in a number of areas and also focused on better analysis aids, partly to help the traditional audience of system programmers and vendor support personnel and partly to help traditional users of formatted dumping tools who are migrating to unformatted dumping at an increasing rate in the last several years.

External trace Transaction trace supports the use of an external writer for processing transaction trace records. An external writer is specified on the initial command that activates transaction trace or is specified standalone while transaction trace is active.

The changes for external trace writing support increased system speed, complexity, and size.

SLIP The SLIP command controls SLIP (serviceability level indication processing), a diagnostic aid that intercepts or traps certain system events and specifies what action to take. Using the SLIP command, you can set, modify, and delete SLIP traps.

IPCS The interactive problem control system (IPCS) is a tool provided in the MVS system to aid in diagnosing software failures. IPCS provides formatting and analysis support for dumps and traces produced by MVS, other program products, and applications that run on MVS.

1.8 Problem analysis with IPCS

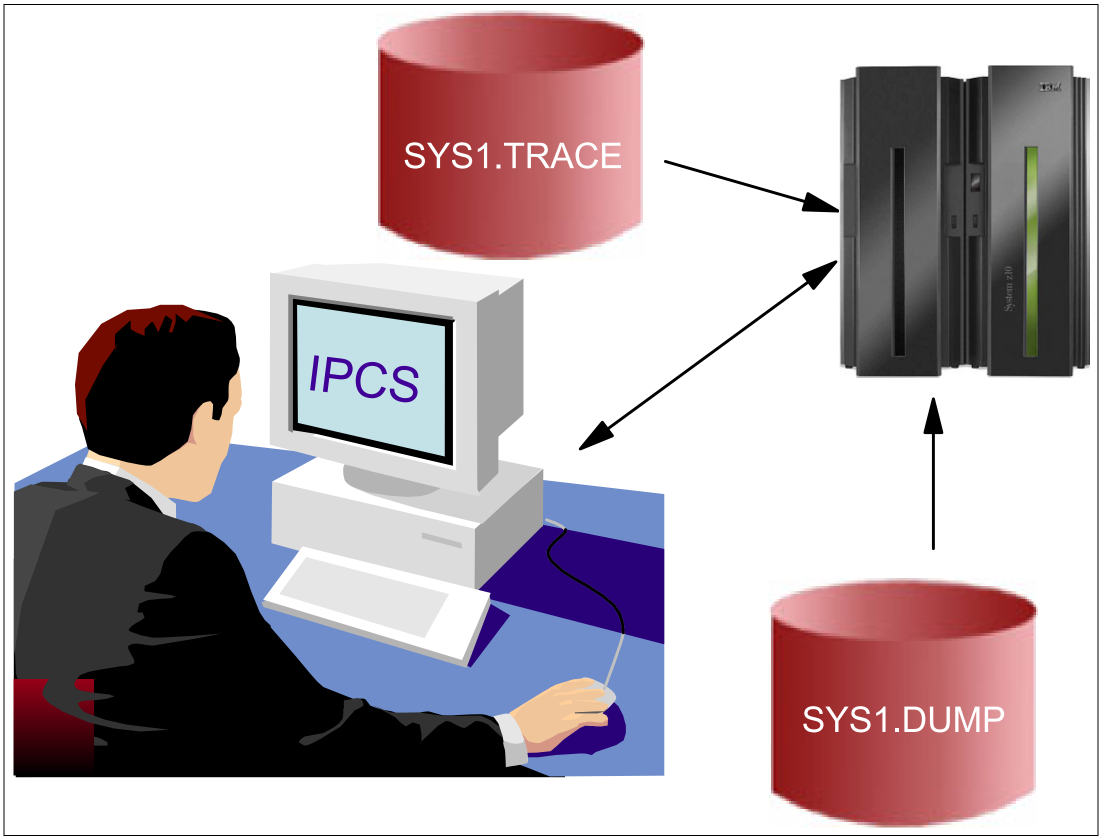

Figure 1-12 Problem determination with IPCS

Dump debug tool IPCS

The most powerful diagnostic tool at your disposal is Interactive Program Control System (IPCS). IPCS is a tool provided in the MVS system to aid in diagnosing software failures. IPCS provides formatting and analysis support for dumps and traces produced by MVS, other program products, and applications that run on MVS. There is an easy way to use IPCS to get search arguments that can be used to look for already known problems.

SVC dumps, stand-alone dumps, and some traces are unformatted and need to be formatted before any analysis can begin. IPCS provides the tools to format dumps and traces in both an online and batch environment. It provides you with commands that will let you interrogate specific components of the operating system, and enables you to review storage locations associated with an individual task or control block. IPCS allows you to quickly review and isolate key information that will assist with your problem determination process.

Some dumps such as CEEDUMP are in a readable format. To debug these dumps you have to browse them.

1.9 Problem analysis with Fault Analyzer

- Fault Analyzer is used to determine why an application abends
- After analyzing information about the application and its environment:
  - Fault Analyzer generates an analysis report
    - The report describes the problem in terms of application code
    - As a result, the reason for the abend is made available sooner and with less effort
- Fault Analyzer performs fault analysis processing, and then records details about the abend in a history file

Figure 1-13 Fault Analyzer

Fault Analyzer

Fault Analyzer is a tool that helps you determine the cause of an application abend. It is a very helpful tool for those having no deep IPCS experience. If you, for example, have to debug a CICS dump, you cannot use base IPCS. For CICS dumps you need to use special CICS-related IPCS commands such as IP VERBX DFHPD660 'KE'. The command is related to the CICS version you were running getting a dump.

The purpose of Fault Analyzer is to determine why an application abends. After analyzing information about the application and its environment, Fault Analyzer generates an analysis report. The report describes the problem in terms of application code, which means that application developers and system programmers are not forced to interpret a low-level system dump or system-level error messages. As a result, the reason for the abend is made known sooner and with less effort.

Fault Analyzer is not in the base pac order. It delivers information about an application when it has abended, to help you assess:

- What happened, and why
- What program
- What line of source code
- What source variables were involved

Fault Analyzer can capture abends in these environments

- z/OS
- IBM CICS
- IBM IMS
- IBM DB2®
- LE (IBM Language Environment®)
- MQSeries
- z/OS UNIX System Services

Side files and compiler listings can be mapped for these IBM compilers

- COBOL
- PL/I
- Assembler
- C/C++

1.10 SMP/E and maintenance

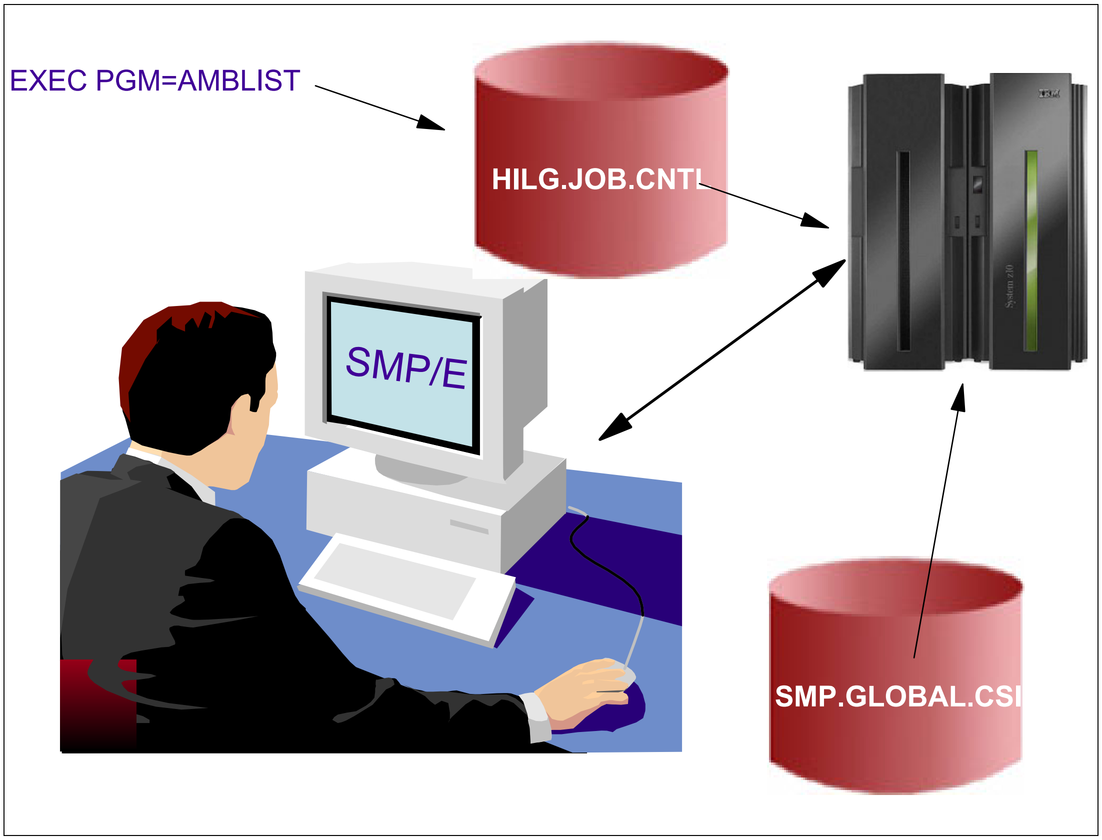

Figure 1-14 Problem determination with SMP/E

Helpful tool and program to get maintenance information

Analyzing a dump you may find that you need a maintenance level for a module you found in the storage area where the problem occurred.

SMP/E is a tool designed for managing the installation of software products on your z/OS system and to track the modifications you make to those products. Usually, it is the system programmer's responsibility to ensure that all software products and their modifications are properly installed on the system. Using SMP/E you can check which maintenance has been installed for different components.

Dump information does not always provide the module name. Instead, it provides the Load Module Name (LMOD). LMOD is a group of modules linked together. To find the module name you are interested in, you need to run the JCL for PGM=AMBLIST. The output can list either the modules or modules and the source. This selection depends on what you are looking for.

PGM=AMBLIST

The AMBLIST service aid prints formatted listings of modules to aid in problem diagnosis. Use it to list the CSECTs in the load module. Use the offset into the load module to identify the CSECT containing the failing instruction. Then subtract the starting address of the CSECT from the instruction address to obtain the offset into the CSECT.

AMBLIST can be used to provide listings showing:

- The attributes of program modules
- The contents of the various classes of data contained in a program module, including SYM records, IDR records, external symbols (ESD entries), text, relocation entries (RLD entries), and ADATA
- A module map or cross-reference for a program module
- The aliases of a program module, including the attributes of the aliases

AMBLIST problem data

AMBLIST provides the following problem data:

- Formatted listing of an object module
- Map of the control sections (CSECTs) in a load module or program object
- List of modifications to the code in a CSECT
- Map of all modules in the link pack areas (LPAs)
- Map of the contents of the DAT-on nucleus (The map no longer represents the IPL version and message AMB129I will be issued.)

1.11 Using SMP/E and dumps

- Use SMP/E to verify product and PTF levels
  - Use the SMP/E CSI GZONE query
    - Displays FMIDs in global zone data sets
  - CROSS-ZONE QUERY
    - Maintenance levels for load modules
- IPCS can be used for operating system releases
  - Format the CVT with the CBFORMAT command
    - Release levels and FMIDs
  - Product maintenance levels
    - CICS - VERBX DFHPD530 'LD=1'
    - DB2 - run DIAGNOSE DISPLAY MEPL utility

Figure 1-15 Using SMP/E and dumps for release and product information

Using SMP/E

In z/OS, SMP/E can be used to verify product and PTF levels. SMP/E is used to manage and maintain information related to system and product installation and maintenance. With SMP/E you can interrogate what has been installed into the product libraries, but this does not necessarily reflect what has been migrated to a production environment. So take care when assuming that the maintenance that is supposed to have fixed a problem, has actually been moved into the production data sets.

SMP/E does not manage the migration of upgrades. Figure 1-16 on page 24 shows the result of an SMP/E CSI GZONE query. This displays the Function Modification Identifiers (FMIDs), or, more specifically, product components that have been received into the global zone data sets. This is the first installation level. The next is to APPLY the product or maintenance into the TARGET libraries, then finally ACCEPT the product or maintenance into the DLIBs, or distribution libraries.

```
 Entry Type:  GZONE                                        Zone Name: GLOBAL
 Entry Name:  GLOBAL                                       Zone Type: GLOBAL

 Default OPTIONS: CICSOPT     Related Zone:



        -------- -------- -------- -------- -------- -------- --------
ZONES    CIC22DZ  CIC22TZ
SRELS    C150
FMIDS    DELCIPM  HBDD110  HCCV320  HCI6200  HCMZ100  HCMZ110  HCMZ200
         HCP2200  H0B5110  H0B7110  H0Z2110  H24D120  H24D130  JCCV32B
         JCI620D  JCI6201  JCI6202  JCI6203  JCMZ111  JCMZ130  JCMZ201
         JCMZ230  JCP2202
```

Figure 1-16 SMP/E SMPCSI query for the GLOBAL zone

CROSS-ZONE QUERY

The SMP/E CROSS-ZONE QUERY panel lets you interrogate the maintenance level of a specific module or load module. Figure 1-17 shows an example of a cross-zone query request against the DFHSMGF module. This shows us that in the target library this module has an RMID level of UQ68396, which means that a PTF (UQ68396) has been applied to this module.

```
Entry Type:  MOD
Entry Name:  DFHSMGF

To return to the previous panel, enter END.

To select an entry from a zone, enter S next to the zone.

     * - Entry not found in zone.
    ** - Zone could not be allocated or is not initialized.

          -------------------- Status -----------------------------------
   ZONE     FMID     RMID     LASTUPD  DISTLIB  UMID(S)
   -------- -------- -------- -------- -------- -------- -------- --------
   CIC22DZ  HCI6200  HCI6200  HCI6200  ADFHMOD
   CIC22TZ  HCI6200  UQ68396  HCI6200  ADFHMOD
   GLOBAL   *
```

Figure 1-17 SMP/E Cross-Zone Query for a MODule

Note: What is reflected in the SMP/E environment does not necessarily reflect what is running in your problem system environment. It shows what maintenance has been received, applied, and accepted, but does not show what libraries or data sets have been migrated to higher-level systems.

Getting release information from the dump

IPCS, the Interactive Problem Control System, which we discuss later, can also be used to verify the operating system or product release, as well as abend symptom data as follows: Using IPCS, we can format the Communication Vector Table (CVT) to determine the release of z/OS that is running. The IPCS command that can be used is the CBFORMAT command, which means Control Block Format, and is usually abbreviated as CBF. Figure 1-18 shows the result of an IPCS CVT format.

```
CBF CVT
CVT: 00FDCA48
-0028  PRODN.... SP7.1.3   PRODI.... HBB7780   VERID....   MDL...... 2094
```

Figure 1-18 IPCS Communication Vector Table format

This is the first line of the formatted CVT control block and tells us that we are running z/OS V7R1, as indicated by the PRODN value, SP7.1.3, and the FMID for this release of z/OS is HBB7780, as indicated in the PRODI field. The MDL field indicates that this version of z/OS is running on a 2094 processor.

In CICS, if we format the dump using IPCS VERBX DFHPD650 'CSA=2' we can review the data at offset x'9F' which displays the CICS release level; for example, 65 or 66. The DFHPDxxx option is related to the CICS level.

```
CSA=2

=== SUMMARY OF ACTIVE ADDRESS SPACES


     ASID(hex):         JOBNAME:
     0052               EHPCIC3
*****************************************
CSA 0004F200 Common System Area

0090  00000224 00000000 001E001E E712E765
```

Figure 1-19 IPCS VERBX DFHPD650 'CSA=2' output

We can also interrogate the maintenance that has been applied to modules using IPCS as follows:

In CICS, for example, issue the IPCS command IPCS VERBX DFHPD650 'LD=1' and locate the PROGRAM STORAGE MAP. Figure 1-20 shows an example of an IPCS format of the CICS Loader domain.

```
DFHCSA   8004F200 DFHKELCL 0004E000 650  HCI6500  06/05/07 05.51
                  -noheda- 0004E4F8
                  DFHKELRT 0004E500 650  HCI6500  06/05/07 05.51
                  -noheda- 0004E8F8
                  DFHCSAOF 0004E900 0650 HCI6500  I  05/06 06.53
                  DFHCSA   0004F000 0650 HCI6500  I  05/06 06.53
                  DFHKERRI 0004F4B0 650  UK58217  06/24/10 12.15
                  DFHKERCD 0004F9C8 650  HCI6500  06/05/07 05.51
                  DFHKERER 0004FCB0 650  HCI6500  06/05/07 05.51
                  DFHKESFM 0004FF40 650  HCI6500  06/05/07 05.52
                  DFHKESGM 00050408 650  HCI6500  06/05/07 05.52
```

Figure 1-20 CICS IPCS format of the Loader domain

In DB2 you can run the DIAGNOSE DISPLAY MEPL utility to format the module information. Figure 1-21 shows an example of the DB2 Diagnose Display MEPL process.

```
*....DSNAA   10/22/9811.44   ....*
*....DSNAPRH 07/10/9813.28   ....*
*....DSNFMNFM07/10/9814.38   ....*
*... DSNFPMSG07/10/9814.42   ....*
*....DSNFSAMG07/10/9814.42   ....*
*....DSNUBBCD09/30/9814.29   ....*
*....DSNUBBCM06/11/02UQ66957 ....*
*....DSNUBBCR08/20/02UQ69047 ....*
*... DSNUBBID08/29/02UQ69311 ....*
*....DSNUBBOP12/02/01UQ60569 ....*
*....DSNUBBRD04/27/99UQ29552 ....*
*....DSNUBBUM01/17/02UQ61891 ....*
```

Figure 1-21 DB2Diagnose Display MEPL output

1.12 SDSF and RMF

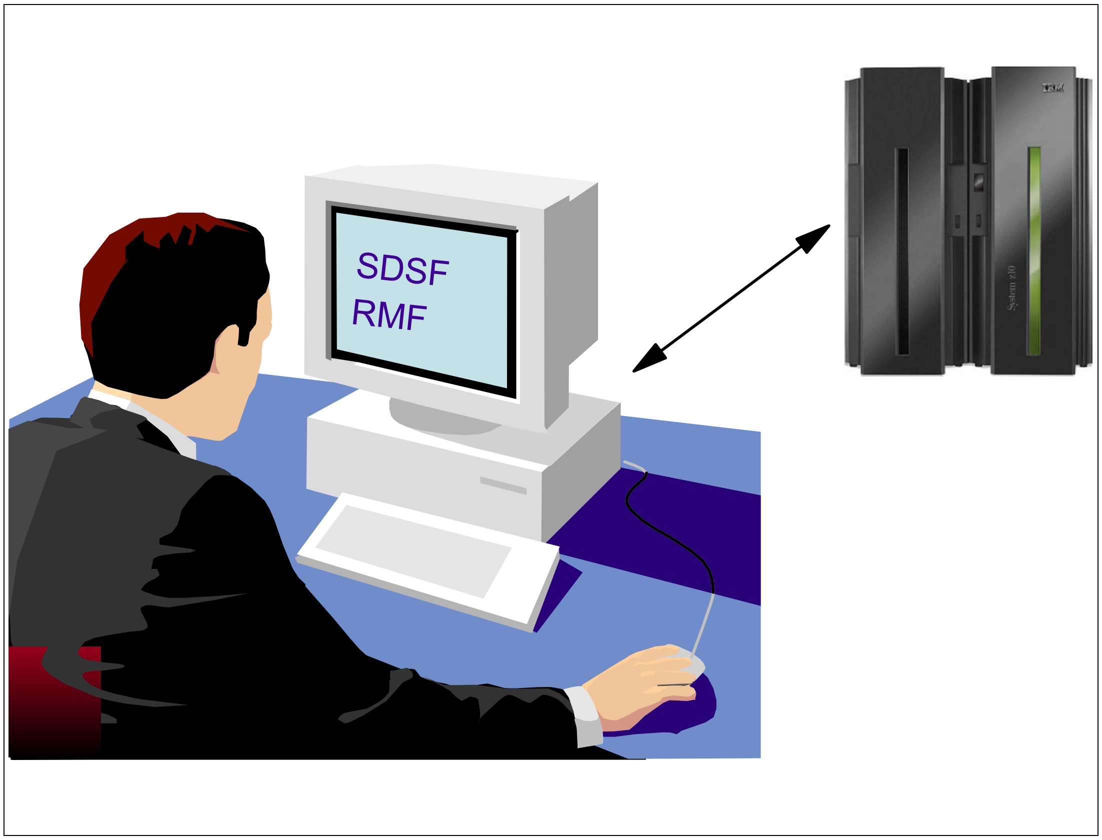

Figure 1-22 Problem determination with SDSF

System Display and Search Facility (SDSF)

SDSF is a program that runs on TSO/E and uses Interactive System Productivity Facility (ISPF) panels.

SDSF provides a powerful and secure way to monitor, manage and control your z/OS sysplex. Its easy-to-use interface lets you control the following:

- Jobs and output
- Devices, such as printers, readers, lines, and spool offloaders
- System resources, such as WLM scheduling environments, the members of your JES2 MAS, and JES2 job classes
- System log and action messages

Resource Measurement Facility (RMF)

IBM RMF™ is designed to ease the management of single or multiple system workloads and to enable faster reaction to system delays. Detecting a possible bottleneck early means that corrective actions can be taken earlier. System delays are avoided or at least remedied at an early stage.

Using RMF for problem analysis

Use output from RMF, SMF, or another system monitoring program to look for problems. Find someone in your installation who is familiar with the program and can interpret the output. Some of the kinds of problems you should look for are:

- A program using a lot of storage, whether it is real, virtual, auxiliary or extended storage
- Data set contention
- ENQ contention
- Tuning problems
- System running over capacity

2

Problem resolution steps

As a system programmer the important part of your job is to keep your system running and avoid application slowdowns or outages. If an error or problem occurs you should be able to collect all necessary information and documentation to fix it or to ask for assistance providing the collected documentation. If you need IBM support you should provide also a severity indication depending on the system impact. You should be able to find a search argument according to the error information to check for known problems or calling IBM support center.

The following problem resolution steps provide a debug guideline:

- Identifying and document the problem
- Prioritize the problem
- Analyze the problem and ask for assistance if necessary
- Implement the resolution and close the problem

2.1 Identifying a problem

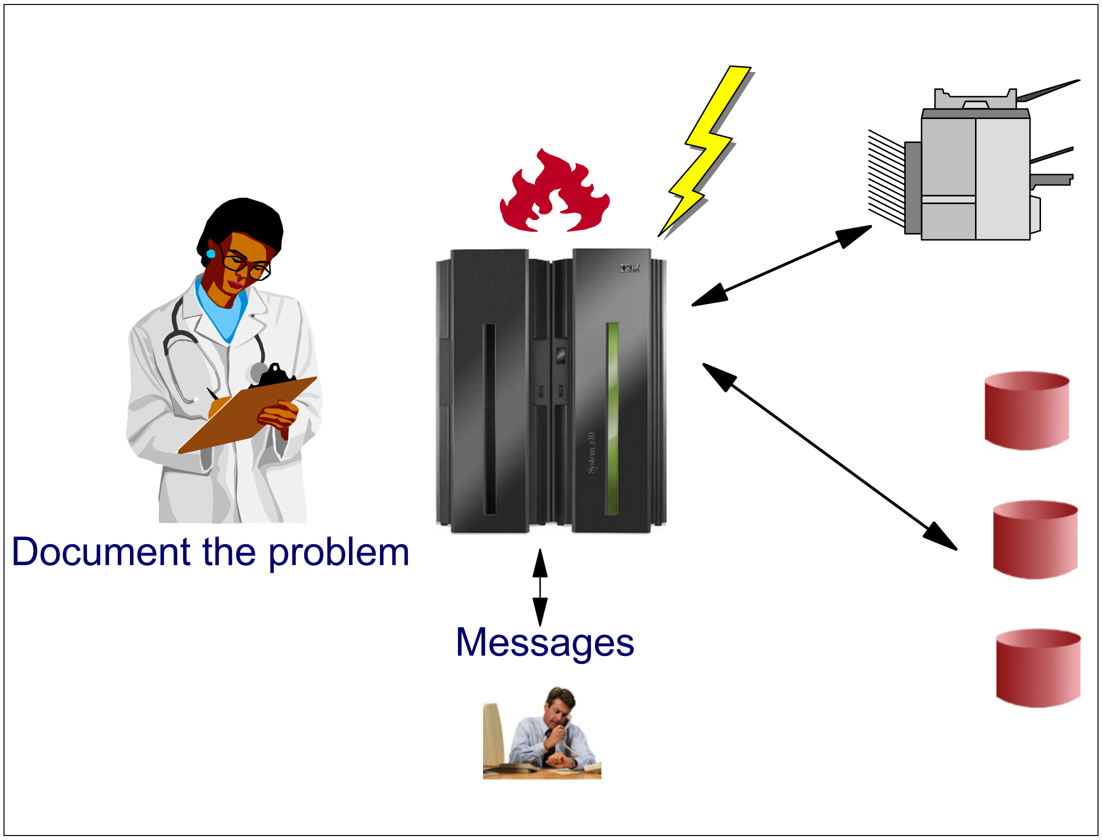

Figure 2-1 Identifying a problem

What caused the problem

Depending on the system or application impact in case of an error, the most important questions you must ask include:

- Is the process that is causing the problem a new procedure, or has it worked successfully before?
- If it was an existing procedure that was previously successful, what has changed?
- What messages are being generated that could indicate what the problem is? These could be presented on the terminal if the process is conversational, or in the batch or subsystem job log, or in the system log (SYSLOG).

> **Note:** Review the *z/OS MVS System Messages*, SA22-763x and *z/OS MVS Systems Codes*, SA22-7626 manuals.

- Can the failure be reproduced, and if so what steps are being performed?
- Has the failing process generated a dump?

All of these questions will enable you to develop an appropriate plan of action to aid with the resolution. You can never be criticized for providing too much diagnostic data, but too little information only delays the solving of the problem.

Document the problem

Documentation of the problem and the analysis steps taken can assist with not only initial resolution, but will also assist if the problem occurs again. For larger more complex problems regular documentation during the analysis process can highlight areas that will become more crucial as the investigation progresses. This will enable you to develop a flow chart and reference point listing that can be referred to throughout your analysis. Document the final resolution for future reference.

Identifying the problem

A system problem can be described as any problem on your system that causes work to be stopped or degraded. The steps involved in diagnosing these problems are different for each type of problem.

Before you can begin to diagnose a system problem, however, you have to know what kind of problem you have. To identify a system problem, look at the following:

- System processing witnessed by the operator.
- The dump, in which the system records information about the system problem. It is important to remember that the error triggering a dump might be a symptom itself, and the information needed to diagnose the root cause might not be captured in that dump. Depending on what type of dump the system or the operator takes, you can determine the type of system problem you need to diagnose and whether you will need to collect additional data.
- The logrec data set, which contains a history of the errors encountered by the system.
- The console log.
- Operlog

2.2 Prioritize problem resolution

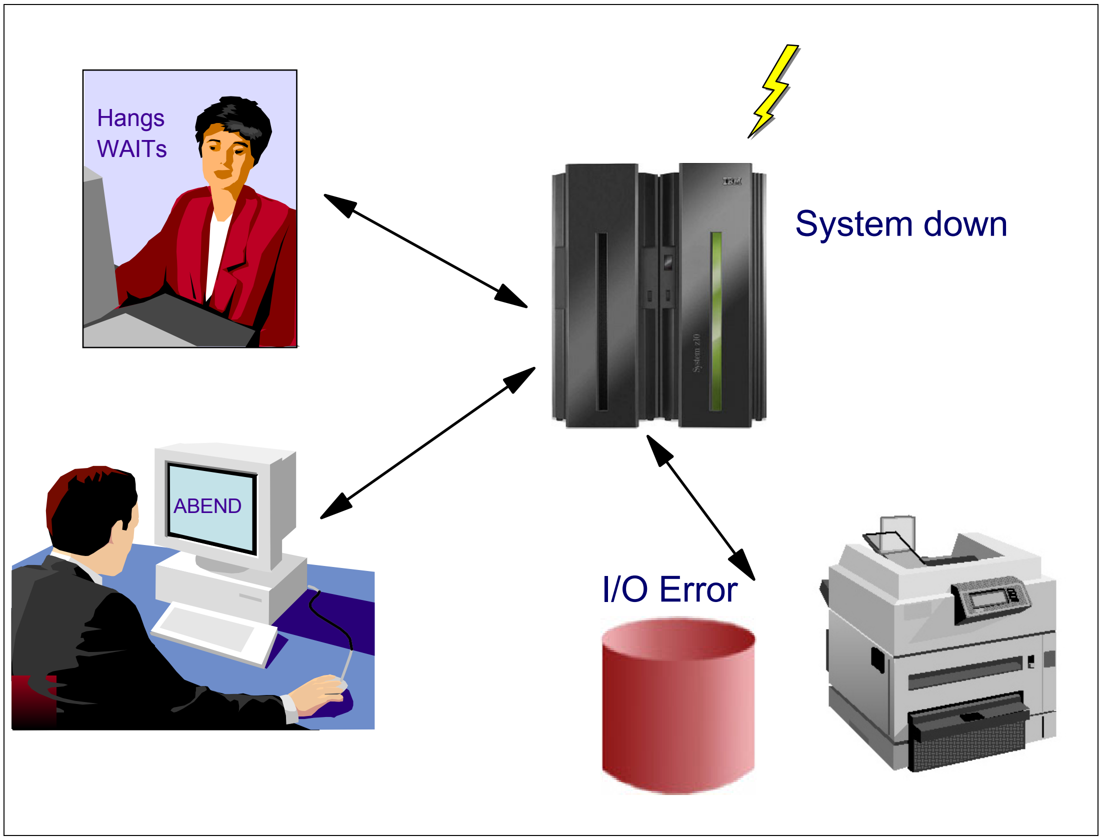

Figure 2-2 Prioritize problem resolution

Prioritize problem resolution

Your prime objective as a system programmer is to ensure system availability, and in the event of a major subsystem failure, for example, a Customer Information Control System (CICS) failure, or worse still the whole z/OS system, your focus will be on the speedy restoration of the system.

Subsystem failures will often generate their own diagnostic data, and the recovery process is often fairly straightforward. These systems will generally perform cleanup processes during recovery and thereby restore system availability. If the subsystem fails during recovery, then immediate problem analysis and resolution will be required.

System down

The worst-case scenario is that your complete z/OS system is down. Swift system recovery is required, but a decision must be made to determine whether the currently preserved main storage should be dumped via a stand-alone dump routine prior to the recovery Initial Program Load (IPL). The IPL process clears main storage; therefore, any failure information will be lost. The stand-alone dump process will take some time but could be extremely valuable should the problem reoccur.

System programmer actions

Depending on the nature of the problem, system programmers can take actions related to the type of problem that has occurred.

Abend
: Review the dump to determine if further diagnosis is required.

  Review system messages to determine the abend's impact on the installation.

Hang or WAIT
: Use the DUMP command to obtain an SVC dump. If the SVC dump does not provide the necessary information, ask the operator to take a stand-alone dump.

I/O error
: Have the operator check to see whether the system console is responsive. If it is not, take a stand-alone dump. If it is, take an SVC dump of the user's address space.

LOOP
: Depending on what loop we got, enabled or disabled, Console or SA dump should be looked at.

High CPU
: If you recognize TSO user eating up CPU more than expected, you may cancel him

2.3 Problem severity

- IBM Support Center
  - Severity of problem - report to IBM
- Four severity levels
  - Severity 1 (SEV 1)
  - Severity 2 (SEV 2)
  - Severity 3 (SEV 3)
  - Severity 4 (SEV 4)

Figure 2-3 Reporting the severity of a problem to the IBM Support Center

Report problems to IBM

When you need to report a problem to the IBM Support Center, you will be asked what the severity of the problem is. We set severity from SEV-1 (highest severity, meaning worst problems) to SEV-4 (lowest severity, meaning least important problems). It's important to be realistic when reporting the severity of an issue, so we can prioritize it properly.

Severity 1 (SEV 1)

Production system down, critical business impact, unable to use the product in a production environment, no workaround is available.

Severity 2 (SEV 2)

Serious problem that has a significant business impact; use of the product is severely limited, but no production system is continuously down. SEV-2 problems include situations where customers are forced to restart processes frequently, and performance problems that cause significant degradation of service but do not render the product totally unusable. In general, a very serious problem for which there is an unattractive but functional workaround would be SEV-2, not SEV-1.

Severity 3 (SEV 3)

Problems that cause some business impact but that can be reasonably circumvented; situations where there is a problem but the product is still usable. For example, short-lived problems or problems with components that have failed and then recovered and are back in normal operation at the time the problem is being reported. The default severity of new problem reports should be SEV-3.

Severity 4 (SEV 4)

This severity is for minor problems that have minimal business impact. While we are all aware of the pressure that customers and management place on the speedy resolution of their problems, the correct problem severity enables all involved support teams to react to and manage the problems according to the “real” severity of the problem. While a “customer is unhappy SEV1” is in many cases valid for business reasons, it does not preclude the fact that a customer with a “production system down SEV1” is more important.

2.4 Analyze a problem - ask for assistance

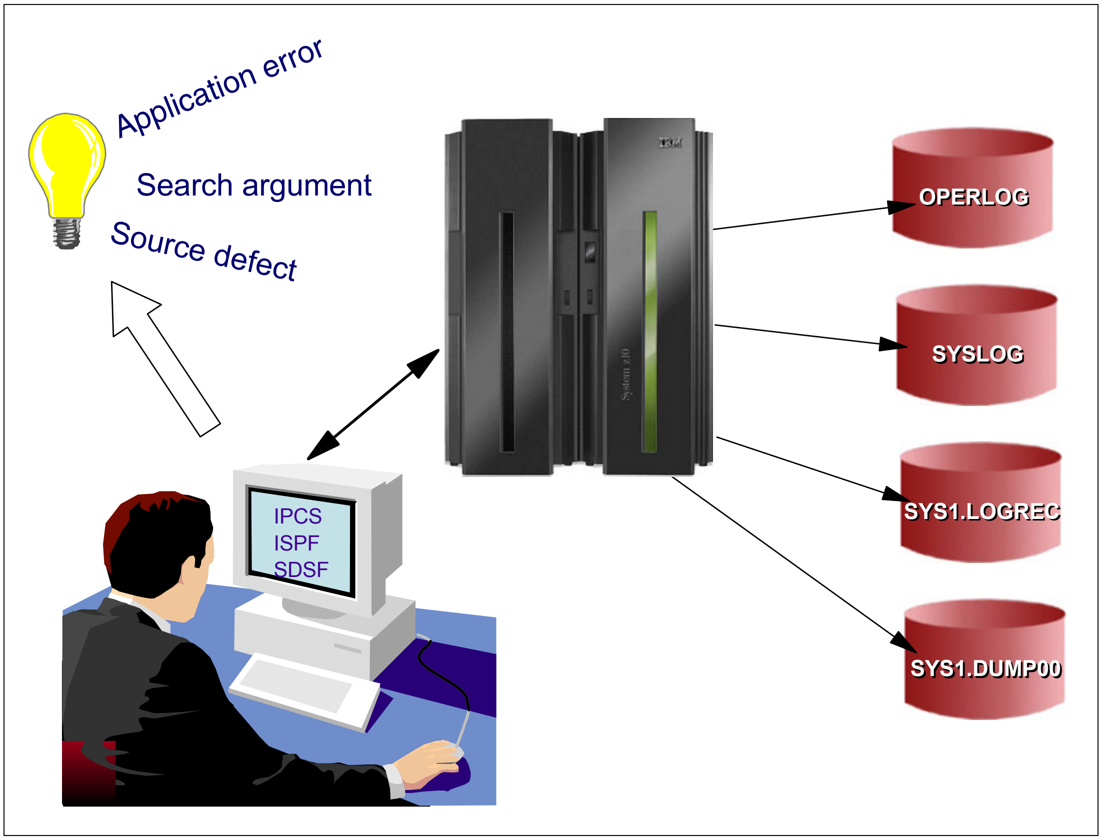

Figure 2-4 Analyze a problem

Analyze the problem

Before you start the process of what could be described as the more complex analysis procedures, you should review all of the data you currently have that may solve your problem. Have you:

1. Looked in the system log for any relevant messages or abend information?
2. Looked in the job log for any relevant messages or abend information?
3. Reviewed the meanings of any messages or codes in the relevant manuals?
4. Reviewed the system error log, SYS1.LOGREC, which contains information about hardware and software failures?

Problem analysis

Problem analysis is, like any process, a skill that develops the more you use it. Of course, problems vary in their complexity and frequency, and it is possible that tasks requiring this type of review may be infrequent in your environment. The ultimate aim is to have little need to perform complex problem diagnosis. This is why a sound methodology is necessary to assist with your analysis.

It is necessary to retain a focus during the analysis process and be aware that there are often alternative ways to approach a problem. To ask for assistance with a problem is not a sign of failure, but an indication you are aware that another person's views could speed up the resolution. A fresh idea can often stimulate and enhance your thought processes.

Solving a problem

Solving a problem is a combination of:

1. Your ability to understand the problem.
2. The quality of the diagnostic data you can review.
3. Your ability to use the diagnostic tools at your disposal.

Ask for assistance

You will hopefully be aware that some assistance may be required when you are making little progress with your diagnosis. What you and your manager are seeking is a speedy resolution, and it is far more professional to use all the facilities and technical expertise available. The IBM Support Center is there to assist you with your problems and the diagnostic data you have collected, and the analysis steps you have already performed will be of great help to the Support Center when they review the problem.

2.5 Gather Messages and Logrec

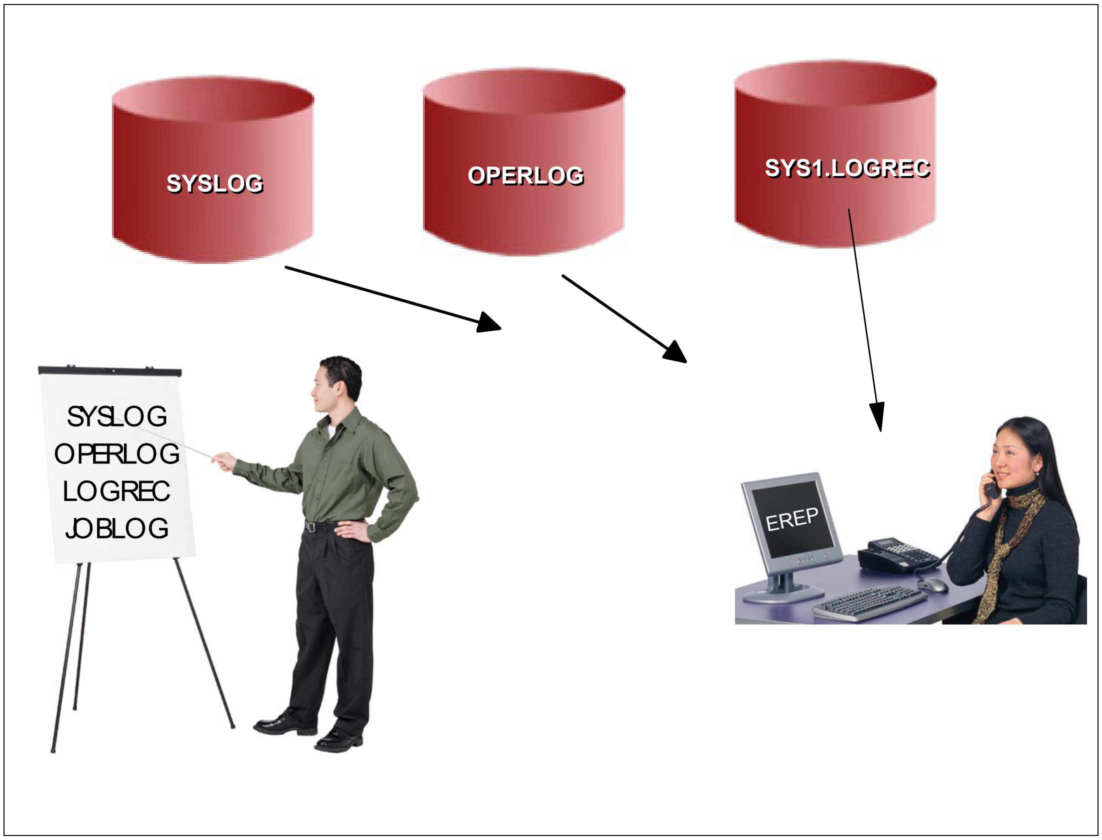

Figure 2-5 Gather messages and logrec

Gathering information

Often, the most readily available source of data identifies the key piece of information that will resolve the problem, and often, this source of data is overlooked. The first places to look when reviewing a problem are:

- The console log
- The system log
- An error log related to a specific product
- The whole system

While a system dump or a trace is often required, the logs may provide enough detail to solve the problem. The location of the relevant logs varies from product to product, and system to system.

Collect and analyze messages and logrec records about the problem. Look at any messages or software, symptom, and hardware records for logrec around the time of the problem.

Diagnostic data sources

The main sources of diagnostic data are contained in the messages provided by the system in the following logs:

- Console log

  Messages sent to a console with master authority are intended for the operators. The system writes in the hard-copy log all messages sent to a console, regardless of whether the message is displayed.

- SYSLOG

  The SYSLOG is a SYSOUT data set provided by the job entry subsystem (either JES2 or JES3). SYSOUT data sets are output spool data sets on direct access storage devices (DASD). An installation should print the SYSLOG periodically to check for problems. The SYSLOG consists of the following:

  – All messages issued through WTL macros
  – All messages entered by LOG operator commands
  – Usually, the hard-copy log
  – Any messages routed to the SYSLOG from any system component or program

- Job log

  Messages sent to the job log are intended for the programmer who submitted a job. Specify the system output class for the job log in the MSGCLASS parameter of the JCL JOB statement.

- OPERLOG

  Operations log (OPERLOG) is an MVS system logger application that records and merges messages about programs and system functions (the hardcopy message set) from each system in a sysplex that activates OPERLOG. Use OPERLOG rather than the system log (SYSLOG) as your hardcopy medium when you need a permanent log about operating conditions and maintenance for all systems in a sysplex.

- Hard-copy log

  The hard-copy log is a record of all system message traffic:

  – Messages to and from all consoles
  – Commands and replies entered by the operator

  In a dump, these messages appear in the master trace. With JES3, the hard-copy log is always written to the SYSLOG. With JES2, the hard-copy log is usually written to the SYSLOG but can be written to a console printer, if the installation chooses.

- Logrec

  Logrec log stream is an MVS System Logger application that records hardware failures, selected software errors, and selected system conditions across the sysplex. Using a logrec log stream rather than a logrec data set for each system can streamline logrec error recording.

2.6 SYSLOG processing

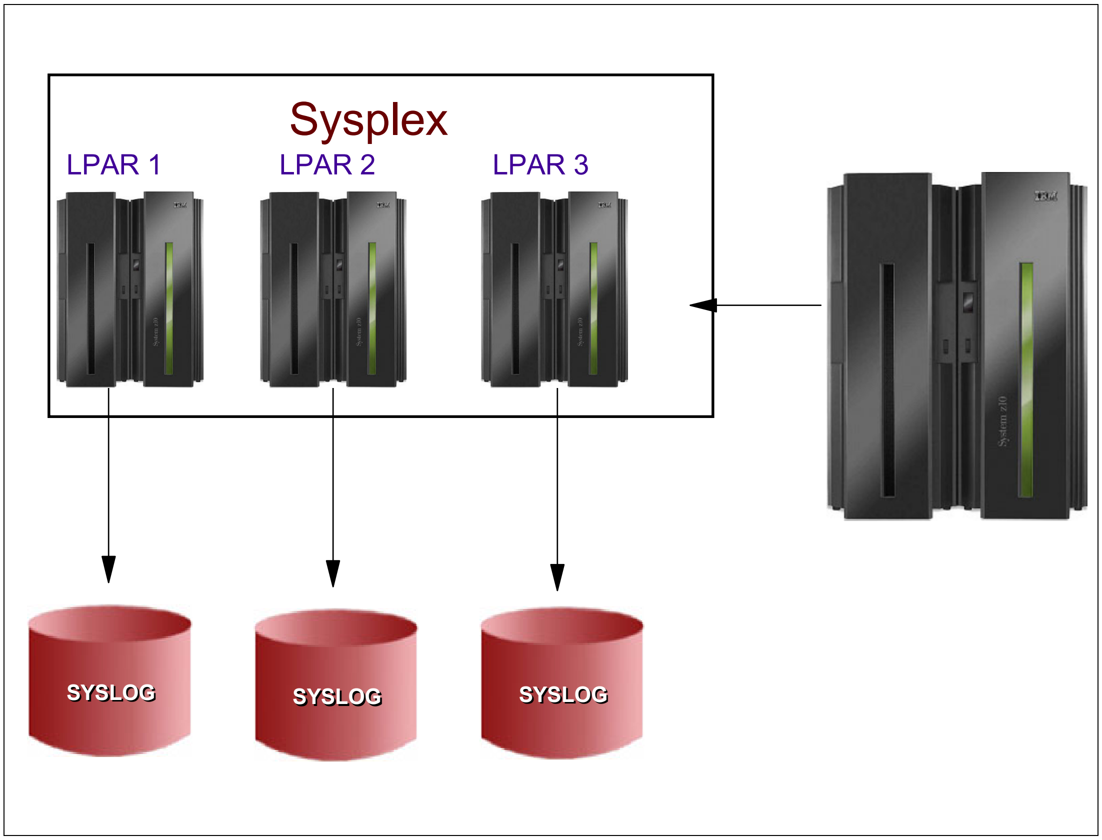

Figure 2-6 SYSLOG processing

SYSLOG processing

The system log (SYSLOG) is a direct access data set that stores messages and commands. It resides in the primary job entry subsystem's spool space. It can be used by application and system programmers (through the WTL macro) to record communications about programs and system functions. You can use the LOG command to add an entry to the system log.

Several kinds of information can appear in the system log:

- Job time, step time, and data from the JOB and EXEC statements of completed jobs entered by user-written routines
- Operating data entered by programs using a write to log (WTL) macro instruction
- Descriptions of unusual events that you enter using the LOG command
- The hardcopy message set

On z/OS, the SYSLOG can be viewed via the Spool Display and Search Facility (SDSF) using the LOG option. A small amount of the SYSLOG is also stored in memory and is included when an address space is dumped. This is referred to as master trace (MTRACE) data and can be accessed via the IPCS using the VERBX MTRACE command.

2.7 SYSLOG messages

```
N 0000000 SC75     2011249 08:25:29.45          00000290  IEF196I IEF285I   SYS1
N 0000000 SC75     2011249 08:25:29.45          00000290  IEF196I IEF285I   VOL
N 0000000 SC75     2011249 08:28:50.72 JES3     00000090  IAT6395 00002 REQUEST(
M 4040000 SC75     2011249 08:29:29.30 HZSPROC  00000090  HZS0002E CHECK(IBMXCF,
D                                           287 00000090  IXCH0448E System SC75
E                                           287 00000090  coupling facility CF7A
M 4040000 SC75     2011249 08:29:29.38 HZSPROC  00000090 *HZS0003E CHECK(IBMXCF,
E                                           288 00000090  IXCH0242E One or more
M 4040000 SC75     2011249 08:29:34.92 HZSPROC  00000090  HZS0002E CHECK(IBMXCF,
D                                           289 00000090  IXCH0220E The number o
E                                           289 00000090  systems in the sysplex
M 4040000 SC75     2011249 08:30:09.36 HZSPROC  00000090  HZS0002E CHECK(IBMXCF,
D                                           290 00000090  IXCH0210E One or more
E                                           290 00000090  either ALLOWED or ENAB
N 0000000 SC75     2011249 08:30:34.31          00000290  IEE252I MEMBER BPXPRM3
N 0000000 SC75     2011249 08:30:34.39          00000290  IEF196I IEF285I   SYS1
N 0000000 SC75     2011249 08:30:34.39          00000290  IEF196I IEF285I   VOL
N 0000000 SC75     2011249 08:30:34.39          00000290  IEF196I IEF285I   CPAC
N 0000000 SC75     2011249 08:30:34.39          00000290  IEF196I IEF285I   VOL
N 0000000 SC75     2011249 08:30:34.39          00000290  IEF196I IEF285I   SYS1
N 0000000 SC75     2011249 08:30:34.39          00000290  IEF196I IEF285I   VOL
```

Figure 2-7 Examples of SYSLOG messages

SYSLOG messages

Figure 2-7 shows an example of the ZOS SYSLOG. The time stamps that would normally be seen to the left of the data shown in the bottom half of the figure are shown in the top part of the figure.

Message description

The system log (SYSLOG) is a data set residing in the primary job entry subsystem's spool space. It can be used by application and system programmers to record communications about problem programs and system functions. The operator can use the LOG command to add an entry to the system log.

Note: You can change the SYSLOG data set characteristics dynamically through the dynamic allocation installation exit. See *z/OS MVS Installation Exits*, SA22-7593.

SYSLOG is queued for printing when the number of messages recorded reaches a threshold specified at system initialization. The operator can force the system log data set to be queued for printing before the threshold is reached by issuing the WRITELOG command.

Message IEC070I

When the IEC070I message is displayed, a description of the first message follows the messages:

```
IEC070I 203-204,RMFGAT,RMFGAT,SYS00753,3E14,SBOX01,RMF3.SC70.B, 808
IEC070I RMF3.SC70.B.DATA,UCAT.VSBOX01
------------------Message description--------------------------
IEC070I rc[(sfi)]- ccc,jjj,sss,ddname,dev,volser,xxx,dsname,cat
```

IEC070I message description

Explanation: An error occurred during EOV (end-of-volume) processing for a VSAM data set.

In the message text:

- 203 is the return code (rc). This field indicates the specific cause of the error. For an explanation of this return code, see message IEC161I.
  - `sfi` is the subfunction information (error information returned by another subsystem or component). This field appears only for certain return codes, and its format is shown with those codes to which it applies. When a catalog LOCATE request fails, this field appears for return code 032 or 034.
- 204 is a problem-determination function (PDF) code. The PDF code is for use by the IBM Support Center if further problem determination is required. If the PDF code has meaning for the user, it is documented with the corresponding reason code (rc).
- RMFGAT (`ccc`) is the job name.
- RMFGAT (`sss`) is the step name. If the step is part of a procedure, this field contains an eight-character procedure step name, with trailing blanks, followed by the name of the job step that called the procedure, without trailing blanks. The two names are not separated by a comma.
- SYS00753 (`ddname`) is the data definition (DD) name.
- 3E14 (`dev`) is the device number, if the error is related to a specific device.
- SBOX01(`volser`) is the volume serial number, if the error is related to a specific volume.
- RMF3.SC70.B (`xxx`) is the name of the cluster that contained the data set being processed when the error was detected, or when not available, the data set name specified in the DD statement indicated in the access method control block (ACB).
- RMF3.SC70.B.DATA (`dsname`) is the name of the data set being processed when the error was detected.
- UCAT.VSBOX01 (`cat`) is the catalog name.

System programmer response

If the error recurs and the program is not in error, look at the messages in the job log for more information. Search problem reporting databases for a fix for the problem. If no fix exists, contact the IBM Support Center. Provide all printed output and output data sets related to the problem.

2.8 OPERLOG (operations log)

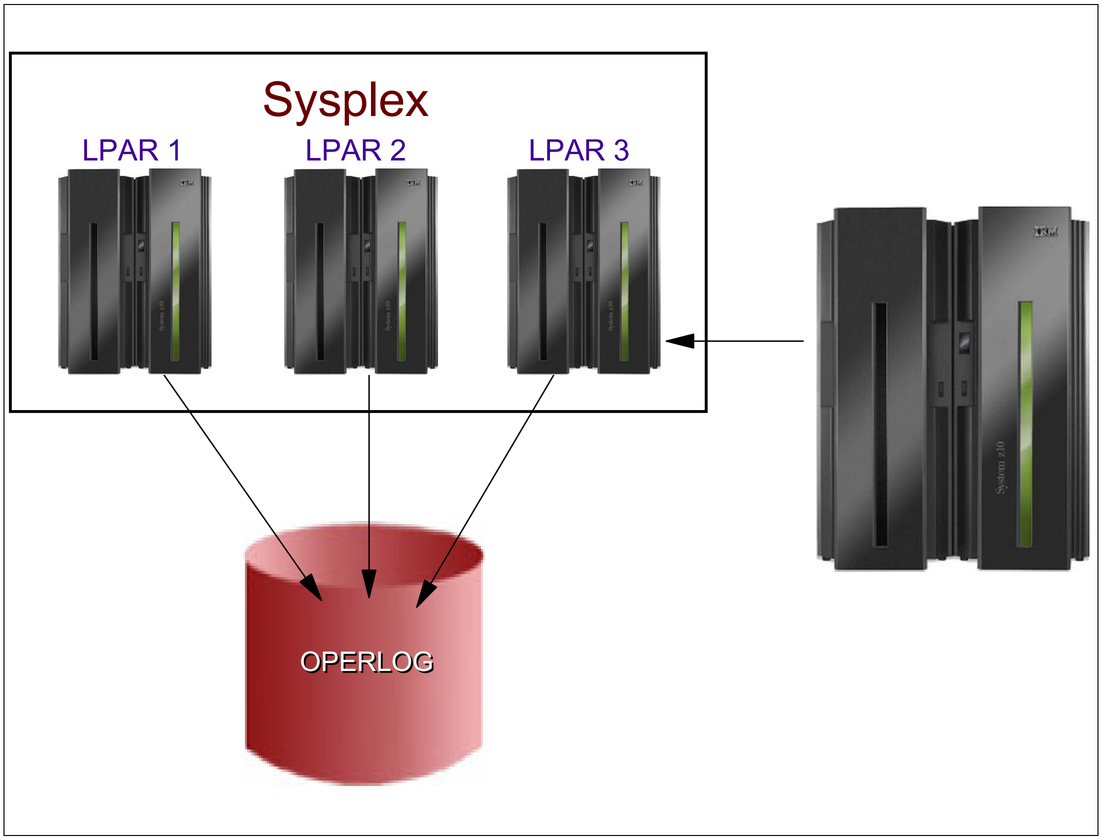

Figure 2-8 OPERLOG processing

OPERLOG

The operations log (OPERLOG) is a log stream that uses the system logger to record and merge communications about programs and system functions from each system in a sysplex. The operations log is operationally independent of the system log. An installation can choose to run with either or both of the logs. If you choose to use the operations log as a replacement for SYSLOG, you can prevent the future use of SYSLOG.

You can use the operations log (OPERLOG) to record messages and commands from all the systems in a sysplex. The operations log centralizes log data in a sysplex. The OPERLOG panel displays the data from a log stream, a collection of log data used by the MVS System Logger to provide the merged, sysplex-wide log.

OPERLOG message

Following is a message from the OPERLOG, the same message described in Figure 2-7 on page 41.

```
M 0020000 SC70     2005185 19:40:01.33 RMFGAT    00000090
E                                           808 00000090
-----------------------------------------------------------------------
IEC070I 203-204,RMFGAT,RMFGAT,SYS00753,3E14,SBOX01,RMF3.SC70.B
IEC070I RMF3.SC70.B.DATA,UCAT.VSBOX01
```

2.9 Job error logs

```
NP   DDNAME   StepName ProcStep DSID Owner
     JESJCLIN                      1 CICSTS
     JESMSGLG JES2                 2 CICSTS
     JESJCL   JES2                 3 CICSTS
     JESYSMSG JES2                 4 CICSTS
     $INTTEXT JES2                 5 CICSTS
     CAFF     SCSCPAA1           101 CICSTS
     CINT     SCSCPAA1           103 CICSTS
     DFHCXRF  SCSCPAA1           104 CICSTS
     COUT     SCSCPAA1           105 CICSTS
     CEEMSG   SCSCPAA1           106 CICSTS
     CEEOUT   SCSCPAA1           107 CICSTS
     PLIMSG   SCSCPAA1           108 CICSTS
     CRPO     SCSCPAA1           109 CICSTS
     MSGUSR   SCSCPAA1           110 CICSTS
```

Figure 2-9 Display of CICS SYSOUT data sets obtained with the SDSF DA operand

Job error log data sets

Each individual product has its own log file on the z/OS platform that may contain data that may be valuable when diagnosing a problem. It is particularly important to look for events that precede that actual failure, because the problem, in many cases, will have been caused by a previous action. Figure 2-9 shows the SYSOUT data sets that might be associated with a CICS address space.

The key SYSOUT data sets to review that may provide problem determination data are:

JESMSGLG and MSGUSR

The following data sets will contain Language Environment (LE) problem data usually associated with application problems:

CEEMSG and CEEOUT

MSGUSR data set

Figure 2-10 on page 45 shows an example of some transaction abend data included in the MSGUSR SYSOUT data set.

```
DFHIR3783 04/11/2005 01:25:50 SCSCPTA2 Transaction SX2 termid E39 -
Connected transaction abended with message DFHAC2206 01:25:50 SCSCPAA4
Transaction SX2
failed with abend AFCV. Updates to local recoverable resources backed out.
DFHAC2236 04/11/2005 01:25:50 SCSCPTA2 Transaction SX2 abend AZI6 in program
*UNKNOWN
term PB09. Updates to local recoverable resources will be backed out.
DFHAC2262 04/11/2005 01:25 (sense code 0824089E).
DFHAC2206 01:25:50 SCSCPAA4 Transaction SX2 failed with abend AFCV.
Updates to local recoverable resources backed out.
```

Figure 2-10 CICS MSGUSR SYSOUT data set sample data

JESMSGLG data set

The CICS JESMSGLG SYSOUT data set includes information related to CICS startup and errors related to system problems, not specifically transaction related. Figure 2-11 is a sample taken from the CICS JES Message Log (JESMSGLG).

```
+DFHTR0103 TRACE TABLE SIZE IS 64K
+DFHSM0122I SCSCPTA2 Limit of DSA storage below 16MB is 5,120K.
+DFHSM0123I SCSCPTA2 Limit of DSA storage above 16MB is 60M.
+DFHSM0113I SCSCPTA2 Storage protection is not active.
+DFHSM0126I SCSCPTA2 Transaction isolation is not active.
+DFHSM0120I SCSCPTA2 Reentrant programs will not be loaded into read-only
storage
+DFHDM0101I SCSCPTA2 CICS is initializing.
+DFHXS1100I SCSCPTA2 Security initialization has started.
+DFHWB0109I SCSCPTA2 Web domain initialization has started.
+DFHSO0100I SCSCPTA2 Sockets domain initialization has started.
+DFHRX0100I SCSCPTA2 RX domain initialization has started.
+DFHRX0101I SCSCPTA2 RX domain initialization has ended.
+DFHLG0101I SCSCPTA2 Log manager domain initialization has started.
+DFHEJ0101 SCSCPTA2  291
 Enterprise Java domain initialization has started. Java is a
 trademark of Sun Microsystems, Inc.
+DFHDH0100I SCSCPTA2 Document domain initialization has started.
.
+DFHLG0103I SCSCPTA2 System log (DFHLOG) initialization has started.
+DFHLG0104I SCSCPTA2  340
 System log (DFHLOG) initialization has ended. Log stream
 ************************** is connected to structure
 ****************.
+DFHSI1519I SCSCPTA2 The interregion communication session was successfully
started
+DFHWB1007 SCSCPTA2 Initializing CICS Web environment.
+DFHWB1008 SCSCPTA2 CICS Web environment initialization is complete.
+DFHSI8430I SCSCPTA2 About to link to PLT programs during the third stage of
initialization
+EYUNX0001I SCSCPTA2 LMAS PLTPI program starting
+EYUXL0003I SCSCPTA2 CPSM Version 220  LMAS startup in progress
+EYUXL0103E SCSCPTA2 CICSPlex SM subsystem (EYUX) not active
+EYUXL0024I SCSCPTA2 Waiting for CICSPlex SM subsystem activation
```

Figure 2-11 CICS JESMSGLG output

2.10 Logrec data set

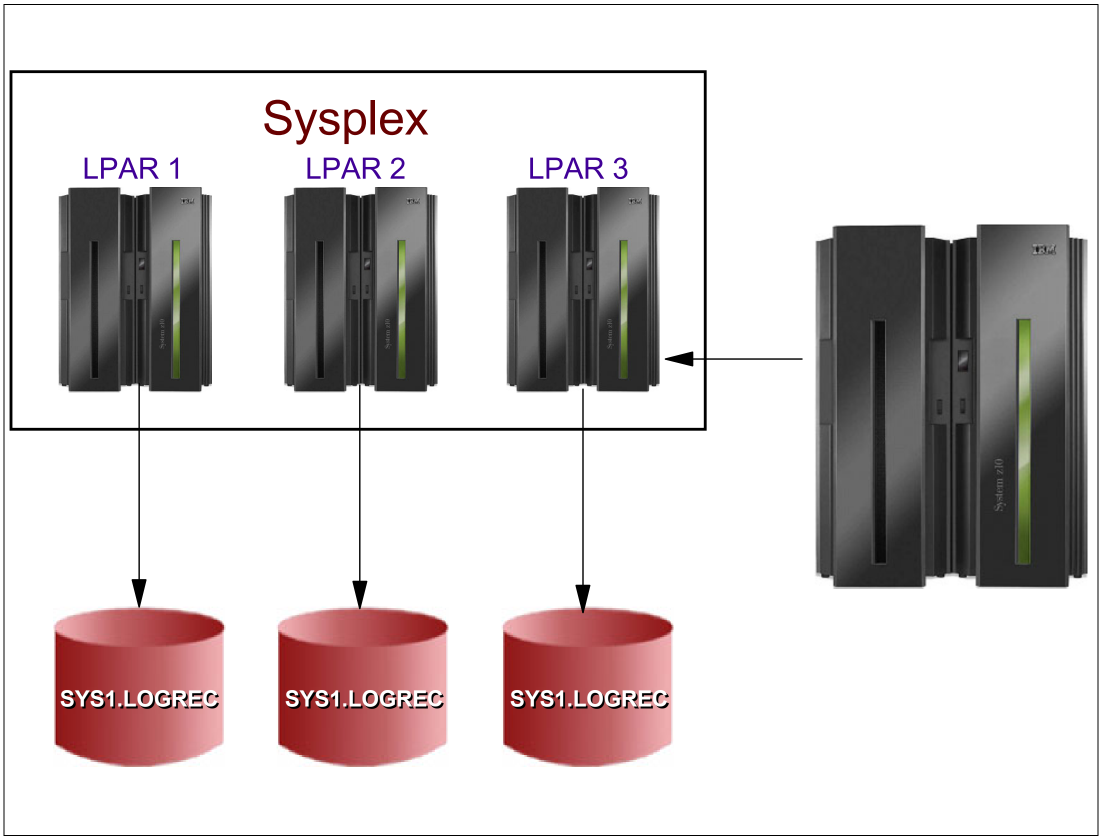

Figure 2-12 SYS1.LOGREC data sets

Logrec data set

The z/OS error log contains data related to hardware and software errors. This data is written to the SYS1.LOGREC data set and is also written to internal storage that is included in a dump. The SYS1.LOGREC data set can be interrogated using the ICFEREP1 program, or if the abend has triggered a dump, the EREP data can be reviewed using the IPCS VERBX LOGDATA command.

Figure 2-13 on page 48 shows the last error record contained in the error log generated when the VERBX LOGDATA command was issued for a dump being reviewed using IPCS. Generally, the error log entries at the end of the display, if they have an influence on the problem being reviewed, will have time stamps that relate to (or immediately precede) the actual abend.

```
JOBNAME: ITSOCIOI   SYSTEM NAME: SC48
ERRORID: SEQ=05462  CPU=0042  ASID=00CE  TIME=15:03:28.1

SEARCH ARGUMENT ABSTRACT

  PIDS/5740XYR00 RIDS/DSNXGRDS#L RIDS/DSNXRIVB AB/S00C7 PRCS/00000000
REGS/0CB2C
  REGS/B6B67 RIDS/DSNTFRCV#R

  SYMPTOM            DESCRIPTION
  -------            -----------
  PIDS/5740XYR00     PROGRAM ID: 5740XYR00
  RIDS/DSNXGRDS#L    LOAD MODULE NAME: DSNXGRDS
  RIDS/DSNXRIVB      CSECT NAME: DSNXRIVB
  AB/S00C7           SYSTEM ABEND CODE: 00C7
  PRCS/00000000      ABEND REASON CODE: 00000000
  REGS/0CB2C         REGISTER/PSW DIFFERENCE FOR R0C: B2C
  REGS/B6B67         REGISTER/PSW DIFFERENCE FOR R0B:-6B67
  RIDS/DSNTFRCV#R    RECOVERY ROUTINE CSECT NAME: DSNTFRCV

OTHER SERVICEABILITY INFORMATION

  DATE ASSEMBLED:         01/29/04
   MODULE LEVEL:           UQ84577
   SUBFUNCTION:            RDS  SQL     DIAGNOSE

 SERVICEABILITY INFORMATION NOT PROVIDED BY THE RECOVERY ROUTINE

   RECOVERY ROUTINE LABEL

 TIME OF ERROR INFORMATION

   PSW: 077C1000 9E43EDFC   INSTRUCTION LENGTH: 04   INTERRUPT CODE: 0007
   FAILING INSTRUCTION TEXT: D5244420 B0219680 D5245820
```

Figure 2-13   Final record in logrec data from IPCS VERBX LOGDATA

Note: Do not ignore the valuable data that is written to the log files.

2.11 Analyzing EREP reports

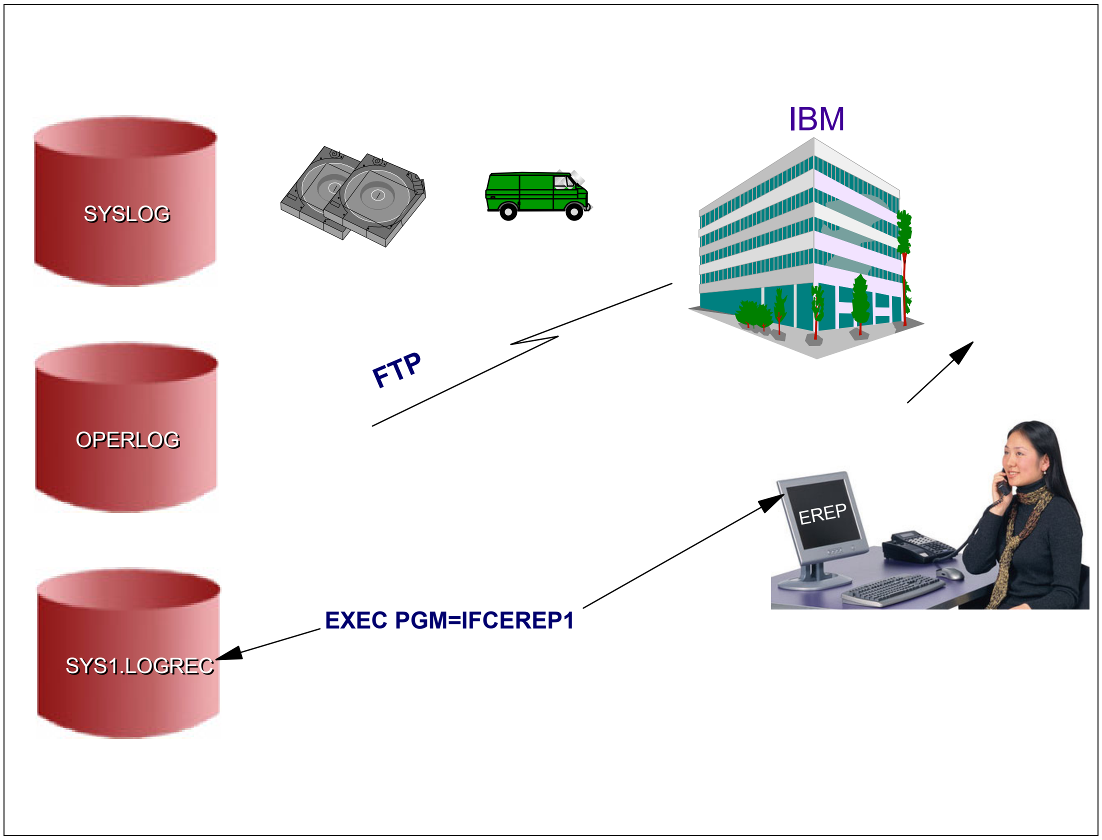

Figure 2-14 Gather messages and logrec

Environmental Record Editing and Printing Program (EREP)

The Environmental Record Editing and Printing Program (EREP) is a diagnostic application program that runs under the MVS, VM, and VSE operating systems.The purpose of EREP is to help IBM service representatives maintain your data processing installation. EREP edits and prints reports from the records placed in the error recording data set (ERDS) by the error recovery program (ERP) of your operating system. Some of these records are the result of device or system errors, while others are informational or statistical data. The service representative analyzes information in the EREP reports to determine whether a problem exists, what the problem is, and where the problem is located.

What EREP does

EREP processes the error records from your operating system to produce formatted reports. These EREP reports can show the status of the entire installation, an I/O subsystem, or an individual device, depending upon which report you request.

Important: EREP is a service tool that shows statistical data that helps your IBM service representative determine whether a problem is media related or hardware related.

1. EREP edits and prints records that already exist; it does not create the error records.
2. EREP is not designed to automate media maintenance or library management.

2.12 Using EREP

- EREP report types
  - System summary
  - Trends
  - Event history
  - System exception
  - Threshold summary
  - Detail edit and summary
- EREP records
  - Software and hardware
- Stages for building EREP records
- Setting EREP environment

Figure 2-15 Establishing an EREP environment

EREP report types

EREP reports vary in format depending on types shown in Table 2-1.

Table 2-1 EREP report types

Report Type	Format
System summary	Error data in summary form
Trends	Error data by daily totals
Event history	Error data in a time sequence by occurrence
System exception	The system exception series is a series of reports that list software and hardware error data in a variety of ways to help you identify problems within your subsystems.
Threshold summary	The threshold summary report shows all the permanent read/write errors, temporary read/write errors, and media statistics for each volume mounted.
Detail edit and summary	The detail edit and summary reports provide environmental information, hexadecimal dumps and summaries of errors to determine their nature and causes.

EREP records

Your operating system with its hardware and software captures statistical and error data, such as:

- A read error on a direct access device or tape volume
- A machine check on a processor
- An IPL of the operating system

Processing EREP data records

The system procedure executing EREP issues commands to write the buffered statistical data from the system-attached devices to the ERDS (error recording data set). The system ERP (error recovery program/processing) builds the records in the stages shown in Table 2-2.

Table 2-2 EREP processing stages

Stage	Action
1	The devices attached to the operating system generate sense data for the events encountered during the day. The sense data can be informational, error-related, or statistical.
2	The ERP of the operating system looks at the sense data. If the sense data indicates that a record should be built, the ERP takes the sense data and places it after the standard header information. The combination of the header information and the sense data becomes the error record.
3	The operating system ERP writes the records onto the system ERDS.

Setting up and running EREP

See *Environmental Record Editing and Printing Program (EREP) User's Guid*e GC35-0151 for the general guidelines for invoking and running EREP.

2.13 EREP reports

- Generating EREP reports
  - Overview reports
  - Analysis reports
  - Detail reports

```
//EREPPRNT JOB ,ESTER,
// MSGCLASS=T,NOTIFY=C961231,USER=C961231
//\-----------------------------------------------------------------\/
//\ STEP0: COPIES SYS1.LOGREC TO TEMPORARY DATA SET \/
//\-----------------------------------------------------------------\/
//S0 EXEC PGM=IFCEREP1,REGION=1024K,
// PARM='ACC,ZERO=N'
//SERLOG DD DISP=(OLD,KEEP),DSN=SYS1.LOGREC
//ACCDEV DD DISP=(NEW,PASS),DSN=&&ERRDATA,
// UNIT=SYSDA,SPACE=(CYL,(2,2)),
// DCB=(RECFM=VB,BLKSIZE=6144)
//DIRECTWK DD DISP=(NEW,DELETE),UNIT=SYSDA,SPACE=(CYL,2,,CONTIG)
//EREPPT DD SYSOUT=A,DCB=BLKSIZE=133
//TOURIST DD SYSOUT=A,DCB=BLKSIZE=133
//SYSIN DD DUMMY
```

Figure 2-16 Generating EREP reports

EREP reports

EREP reports are designed to give you a variety of views of the data being processed. EREP produces:

Overview reports From which you can determine if there are problems

Analysis reports From which you can determine where there are problems

Detail reports From which you can determine what the problems are

Generating an EREP report

MVS systems require system controls that create the interface between EREP and the operating system. The following is an example of job control language (JCL) to execute a series of EREP reports as it would appear in a file without the annotation of the more detailed example provided in *Environmental Record Editing and Printing Program (EREP) User's Guide*, GC35-0151.

You run EREP by executing a procedure containing the operating system EREP command and its associated parameter and control statements. You can only request one type of report each time you execute the EREP command for your system. You may produce any number of different type reports by issuing additional EREP commands with the associated parameters and control statements.

Create MVS JCL

Define the input and output data sets using JCL DD statements. The JCL submits the job as a batch job or interactively via TSO. Put the IFCEREP1 program in the JCL EXEC statement. Include the EREP parameters on the EXEC statement or as part of SYSIN in-stream data with the EREP control statements, as shown in Figure 2-17.

```
//EREPPRNT JOB ,ESTER,
// MSGCLASS=T,NOTIFY=C961231,USER=C961231
//\------------------------------------------------------------------\/
//\ STEP0: COPIES SYS1.LOGREC TO TEMPORARY DATA SET \/
//\------------------------------------------------------------------\/
//S0 EXEC PGM=IFCEREP1,REGION=1024K,
// PARM='ACC,ZERO=N'
//SERLOG DD DISP=(OLD,KEEP),DSN=SYS1.LOGREC
//ACCDEV DD DISP=(NEW,PASS),DSN=&&ERRDATA,
// UNIT=SYSDA,SPACE=(CYL,(2,2)),
// DCB=(RECFM=VB,BLKSIZE=6144)
//DIRECTWK DD DISP=(NEW,DELETE),UNIT=SYSDA,SPACE=(CYL,2,,CONTIG)
//EREPPT DD SYSOUT=A,DCB=BLKSIZE=133
//TOURIST DD SYSOUT=A,DCB=BLKSIZE=133
//SYSIN DD DUMMY
//\
//\------------------------------------------------------------------\/
//\ STEP1: PRINTS SYSTEM SUMMARY REPORT \/
//\------------------------------------------------------------------\/
//S1 EXEC PGM=IFCEREP1,REGION=1024K,
// PARM='HIST,ACC=N,SYSUM'
//ACCIN DD DISP=(OLD,PASS),DSN=&&ERRDATA
//DIRECTWK DD DISP=(NEW,DELETE),UNIT=SYSDA,SPACE=(CYL,2,,CONTIG)
//EREPPT DD SYSOUT=A,DCB=BLKSIZE=133
//TOURIST DD SYSOUT=A,DCB=BLKSIZE=133
//SYSIN DD DUMMY
//\
//\------------------------------------------------------------------\/
//\ STEP2: PRINTS SYSTEM EXCEPTION REPORTS \/
//\------------------------------------------------------------------\/
//S2 EXEC PGM=IFCEREP1,REGION=1024K,
// PARM='HIST,ACC=N,SYSEXN,TABSIZE=128K'
//ACCIN DD DISP=(OLD,PASS),DSN=&&ERRDATA
//DIRECTWK DD DISP=(NEW,DELETE),UNIT=SYSDA,SPACE=(CYL,2,,CONTIG)
//EREPPT DD SYSOUT=A,DCB=BLKSIZE=133
//TOURIST DD SYSOUT=A,DCB=BLKSIZE=133
//SYSIN DD DUMMY
//\
//\------------------------------------------------------------------
```

Figure 2-17 EREP save and report JCL example

2.14 EREP parameter and control statements

- When submitting JCL for EREP reports, use:
  - EREP report parameters
  - EREP selection parameters
  - EREP processing parameters
  - EREP control statements
  - EREP parameter combinations
    - Example of parameter and control statements

```
//STEP1   EXEC  PGM=IFCEREP1,PARM='CARD'
            HIST=Y
            ACC=N
            PRINT=PS
            TABSIZE=800K
            ZERO=NO
            ENDPARM
            /*
```

Figure 2-18 Parameter and control statements for EREP reports

Using parameter and control statements

The parameters and control statements can be grouped according to the type of information they convey to the EREP program, as shown in Figure 2-19 on page 55 and Figure 2-20 on page 55.

These parameter and control statements determine the following:

- Which report to produce
- Which records to select for the requested report
- How to control the processing of error records and report output
- How to direct EREP processing and supply more information about the system's configuration

This provides organization to the requested reports.

Using PARM=CARD

In the JCL, specify PARM='CARD' and enter the parameters and control statements on the SYSIN statement, as follows:

```
//STEP1   EXEC  PGM=IFCEREP1,PARM='CARD'
```

EREP summary report

The system summary report, using the SYSUM parameter, provides an overview of errors for each of your installation's principal parts, or subsystems. SYSUM produces a condensed two-part system summary report of all errors for the principal system elements, such as CPU, channels, storage, SCP, and the I/O subsystem.

```
//HILG1A  JOB  (7904),MSGLEVEL=(1,1),MSGCLASS=K,REGION=6000K,
//          NOTIFY=HILG,CLASS=A
//STEP1     EXEC PGM=IFCEREP1,PARM='CARD'
//SERLOG    DD   DSN=SYS1.LOGREC,DISP=SHR
//ACCIN     DD   DSN=VSA1.EREP.RECCRW,DISP=SHR
//DIRECTWK DD   UNIT=SYSDA,SPACE=(CYL,5,,CONTIG)
//EREPPT    DD   SYSOUT=*
//TOURIST   DD   SYSOUT=*
//SYSIN     DD   *
HIST=Y
ACC=N
SYSUM
TABSIZE=800K
ZERO=NO
ENDPARM
/*
```

Figure 2-19 EREP summary report

EREP SYSEXN report

The SYSEXN parameter produces a system exception report series covering processors, channels, DASD, optical, and tape subsystems.

```
//HILG1A  JOB  (7904),MSGLEVEL=(1,1),MSGCLASS=K,REGION=6000K,
//          NOTIFY=HILG,CLASS=A
//STEP1     EXEC PGM=IFCEREP1,PARM='CARD'
//SERLOG    DD   DSN=SYS1.LOGREC,DISP=SHR
//ACCIN     DD   DSN=VSA1.EREP.RECCRW,DISP=SHR
//DIRECTWK DD   UNIT=SYSDA,SPACE=(CYL,5,,CONTIG)
//EREPPT    DD   SYSOUT=*
//TOURIST   DD   SYSOUT=*
//SYSIN     DD   *
HIST=Y
ACC=N
SYSEXN
TABSIZE=800K
ZERO=NO
ENDPARM
/*
```

Figure 2-20 EREP exception report

2.15 Copy logs to tape

❑ Send SYSLOG data set to IBM support center

```
//HILG1A  JOB  (7904),MSGLEVEL=(1,1),MSGCLASS=K,REGION=6000K,
//           NOTIFY=HILG,CLASS=A
//STEP1      EXEC PGM=IEHINITT
//LABEL1     DD   UNIT=(3480,1,DEFER),VOL=(,RETAIN),STORCLAS=NONSMS
//SYSPRINT   DD   SYSOUT=*
//SYSIN       DD   *
LABEL1 INITT SER=SHARK,DISP=REWIND
//GENER1     EXEC PGM=IEBGENER
//SYSIN      DD   DUMMY
//SYSPRINT   DD   SYSOUT=*
//SYSUT1     DD   DSN=SYS1.LOG.DATA,DISP=SHR
//SYSUT2     DD   DSN=HILG.LOG.DATA,DISP=(,KEEP),
//                DCB=*.SYSUT1,
//                UNIT=3480,LABEL=(1,SL),VOL=(,RETAIN,SER=SHARK),
//                STORCLAS=NONSMS
```

Figure 2-21 JCL to create SYSLOG on tape

SYSLOG to support center

Sometimes it might be necessary to copy log data sets to a tape and send them to IBM or any other support center. The following JCL can be used to label the tape and copy data:

To send data to IBM you don’t need the data on a tape. You can send the data using FTP to a server. Ask your support center for the address.

2.16 Implement a resolution

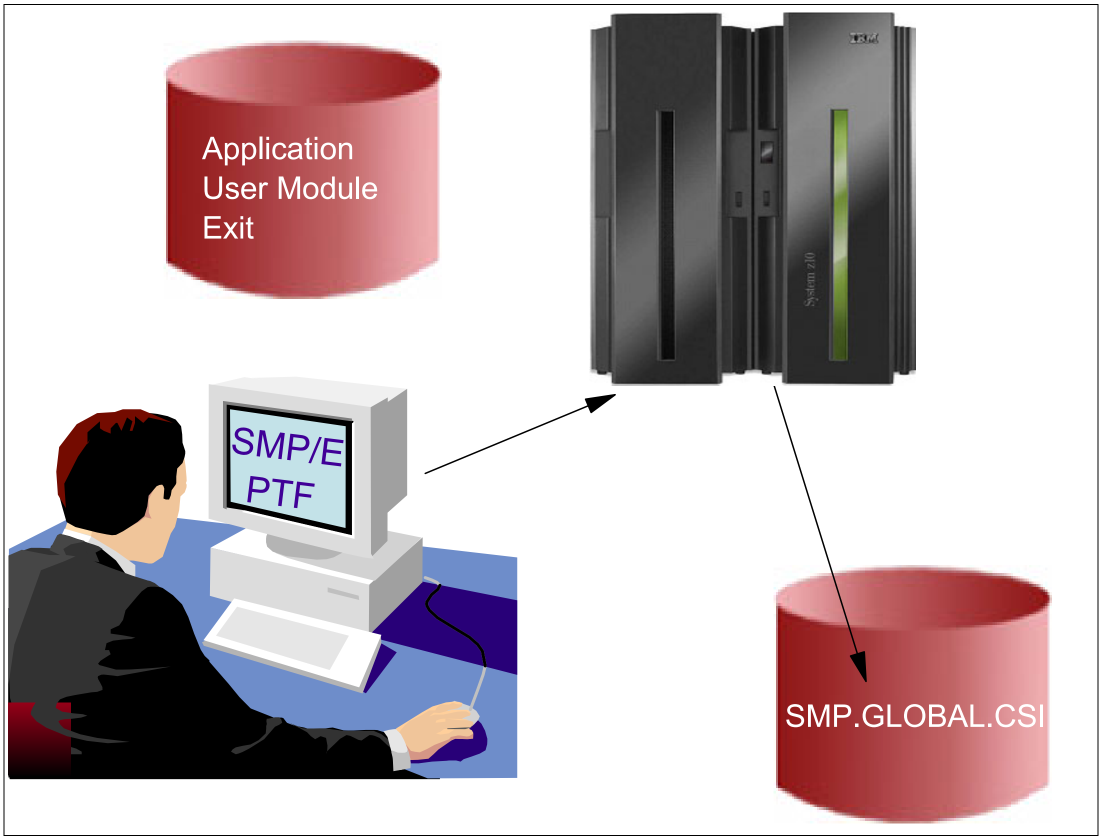

Figure 2-22 Implement a resolution

Implement the resolution

Successful diagnosis of the problem will result in a number of possible resolutions:

- User Error

  This will require you to correct your procedure to ensure a satisfactory resolution is implemented. If your procedure is impacting other users, then prompt action is encouraged.

- Software implementation error

  You must ensure that all installation procedures have been correctly executed and any required customization has been performed correctly. Until you can be sure of a successful implementation, it is advisable to remove this software, or regress to a previous level of the software until more extensive testing can be done in an environment that will not impact production workloads.

- Software product fault

  If the fault is identified as a failure in software a fix might already have been developed to solve this problem. This fix is identified as a Program Temporary Fix (PTF) and will need to be installed into your system. If the problem is causing a major impact, it is suggested that you expedite your normal migration process and promote the fix to the problem system to hopefully stabilize that environment.

  If the problem has not been previously reported, an authorized program analysis report (APAR) will be created and a PTF will be generated.

- Hardware fault

  This is the resolution that will be controlled by the hardware service representative, but may require some reconfiguration tasks, depending on the nature of the problem. Consultation with the hardware vendor's service representative will clarify the requirements.

Close the problem

When you have tested and implemented the problem resolution, ensure that all parties involved with this problem are informed of the closure of this issue.

It should be noted that during your career you will experience some problems that occur only once, and even with the best diagnostic data, cannot be recreated or solved, by anyone. When this happens there is a point in time where you must accept the fact that this anomaly was in fact just that, an anomaly.

3

Common problem types

z/OS can process large amounts of work efficiently because it keeps track of storage in a way that makes its storage capacity seem greater than it is. It's a complex system made up of many components, similar to the human body. And, like the human body, z/OS can experience problems that need to be diagnosed and corrected.

The following are examples of problems you might encounter while running z/OS:

- An abnormal end occurs in processing, known as an abend.
  - Application program abends
  - System program abends
- A job remains hung in the system.
  - System, subsystem and application hang.
- The system or process repetitively loops through a series of instructions.
  - System, subsystem and application loop
- I/O errors.
- System wait states.
- Processing slows down.

For system problems, z/OS displays symptoms that will help you with your diagnosis. Problem source identification, called PSI, is the determination of what caused the error. Why was an abend issued? What program is using so much of system storage? What component caused the hang? Which program is looping?

3.1 Common problem types

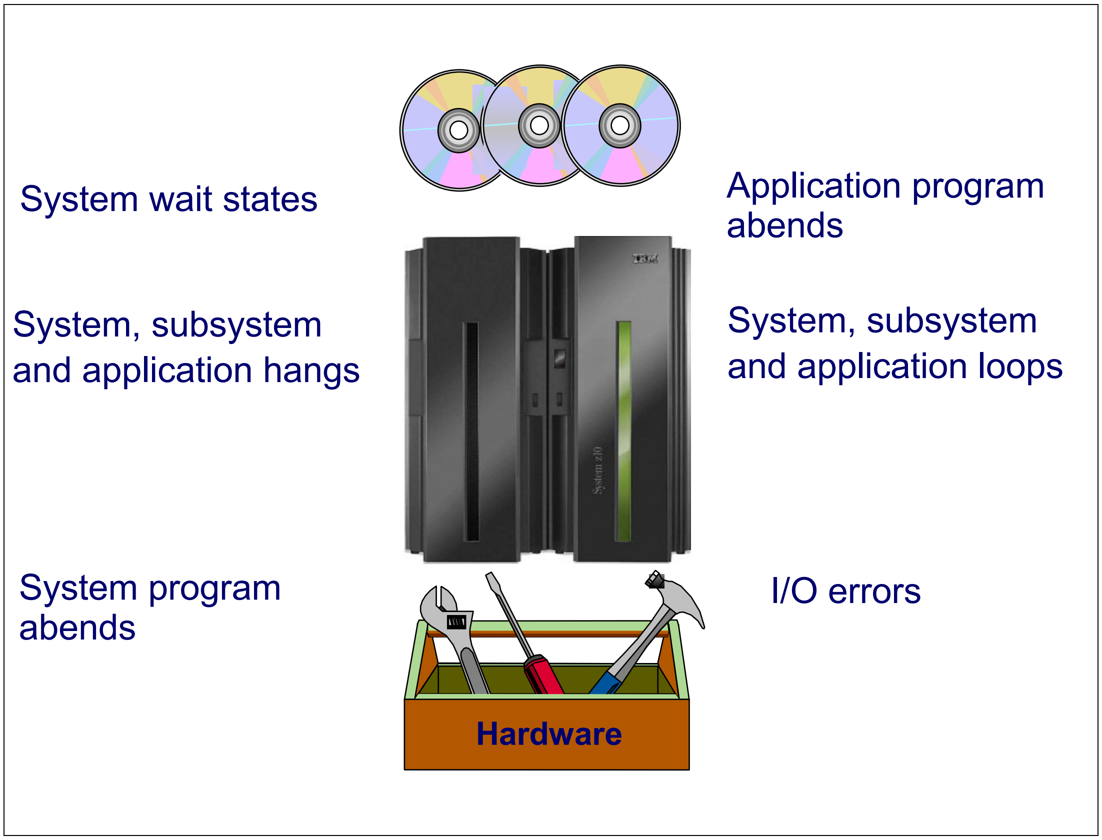

Figure 3-1 Common problem types

Application program abends

Application program abends are always accompanied by messages in the system log (SYSLOG) and the job log indicating the abend code and usually a reason code. Many abends also generate a symptom dump in the SYSLOG and job log. A symptom dump is a system message, either message IEA995I or a numberless message, which provides some basic diagnostic information for diagnosing an abend. Often the symptom dump information can provide enough information to diagnose a problem.

For a system-detected problem, the system abnormally ends a task or address space when it determines that the task or address space cannot continue processing and produce valid results.

System program abends

Like application program abends, system program abends are usually accompanied by messages in the system log (SYSLOG), and if there is a SYS1.DUMPxx data set available or dynamic dump data set allocation at the time of the abend, and this dump code was not suppressed by the dump analysis and elimination (DAE) facility, then an SVC dump will be taken. SVC dumps will be discussed later in this chapter.

I/O errors

I/O errors are most likely caused by a hardware failure or malfunction. The visible symptom will be an abend, accompanied by messages in the SYSLOG that include reason codes, which can identify the type of error, and sense data, which will offer more detailed, hardware-specific information.

I/O errors can also be the result of software conditions that create a situation where subsequent operations will appear as I/O errors. This could be the result of a corruption in a data set, or data set directory, and the rectification process may be as simple as redefining the data set.

System wait states

The basic summation of a wait state is: the "machine is dead and will not IPL". You will usually experience this condition during the IPL process, and the disabled wait state code will indicate the problem. The cause is often as simple as the system not being able to find some data that is crucial to the IPL process on the IPL volume. Wait codes are documented in *z/OS MVS System Codes*, SA22-7626.

The types of waits are:

- Disabled wait with a wait state code - The system issues a wait state code and stops. The operator can see the wait state code on the system console. This wait is called a coded wait state or a disabled wait. There are two types of disabled wait state codes, restartable and non-restartable.

  For a non-restartable wait state code, the operator must reIPL the system. For a restartable wait state code, the operator may restart the system.
- Enabled wait - The system stops processing without issuing a wait state code when the dispatcher did not find any work to be dispatched.

The operator sees a WAIT indicator on the system console, followed by a burst of activity caused by system resources manager (SRM) processing, followed by the WAIT indicator, followed by a burst of activity, and so on. An indication of an enabled wait is a PSW of X'07xxxxxx xxxxxxxx'.

A special type of enabled wait is called a *no work wait* or a *dummy wait*.

System hangs and loops

The operator usually takes a standalone dump for one of the following types of problems:

- Disabled wait
- Enabled wait
- Loop
- Partial system hang

3.2 standalone dumps

- For certain problem types:
  - The stand-alone dump program produces a stand-alone dump of storage
  - Use for:
    - A system that fails
    - The system stops processing
    - The system enters a wait state with or without a wait state code
    - The system enters an instruction loop or hangs
    - The system is processing slowly

Figure 3-2 Conditions for taking standalone dumps

standalone dumps

The standalone dump program (SADMP) produces a standalone dump of storage that is occupied by one of the following:

- A system that failed.
- A standalone dump program that failed.

  Either the standalone dump program dumped itself — a self-dump —, or the operator loaded another standalone dump program to dump the failed standalone dump program.

The standalone dump program and the standalone dump together form what is known as the standalone dump service aid. The term standalone means that the dump is performed separately from normal system operations and does not require the system to be in a condition for normal operation.

The standalone dump program produces a high-speed, unformatted dump of central storage and parts of paged-out virtual storage on a tape device or a direct access storage device (DASD). The standalone dump program, which you create, must reside on a storage device that can be used to IPL.

When an operator takes a standalone dump, it is important to determine the conditions of the system at the time the dump was taken. Because a standalone dump can be requested for various problem types, the collection of problem data is imperative for determining the cause of the error.

The objectives for analyzing the output of a standalone dump are:

- Gather symptom data
- Determine the state of the system
- Analyze preceding system activity
- Find the failing module and component

Determine symptoms

Operational conditions should be determined to understand the exact circumstances that caused the dump to be taken, as follows:

- Was the system put into a wait state?
- Were the consoles hung or locked up?
- Were commands being accepted on the master console without a reply?
- Was a critical job or address space hung?

3.3 Symptom dump output

- For system and application program abends
  - Normally a symptom dump is displayed

```
IEA995I SYMPTOM DUMP OUTPUT
  SYSTEM COMPLETION CODE=0C4  REASON CODE=00000004
   TIME=16.44.42  SEQ=00057  CPU=0000  ASID=000C
   PSW AT TIME OF ERROR  078D0000   00006FEA  ILC 4  INTC 04
     ACTIVE LOAD MODULE=ABENDER   ADDRESS=00006FD8
OFFSET=00000012
     DATA AT PSW  00006FE4 - 00105020  30381FFF  58E0D00C
     GPR  0-3  FD000008  00005FF8  00000014  00FD6A40
     GPR  4-7  00AEC980  00AFF030  00AC4FF8  FD000000
     GPR  8-11 00AFF1B0  80AD2050  00000000  00AFF030
     GPR 12-15 40006FDE  00005FB0  80FD6A90  00006FD8
   END OF SYMPTOM DUMP
```

Figure 3-3 SYMPTOM dump data as shown in the MVS SYSLOG and related job log

Symptom dumps

A symptom dump is a system message, either message IEA995I or a numberless message, that provides some basic diagnostic information for diagnosing an abend. Often the symptom dump information can provide enough data to diagnose a problem.

Symptom dumps appear in the following places:

- For SYSUDUMP and SYSABEND ABEND dumps: in message IEA995I, which is routed to the job log.
- For a SYSMDUMP ABEND dump: in message IEA995I in the job log and in the dump header record.
- For an SVC dump: in the dump header record.
- For any dump in a Time Sharing Option/Extensions (TSO/E) environment: displayed on the terminal when requested by the TSO/E PROFILE command with the WTPMSG option.
- In response to a DISPLAY DUMP,ERRDATA operator command, which displays information from SYS1.DUMPxx data sets on direct access.

Symptom dump output

Figure 3-3 shows the symptom dump for an abend X' 0C4' with reason code X'4'. This symptom dump shows that:

- Active load module ABENDER is located at address X'00006FD8'.

- The failing instruction was at offset X'12' in load module ABENDER.
- The address space identifier (ASID) for the failing task was X' 000C'.

If the information in a symptom dump is insufficient, you can capture additional dump data by including specific DD statements, as discussed in the following section.

Note: Abend codes starting with U are user abends, and are not issued by z/OS. Any program can issue a user abend. Its meaning is determined by the program. Language Environment (LE) shows these kinds of abends according to the LE option settings because z/OS will not handle them.

3.4 Waits, hangs, and loops

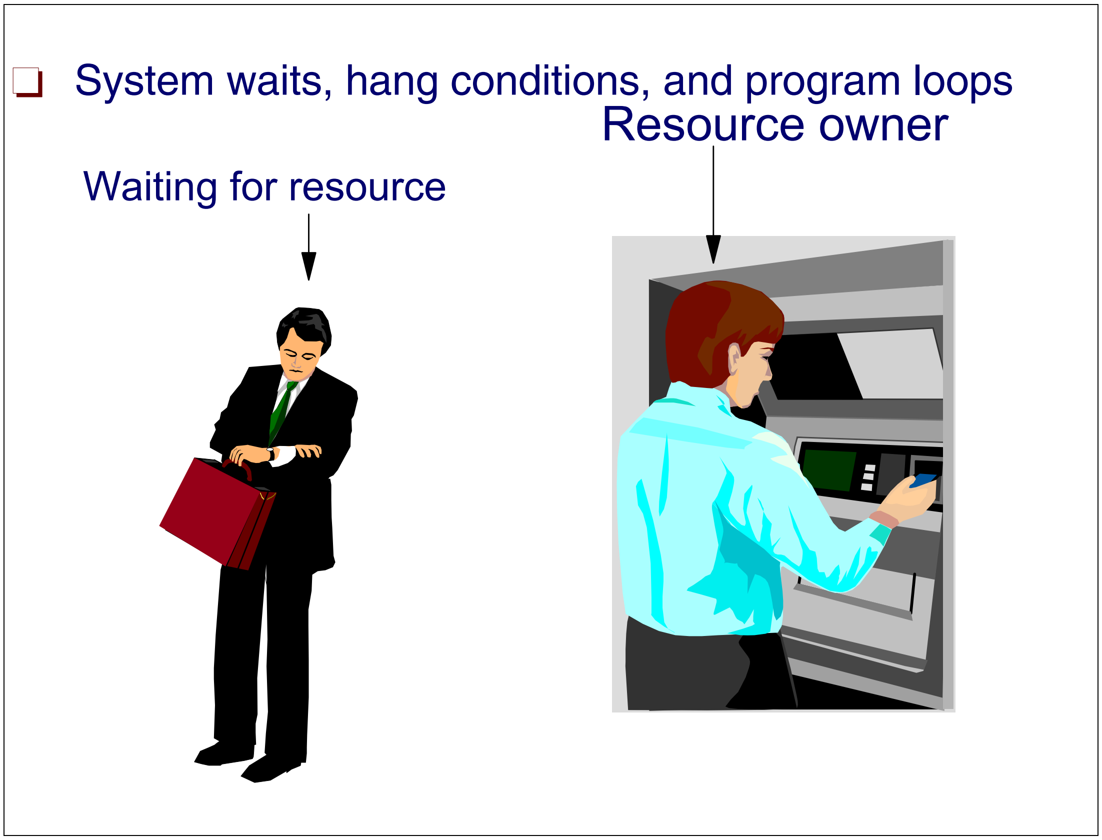

Figure 3-4 Wait scenarios

System, subsystem, and application hangs

"Hangs" are usually caused by a task, or tasks, waiting for an event that will either never happen, or an event that is taking an excessive amount of time to occur. If one of the waiting tasks is a fundamental system task, or is holding control of a resource, for example a data set, then other tasks will queue up and wait for the required resource to become available. As more tasks enter the system they will also join the queue until the system eventually stops, or the task causing the contention is cancelled. Unfortunately, by the time the system grinds to a halt, the operating system will no longer process any operator commands, so an IPL will be the only alternative. A system hang is more specifically known as an *enabled wait* state.

Hangs and loops

One of the difficult things to determine is whether a system or subsystem is in a hung or looping state. While the symptoms in many cases are similar, for example, the inability to process other units of work, or transactions; or the inability to get the system or subsystem to accept commands—the key difference is whether there is CPU and EXCP activity that indicates the system is still performing work.

If no other tasks can be dispatched within a subsystem, and the CPU activity is high, often 100%, this is generally a symptom that you have a loop condition. Loops can usually be categorized as either *enabled*, *disabled* or a *spin* loops.

Loops are caused by a program, application, or subsystem attempting to execute the same instructions over and over again. The most severe loop condition causes the task experiencing the condition to use all available CPU resources, and subsequently no other task is allowed to gain control. The only way to alleviate the problem is to cancel the problem task, or if this is unsuccessful, an IPL is necessary. The three types of loop conditions are:

Enabled Enabled loops are usually caused by a programming error, but do not impact other jobs in the system, unless the looping task is a subsystem, which will generally impact the whole system.

Disabled Disabled loops will not allow an interrupt to be processed, and are generally identified by continuous 100 percent CPU utilization.

Spin Spin loops occur when one processor in a multiple-processor environment is unable to communicate with another processor, or is unable to access a resource being held by another processor.

A CPU entering a disabled loop will often be presented to the operators as a spin loop, where the system will cycle (or spin) through the available CPUs.

There are many tools that can be used to assist with hang or loop problem diagnosis, and many of the system monitoring tools will enable you to interrogate at the transaction or thread level and to cancel or purge the individual unit of work or task associated with the loop.

It is important to remember that the monitoring tools should have a high dispatching priority to enable them to get control when required.

It is good to remember that trace data can be used to assist with loop and hang diagnosis, and even 20 seconds of trace data can help identify a looping sequence and often the associated unit of work or transaction. For example, the CICS Auxtrace facility or CICS internal tracing with all CICS components traced at level 1 and a dump of the suspected problem regions can show via a quick IPCS review the type of problem you are experiencing.

An indication of a dummy wait or no work wait is a PSW of X'070E0000 00000000' and GPRs containing all zeroes. Diagnosis is required for this type of wait only when the system does not resume processing.

Processing slows down

In case of system processing slows—central processor at 100% utilization or a job using a high percentage of central processor storage—use an online monitor such as RMF to determine where the problem originates.

3.5 SLIP command

- Types of SLIP commands
  - SLIP SET - "Setting a SLIP Trap"
  - SLIP MOD - "Modifying an Existing SLIP Trap"
  - SLIP DEL - "Deleting an Existing SLIP Trap"
- Using SLIP commands
  - On a console with MVS master authority
  - On a TSO terminal in OPERATOR mode
  - In a TSO CLIST
  - In an IEACMD00, COMMNDxx, or IEASLPxx parmlib member

Figure 3-5 Using SLIP commands

Types of SLIP commands

The **SLIP** command controls SLIP (serviceability level indication processing). It is a diagnostic aid that intercepts or traps certain system events and specifies what action to take. Using the **SLIP** command, you can set, modify, and delete SLIP traps. You must specify SET, MOD, or DEL immediately following SLIP, as shown in Figure 3-5.

SLIP command examples

```
SLIP SET[,options],END - Command for an error event trap (non-PER)
SLIP SET,IF[,options],END - Command for an instruction fetch PER trap
SLIP SET,SBT[,options],END - Command for a successful branch PER trap
SLIP SET,SA|SAS[,options],END - Commands for a storage alteration PER trap
SLIP MOD[,options] - Command to modify an existing trap
SLIP DEL[,options] - Command to delete an existing trap
```

> **Note:** If you specify IF, SBT, SA, or SAS, they must immediately follow SET. Specify END at the end of all **SLIP SET** commands.

Using SLIP commands

Use a **SLIP** command only at the direction of the system programmer. You can enter a SLIP command as follows:

- On a console with MVS master authority

- On a TSO terminal in OPERATOR mode
- In a TSO CLIST

  In the CLIST, use the line continuation character at the end of each line and the END parameter at the end of the last line.
- In an IEACMD00, COMMNDxx, or IEASLPxx parmlib member

  While you can enter a **SLIP** command in any of these members, IBM recommends that you place your **SLIP** commands in IEASLPxx and enter a **SET SLIP=xx** command to activate the member. IEACMD00 and COMMNDxx require that a command be on a single line. Also, SLIP may process commands in IEACMD00 and COMMNDxx in any order, but processes commands in IEASLPxx in the order in which they appear.

For a sysplex containing similar systems, certain problems might require identical SLIP traps on those similar systems. To set up these traps, do the following:

- Assign similar names to identical jobs on different systems. The names should form a pattern, such as JOB1, JOB2, JOB3, and so on.
- Create one IEASLPxx member containing the trap you need for the problem.
- Place the member in the shared parmlib data set or in the parmlib data set for each of the similar systems.
- In systems using JES2 or JES3, activate the member or members with the following command entered on one of the systems:

  ```
  ROUTE *ALL,SET SLIP=xx
  ```

3.6 Storage overlays

- System problems in MVS are often caused by storage overlays that:
  - Destroy data, control blocks, or executable code
- Overlays result in:
  - MVS detects an error and issues an abend code
  - Referencing the data or instructions can cause an immediate error
  - Bad data is used to reference a second location, which then causes another error

Figure 3-6 Problems with storage overlays

Storage overlays

Storage overlays can affect your system during IPL and during production lifetime. The system can crash if any of the system-related control blocks have been overlaid. Data overlay may be recoverable but you still need to determine why you get the overlay and who is storing data to an area not owned or where data has already been located.

If the data that causes the overlay is still stored at the same storage address, you can use a storage alteration SLIP (SA) to locate the culprit. If the data is stored randomly in a storage area, it's quite difficult to find the responsible module or program.

If you know what the overlaid storage area should look like in a clean environment, you can use an SA slip to get a dump and to replace the overlaid area by the expected value.

Assuming the storage is overlaid pointed to by the address located at CVT offset 1234, which shows JUNK but it should show GOOD. The following slip will take a dump when the area is overlaid but will also remove the JUNK and add GOOD at the storage area pointed to by the CVT+1234 address.

```
SL SET,SA,ASIDSA=SA,RANGE=(10?+1234?), DATA=(10?+1234?,EQ,D1E4D5D2),
A=(REFAFTER,SVCD), REFAFTER=(10?+1234?,EQ,C7D6D6C4),END
```

Figure 3-7 Get a dump and restore correct storage value

System problems

Always be aware of the possibility of a storage overlay when analyzing a dump. System problems in MVS are often caused by storage overlays that destroy data, control blocks, or executable code. The results of such an overlay vary. For example:

- The system detects an error and issues an abend code, yet the error can be isolated to an address space. Isolating the error is important in discovering whether the overlay is in global or local storage.
- Referencing the data or instructions can cause an immediate error such as a specification exception (abend X'0C4') or operation code exception (abend X'0C1').
- The bad data is used to reference a second location, which then causes another error.

When you recognize that the contents of a storage location are not valid and subsequently recognize the bit pattern as a certain control block or piece of data, you generally can identify the erroneous process or component and start a detailed analysis.

Analyzing the damaged area

Once you determine that storage is bad or overlaid, try to identify the culprit. First, determine the extent of the bad data. Look for EBCDIC data or module addresses in storage to identify the owner. Any type of pattern in storage can indicate an error and identify the program that is using the damaged storage. Look at the data on both sides of the obviously bad areas. See if the length of the bad area is familiar; that is, can you relate the length to a known control block length, data size, MVC length? If so, check various offsets to determine their contents and, if you recognize some, try to determine the exact control block.

Common bad addresses

The following are commonly known bad addresses. If you recognize these in the code you are diagnosing, focus your problem source identification on these areas:

- X'000C0000', X'040C0000', or X'070C0000', and one of these addresses plus some offset. These are generally the result of some code using 0 as the base register for a control block and subsequently loading a pointer from 0 plus an offset, thereby picking up the first half of a PSW in the PSA.

  Look for storage overlays in code pointed to by an old PSW. These overlays result when 0 plus an offset cause the second half of a PSW to be used as a pointer.
- X'C00', X'D00', X'D20', X'D28', X'D40', and other pointers to fields in the normal functional recovery routine (FRR) stack. Routines often lose the contents of a register during a SETFRR macro expansion and incorrectly use the address of the 24-byte work area returned from the expansion.
- Register save areas. Storage might be overlaid by code doing a store multiple (STM) instruction with a bad register save area address. In this case, the registers saved are often useful in determining the component or module at fault.

3.7 Storage overlay during IPL

- ❑ Storage overlay of PSA or related control blocks
  - ➢ Take a stand-alone dump
  - ➢ Use IPCS to format the dump
- ❑ Analysis of dump
  - ➢ Identify failing CP
  - ➢ Identify failing module
  - ➢ Create a trap to find the overlay
  - ➢ Diagnose the cause

Figure 3-8 Analyzing storage overlays

Storage overlays during IPL

When you recognize that the contents of a storage location are not valid and subsequently recognize the bit pattern as a certain control block or piece of data, you can generally identify the erroneous process or component and start a detailed analysis.

WAIT 014

A WAIT 014 is usually the result of an overlay of a critical control block such as the PSA, ASCB, SGTE, or PGTE. Typically the last program running on the CP caused the overlay of the PSA or related control blocks. The system enters a non-restartable wait state.

Dump to analyze overlay

To determine the control block that has been overlaid and the module that did the overlay ask the system programmer to provide a standalone dump. Use IPCS to format the dump and start with the debug.

Identify the failing processor

Enter `IP ST WORKSHEET` and examine the common system data area (CSD) CPU online mask. There is one bit for each processor online. To determine which processor was taken offline look at:

```
CSD  Available CPU mask: FC00  Alive CPU mask: 7C00  No. of active CPUs: 0005
```

Where:

```
FC00 shows the available CPU mask. Bits 0 to 5 are set to one.
7C00 shows the alive CPU mask. Bits 1 to 5 are set to one
```

This means that CPUs 1 to 5 are active and CPU 0 is the failing processor.

In addition, the IPCS command ST WORKSHEET also shows the automatic CPU recovery (ACR) pair leading to failing and recovery processors.

Identify the failing module and overlaid control block

Examine the last program interrupt on the failing processor:

```
Program old PSW at PSA+x'28' identifies the failing module
ILIC (Instruction Length Interrupt Counter) is at PSA+x'8C'
```

Use the PSW address and the ILC to determine the offset in the failing module. Examine that code to obtain the control block field that was being referenced. This is typically a PSA field. If possible, use known/valid control block values to determine the extent of the overlay. For detailed control block information see the volumes on z/OS MVS Data Areas, as follows:

- *z/OS MVS Data Areas, Volume 1 (ABEP - DALT)*, GA22-7581
- *z/OS MVS Data Areas, Volume 2 (DCCB - ITZYRETC)*, GA22-7582
- *z/OS MVS Data Areas, Volume 3 (IVT - RCWK)*, GA22-7583
- *z/OS MVS Data Areas, Volume 4 (RD - SRRA)*, GA22-7584
- *z/OS MVS Data Areas, Volume 5 (SSAG - XTLST)*, GA22-7585

Provide a trap to catch the overlayer

A storage alteration (SA) trap could be supplied to catch the overlayer.

Note: The trap should only be set on a field that is not ordinarily updated.

Create a SLIP trap to wait when the PSA+x'200' is overlaid, as follows:

```
SLIP SET,SA,ASA=SA,A=WAIT,RA=(200,203),END
```

`ASA=SA` prevents the trap from hitting on a data space update.

Diagnosing the cause

From the SA dump of the WAIT 014, determine the *Window of Error* by:

- Examining the system trace to identify the last program that successfully ran on the failing CP.
- Identify the failing instruction address via LCCAPPSW, LCCA+x'88'.

These two events define the Window of Error, and the code that executed in the Window probably caused the error.

3.8 Storage overlay in a production system

- ❑ Determine overlay area
  - ➢ Find storage address
  - ➢ Determine data overlayed
- ❑ Set a SLIP trap
  - ➢ Determine if storage or a register is needed
  - ➢ Sample SLIP trap

SLIP SET,IF,N=(IAXUA,237A),A=(SVCD,REFAFTER),SUMLIST=(009C.5000,6000),
REFAFTER=(009C.5000.EQC(2),009C.5098,1REQ,00000000),END

Figure 3-9 Setting a SLIP trap for an overlay

Storage overlay SLIP trap

A dump contains information about an error that can help you identify a problem type. Using interactive problem control system (IPCS), the information about the error is formatted to provide a quick and effective method of retrieval. Sometimes system problems in MVS are caused by storage overlays that destroy data, control blocks, or executable code.

Depending on the overlaid area, it could be possible to repair the overlaid control block or storage information. To fix the overlay you need to know the storage address and the data that has been overlaid. The SLIP definition provides the possibility to check the control block using the indirect pointing.

Use a powerful option where SLIP will modify the storage or register as part of the action taken when the PER trap hits.

Use with caution and ensure accuracy. This will allow correction of an overlay or improperly specified register or storage, but if the target is not correct, or the refresh data is incorrect, further potential damage may occur.

The following SLIP shows an example of how to get a dump and repair the overlaid area. The SLIP indicates the module name is located in ASID X'9C' at offset x'5000', and refreshes the first two bytes to zeroes and sets R1=0.

```
SLIP SET,IF,N=(IAXUA,237A),A=(SVCD,REFAFTER),SUMLIST=(009C.5000,6000),
REFAFTER=(009C.5000.EQC(2),009C.5098,1REQ,00000000),END
```

3.9 SLIP to catch the overlayer

- ❑ Determine how to set the SLIP
- ❑ Check if SLIP does not match
- ❑ PER traps
- ❑ DEBUG option
- ❑ Environments where SLIP PER not supported

SLIP SET,SA,ASA=SA,RA=(2D0,2D3),A=SVCD,ID=HILG,
SDATA=(ALLNUC,PSA,SQA,CSA,RGN,LPA,TRT,SUM),END

Figure 3-10 Setting SLIP traps

Sample SLIP trap

The following SLIP is an example how to catch the program overlaying the storage area on offset x'2D0' length 4 bytes.

```
SLIP SET,SA,ASA=SA,RA=(2D0,2D3),A=SVCD,ID=HILG,
SDATA=(ALLNUC,PSA,SQA,CSA,RGN,LPA,TRT,SUM),END
```

Determining if SLIP matches

Check the following to see whether the SLIP is not matching:

- Issue a D SLIP=XXXX (where XXXX is the trap id) to verify that the trap was set as intended.
- With the LPAMOD or PVTMOD keywords, verify that it specifies the load module name, not the CSECT name.
- Be sure that MODE=HOME,JOBNAME= or ASID is specified with PVTMOD for a module that is loaded into private storage.
- PER traps:
  - Check the PSA+X'98' for the residual PER address stored by the hardware when the PER interrupt is presented. The PER trap is not active if 0 or the PER bit is not on in the PSW.
  - Check control registers 9, 10, and 11 to determine whether they are set correctly. These registers are the STATUS REGS, as follows:

- CR 9 - PER EVENT TYPE
- CR 10 - BEGIN RANGE
- CR 11 - END RANGE

Note: Any SLIP trap affects system performance, but PER traps can have a measurable effect on performance. Therefore, use conditions to filter the events being checked for matches, especially for PER traps. Improper use of PER traps can cause severe performance problems.

- Use the DEBUG option with A=TRACE to see which keyword is not matching on the SLIP trap. With DEBUG a GTF record will be cut regardless of whether the trap matches, and will contain a key indicating which keyword did not match.

  For a SLIP SET trap, the DEBUG option allows you to determine why a trap is not working as you expected by indicating which of the conditions you established is not being met. DEBUG provides trap information each time the trap is tested rather than just when it matches.

  The generalized trace facility (GTF) and its trace option for SLIP records must be active. Each DEBUG trace record contains SLIP information plus two bytes: the first byte contains a value indicating the failing parameter and the second byte contains zero.

- With PVTMOD, A=IGNORE, traps will not match if the local lock is not available at the time the PER interrupt is presented and SLIP module IEAVTSL2 is checking for a match. See DOC APAR OY37341.

  SLIP has a default match limit of 1 on all traps that specify, or default to, ACTION=SVCD. The match limit can be changed by the MATCHLIM parameter when setting the SLIP trap. You can further qualify the SLIP trap by using other parameters, such as DATA and PVTMOD.

SLIP PER environment

SLIP PER is not active or is not supported in the following environments:

- Program check, machine check, and restart FLIHs
- Some RSM modules
- Dispatcher
- Lock manager (cannot SLIP on lock words)
- DAT-OFF code (SLIP only supports virtual addresses)
- Any code that turns the PER bit off in the PSW

If any of the above cases apply, use the CP address compare hardware function or a software detection trap.

4

Dump processing

Dumps can provide useful diagnosis data. But you need to check the dump-related options to be sure all information needed will be dumped.

Generally, the system automatically captures a dump when it detects a serious error with an operating system component (for example, JES, VTAM, etc.), a subsystem (for example, CICS, DB2, MQ, etc.), or application program. For most system or subsystem failures an SVC (Supervisor Call) dump is generated and written out to a predefined, or dynamically defined, dump data set. You do, however, have the ability to manually capture a dump should you need to capture specific diagnostic data.

The DUMP command requests a system dump (SVC dump) of virtual storage. The data set may be either a pre-allocated dump data set named SYS1.DUMPxx, or an automatically allocated dump data set named according to an installation-specified pattern. You should request only one dump at a time on one system. A system writes only one SVC dump at a time, so it does not save time to make several requests at once.

4.1 Defining dump data sets

- Define in IEASYSxx parmlib member
  - Following parameter specifies whether SYS1.DUMP data sets on direct access device(s) are to be made available at IPL time
    - DUMP={NO }
    - {DASD }
    - {(DASD,xx-yy)}
- Dump data sets can only reside on direct access devices
  - Space for direct access data sets must be pre-allocated
  - Data sets must be catalogued

Figure 4-1 Defining dump data sets

Defining dump data sets

The DUMP= parameter in the IEASYSxx parmlib member specifies whether SYS1.DUMP data sets on direct access devices are to be made available at IPL time. SVC dump options are not included in IEASYSxx. The installation can specify the options, if it so desires, through the CHNGDUMP operator command, either in the COMMNDxx parmlib member or from the console.

When planning for dump data sets, the installation should be aware that dump data sets can sometimes contain privileged data. By using protected data sets (through passwords or other security methods), the installation can limit access.

Operand descriptions

The DUMP= parameter options are as follows:

NO Specifies that no dump data sets will be made available for SVC dump at IPL time.

> **Note:** Dump data sets can be specified after IPL by using the DUMPDS command or by adding the DUMPDS command to COMMNDxx parmlib member.

DASD Specifies that all currently cataloged SYS1.DUMPnn data sets (if any), on permanently resident direct access volumes are to be used. The catalog will be scanned for SYS1.DUMP00 through SYS1.DUMP99. DASD is the default if the DUMP parameter is omitted.

> **Note:** Specifying DASD is equivalent to specifying DUMPDS ADD,DSN=ALL in the COMMNDxx parmlib member.

DASD,xx-yy This parameter specifies that all currently cataloged SYS1.DUMPnn data sets (if any) on permanently resident direct access volumes are to be used. The catalog will be scanned for SYS1.DUMP00 through SYS1.DUMP99. DASD is the default if the DUMP parameter is omitted.

> **Note:** Specifying DASD is equivalent to specifying DUMPDS ADD,DSN=(xx-yy) in the COMMNDxx parmlib member.

Indicating which dump data sets are to be used by a particular system avoids unnecessary scanning of the possible 100 cataloged dump data sets and the possibility of more than one system using the same data sets.

How dump data sets are used

Dump data sets can only reside on direct access devices. Space for direct access data sets must be pre-allocated, and the data sets must be catalogued. Eligible device types consist of any direct access device supported by the system that has a track size of at least 4160 bytes (4160 bytes equals 1 SVC dump output record).

As many as 100 dump data sets may be allocated. They must be in the form SYS1.DUMPnn, in which nn may be digits 00 to 99.

> **Note:** Specify both primary and secondary allocations for SYS1.DUMPnn data sets. IBM suggests using the DUMPDS ADD command in COMMNDxx and DUMP=NO in IEASYSxx to make the allocated dump data sets available to SVC dump. If you do this, MVS provides better diagnostic messages, which indicate which dump data sets were added, which were not added, and why.
>
> You can also allow the system to create dump data sets dynamically. For details, see *z/OS MVS Diagnosis: Tools and Service Aids*, SY28-1085.

4.2 Getting or requesting dumps

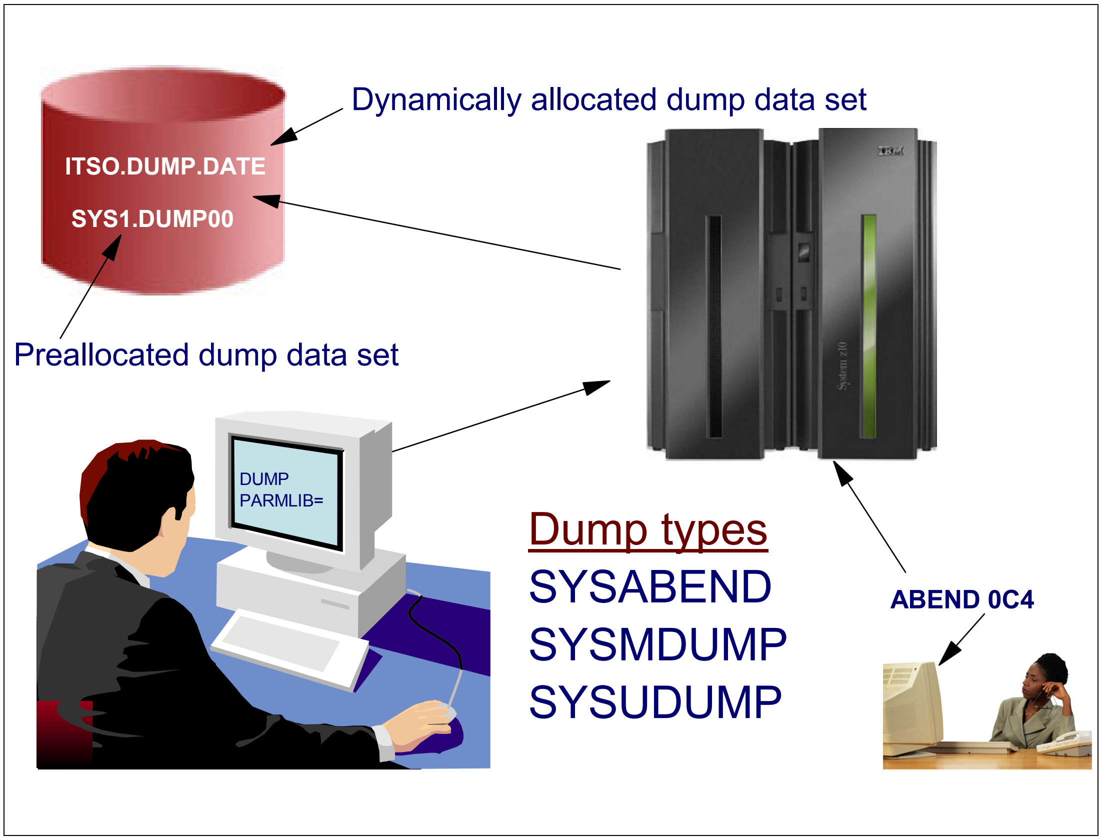

Figure 4-2 Getting or requesting dumps

Diagnostic data - dumps

Different types of dumps can be used to analyze problems. The dump types and the procedures that can be used to initiate these processes are discussed later in detail.

Dumps could best be described as a *SNAPshot* of the system at the time a failure is detected by the operating system or application, or at the time the system is dumped by the operator (console dump) via the DUMP command or the standalone dump procedure.

Following are the dump types that will be discussed:

- Abend dumps
- SLIP dumps
- SNAP dumps
- Standalone dumps
- SVC dumps
- LE Dumps

ABEND dump types

Use an ABEND dump when ending an authorized program or a problem program because of an uncorrectable error. These dumps show:

- The virtual storage for the program requesting the dump.

- System data associated with the program.

The system can produce three types of ABEND dumps:

SYSABEND The largest of the ABEND dumps, containing a summary dump for the failing program plus many other areas useful for analyzing processing in the failing program. This dump is formatted.

SYSMDUMP Contains a summary dump for the failing program, plus some system data for the failing task. SYSMDUMP dumps are the only ABEND dumps that are unformatted and must be formatted with IPCS.

SYSUDUMP The smallest of the ABEND dumps, containing data and areas only about the failing program. This dump is formatted.

Specifying dumps via JCL

You can obtain SYSABEND, SYSUDUMP, and SYSMDUMP dumps by specifying the appropriate DD statement in your JCL, as follows:

- SYSABEND dumps are formatted as they are created and can be directed to either DASD, TAPE, or SYSOUT.

```
//SYSABEND    DD SYSOUT=*
```

- SYSUDUMP dumps are formatted as they are created and can be directed to either DASD, TAPE, or SYSOUT.

```
//SYSUDUMP    DD SYSOUT=*
```

- SYSMDUMP dumps are unformatted and must be analyzed using the Interactive Problem Control System (IPCS). These data sets must reside on either DASD or TAPE. Figure 4-3 shows an example of a SYSMDUMP DD statement.

```
//SYSMDUMP    DD DSN=MY.SYSMDUMP,DISP=(,CATLG),UNIT=DISK,
//               SPACE=(CYL,(50,20),RLSE),
//               LRECL=4160,BLKSIZE=4160
```

Figure 4-3 SYSMDUMP DD statement

Language Environment (LE) dumps can be formatted or unformatted depending on the LE Runopts being active at the time of dump. LE dumps will be discussed more in detail in Chapter 7, “z/OS Language Environment” on page 205.

4.3 Slip commands

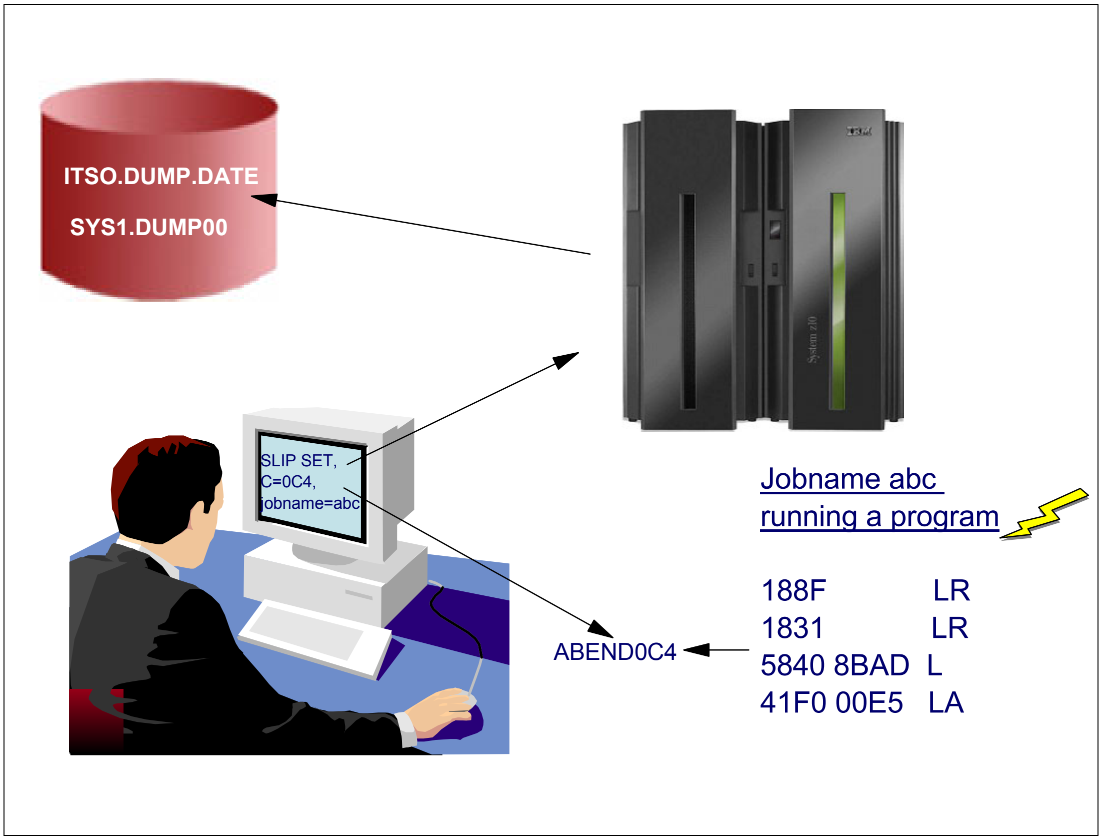

Figure 4-4 SLIP commands

SLIP commands

The SLIP command controls SLIP (serviceability level indication processing), a diagnostic aid that intercepts or traps certain system events and specifies what action to take. Using the SLIP command, you can set, modify, and delete SLIP traps. Following are the SLIP commands:

SLIP SET[,options],END	Command for an error event trap (non-PER)
SLIP SET,IF[,options],END	Command for an instruction fetch PER trap
SLIP SET,SBT[,options],END	Command for a successful branch PER trap
SLIP SET,SA|SAS[,options],END	Commands for a storage alteration PER trap
SLIP MOD[,options]	Command to modify an existing trap
SLIP DEL[,options]	Command to delete an existing trap

Setting a SLIP dump

In Figure 4-4, the operator is setting a SLIP that forces a dump in jobname abc, which is executing a program that has an 0C4 abend at instruction 58408BAD every time it executes. Setting the SLIP forces the program to take a dump on the occurrence of the 0C4. The command is set as follows, as shown in the figure:

```
SLIP SET,C=0C4,JOBNAME=ABC
```

Using SLIP with ABEND dumps

ABEND dumps can be suppressed using the SLIP command in member IEASLPxx in SYS1.PARMLIB. These commands used to reside in member IEACMDxx in SYS1.PARMLIB but it is recommended that you move any SLIP commands from IEACMDxx to IEASLPxx to avoid restrictions found in other parmlib members. For example,

- IEASLPxx supports multiple-line commands; IEACMD00 does not.
- IEASLPxx does not require any special command syntax; IEACMD00 does.

Figure 4-5 shows the SLIP commands in the IEASLP00 parmlib member.

```
SET,C=013,ID=X013,A=NOSVCD,J=JES2,END SLIP SET,C=028,ID=X028,A=NOSVCD,END SLIP
SET,C=47B,DATA=(15R,EQ,0,OR,15R,EQ,8),ID=X47B,A=NODUMP,END SLIP
SET,C=058,DATA=(15R,EQ,4,OR,15R,EQ,8,OR,15R,EQ,C,OR,15R,EQ,10,OR,
15R,EQ,2C,OR,15R,EQ,30,OR,15R,EQ,3C),ID=X058,A=NODUMP,END SLIP
SET,C=0E7,ID=X0E7,A=NOSVCD,END SLIP SET,C=0F3,ID=X0F3,A=NODUMP,END SLIP
SET,C=13E,ID=X13E,A=NODUMP,END SLIP SET,C=222,ID=X222,A=NODUMP,END SLIP
SET,C=322,ID=X322,A=NODUMP,END SLIP SET,C=33E,ID=X33E,A=NODUMP,END SLIP
SET,C=422,ID=X422,A=NODUMP,END SLIP SET,C=622,ID=X622,A=NODUMP,END SLIP
SET,C=804,ID=X804,A=(NOSVCD,NOSYSU),END SLIP
SET,C=806,ID=X806,A=(NOSVCD,NOSYSU),END SLIP
SET,C=80A,ID=X80A,A=(NOSVCD,NOSYSU),END SLIP
SET,C=9FB,ID=X9FB,A=NOSVCD,J=JES3,END SLIP
SET,C=B37,ID=XB37,A=(NOSVCD,NOSYSU),END SLIP
SET,C=D37,ID=XD37,A=(NOSVCD,NOSYSU),END SLIP
SET,C=E37,ID=XE37,A=(NOSVCD,NOSYSU),END SLIP
SET,C=EC6,RE=0000FFXX,ID=XEC6,A=NODUMP,END SLIP
SET,C=EC6,RE=0000FDXX,ID=XXC6,A=NOSVCD,END
```

Figure 4-5 SLIP commands in SYS1.PARMLIB member IEASLP00

4.4 SLIP dumps

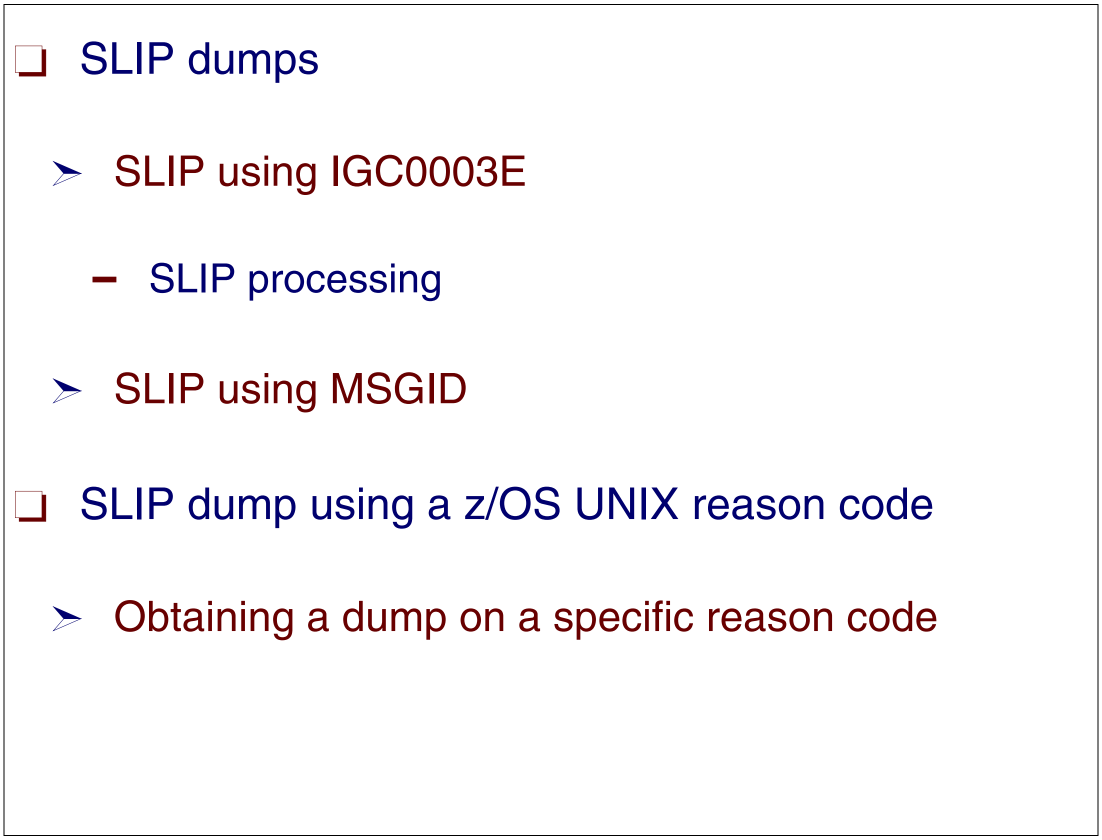

Figure 4-6 Taking SLIP dumps using the SLIP command

SLIP dumps

The SLIP command is set via the z/OS operator SLIP SET command. This is a most powerful tool and allows for great complexity to be used to trigger a dump for a specific situation. It can be used to check storage associated with an event and trigger a dump when that event is true. We are going to concentrate on the most common use of the SLIP command: where it is set to trigger a dump when a specific message is written to the console. There are two forms of this command, as follows:

- The first, being the “old” way, where we interrogate storage being used by the WTOR routine
- The second, the later and more understandable version of the message SLIP

SLIP using IGC0003E

It is not necessary to set SLIP traps individually and run a failing job multiple times, using one trap for each execution until a dump is taken. You can set SLIP PER traps at multiple points in a load module as follows: use a non-IGNORE PER trap to monitor the range that encompasses all of the points in which you are interested, followed by several IGNORE PER traps to prevent the SLIP action from being taken on the intervening instructions, in which you are not interested.

Figure 4-7 shows a **SLIP** command example.

```
SLIP SET,IF,LPAMOD=(IGC0003E,0),
DATA=(1R?+4,EQ,C3E2D8E7,1R?+8,EQ,F1F1F1C5),
JOBNAME=ssidCHIN,
JOBLIST=(ssidMSTR,ssidCHIN),
DSPNAME=('ssidCHIN'.CSQXTRDS),
SDATA=(CSA,RGN,PSA,SQA,LSQA,TRT,SUM),
MATCHLIM=1,END
```

Figure 4-7 SLIP SET example

SLIP processing

This **SLIP** command example would interrogate the Register 1 storage owned by the WTOR routine, IGC0003E, and check for the values, staring at offset 4, to see if they match, CSQX (x'C3E2D8E7), and the Register 1 values starting at offset 8, 111X (x'F1F1F1C5). If the matching message was written, in this case, by job ssid CHIN, then the MQ MSTR and CHIN address spaces, and associated CHIN data space, will be dumped for a maximum match limit of 1 time. No further dumps will be taken if this job generates this message again.

SLIP using MSGID

Figure 4-8 shows the new form of the SLIP message, and as you can see, is much more user friendly because the MSGID can be included in its ASCII form, not as a HEX representation.

```
SLIP SET,MSGID=CSQX111E,
JOBNAME=ssidCHIN,
JOBLIST=(ssidMSTR,ssidCHIN),
DSPNAME=('ssidCHIN'.CSQXTRDS),
SDATA=(CSA,RGN,PSA,SQA,LSQA,TRT,SUM),
MATCHLIM=1,END
```

Figure 4-8 SLIP SET using the MSGID parameter

Another simple use of the SLIP is to capture a dump when a specific application abend occurs. For example, you might be getting an S0C4 abend in an application program and require an SVC dump to assist with this, instead of an application or transaction dump. Figure 4-9 shows an example of a completion code SLIP.

```
SLIP SET,ENABLE,COMP=0C4,ERRTYP=PROG,JOBNAME=JOBXYZ,LPAMOD=MOD01,END
```

Figure 4-9 Completion code SLIP example

This example will capture an SVC dump when there is an S0C4 program check interruption while module MOD01 and job JOBXYZ are in control.

SLIP dump using a z/OS UNIX reason code

If a z/OS UNIX reason code is obtained and additional information is are required, the IBM Support Center personnel may ask that you set a SLIP to collect a dump or trace on a recreation of the problem. Included below are the general instructions on how to gather this data.

Obtain a dump on a specific reason code

Figure 4-10 shows an example of a SLIP that will produce a dump on the issuance of a specific reason code.

```
SLIP SET,IF,A=SYNCSVCD,
RANGE=(10?+8C?+F0?+1F4?),DATA=(13R??+1B0,EQ,xxxxxxxx),DSPNAME=('OMVS'.*),
SDATA=(ALLNUC,PSA,CSA,LPA,TRT,SQA,RGN,SUM),j=jobname,END
```

Figure 4-10 Register 13 reason code SLIP example

Where:

- `xxxxxxxx` = the 8-digit (4 byte) reason code that is to be trapped.
- j=jobname is the optional jobname that is expected to issue the error (for example j=IBMUSER).

> **Note:** In rare instances the above SLIP will not capture the requested reason code if the module in question does not use R13 as a data register. Your IBM software support provider can check the specific reason code and determine if this is the reason the SLIP did not match.

4.5 SNAP dumps

Figure 4-11 SNAP dump processing

SNAP dump

A SNAP dump is like getting a snapshot of yourself while kicking a ball. You can go back later and look at what you did wrong so that you can improve.

A SNAP dump shows virtual storage areas that a program, while running, requests the system to dump. A SNAP dump, therefore, is written while a program runs, rather than during abnormal end. The program can ask for a dump of as little as a 1-byte field to as much as all of the storage assigned to the current job step. The program can also ask for some system data in the dump. A SNAP dump is especially useful when testing a program. A program can dump one or more fields repeatedly to let the programmer check intermediate steps in calculations. For example, if a program being developed produces incorrect results, requests for SNAP dumps can be added to the program to dump individual variables. The first time incorrect storage is encountered should narrow down the section of code causing the error.

Note: A SNAP dump is written while a program runs, rather than during abnormal end.

Obtaining a SNAP dump

Obtain a SNAP dump by taking the following steps:

1. Code a DD statement in the JCL for the job step that runs the problem program to be dumped with a ddname other than SYSUDUMP, SYSABEND, SYSMDUMP, or another restricted ddname. The statement can specify that the output of the SNAP dump should be written to one of the following:

– Direct access storage device (DASD). For example,

```
//SNAP1 DD DSN=MY.SNAP.DUMP,DISP=(OLD)
```

– Printer. Note that a printer is not recommended because the printer cannot be used for anything else while the job step is running, whether a dump is written or not.

– SYSOUT. SNAP dumps usually use SYSOUT. For example,

```
//SNAP1 DD SYSOUT=X
```

– Tape. For example,

```
//SNAP1 DD DSN=SNAP.TO.TAPE,UNIT=TAPE,DISP=(OLD)
```

2. In the problem program:

   a. Specify a data control block (DCB) for the data set to receive the dump. For a standard dump, which has 120 characters per line, the DCB must specify:

```
BLKSIZE=882 or 1632
    DSORG=PS
    LRECL=125
    MACRF=(W)
    RECFM=VBA
```

   For a high-density dump, which has 204 characters per line and will be printed on an APA 3800 printer, the DCB must specify:

```
    BLKSIZE=1470 or 2724
    DSORG=PS
    LRECL=209
    MACRF=(W)
    RECFM=VBA
```

   b. Code an OPEN macro to open the DCB.

   Before you issue the SNAP or SNAPX macro, you must open the DCB that you designate on the DCB parameter, and ensure that the DCB is not closed until the macro returns control. To open the DCB, issue the DCB macro with the following parameters, and issue an OPEN macro for the data set:

```
DSORG=PS,RECFM=VBA,MACRF=(W),BLKSIZE=nnn,LRECL=xxx,
    and DDNAME=any name but SYSABEND, SYSMDUMP or SYSUDUMP
```

   If the system loader processes the program, the program must close the DCB after the last SNAP or SNAPX macro is issued.

   c. Code a SNAP or SNAPX assembler macro to request the dump. We recommend the use of the SNAPX macro as this allows for programs running in Access-Register (AR) mode to cause the macro to generate larger parameter lists. In the following example, the SNAPX macro requests a dump of a storage area, with the DCB address in register 3, a dump identifier of 245, the storage area's starting address in register 4, and the ending address in register 5:

```
SNAPX  DCB=(3),ID=245,STORAGE=((4),(5))
```

   Repeat this macro in the program as many times as wanted, changing the dump identifier for a unique dump. The system writes all the dumps that specify the same DCB to the same data set.

   d. Close the DCB with a CLOSE assembler macro.

Customizing SNAP dumps

An installation can customize the contents of SNAP dumps through the IEAVADFM or IEAVADUS installation exits. IEAVADFM is a list of installation routines to be run and IEAVADUS is one installation routine. The installation exit routine runs during control block formatting of a dump when the CB option is specified on the SNAP or SNAPX macro. The routine can format control blocks and send them to the data set for the dump. See *z/OS MVS Installation Exits*, SC28-1753, for more information.

4.6 Standalone dumps

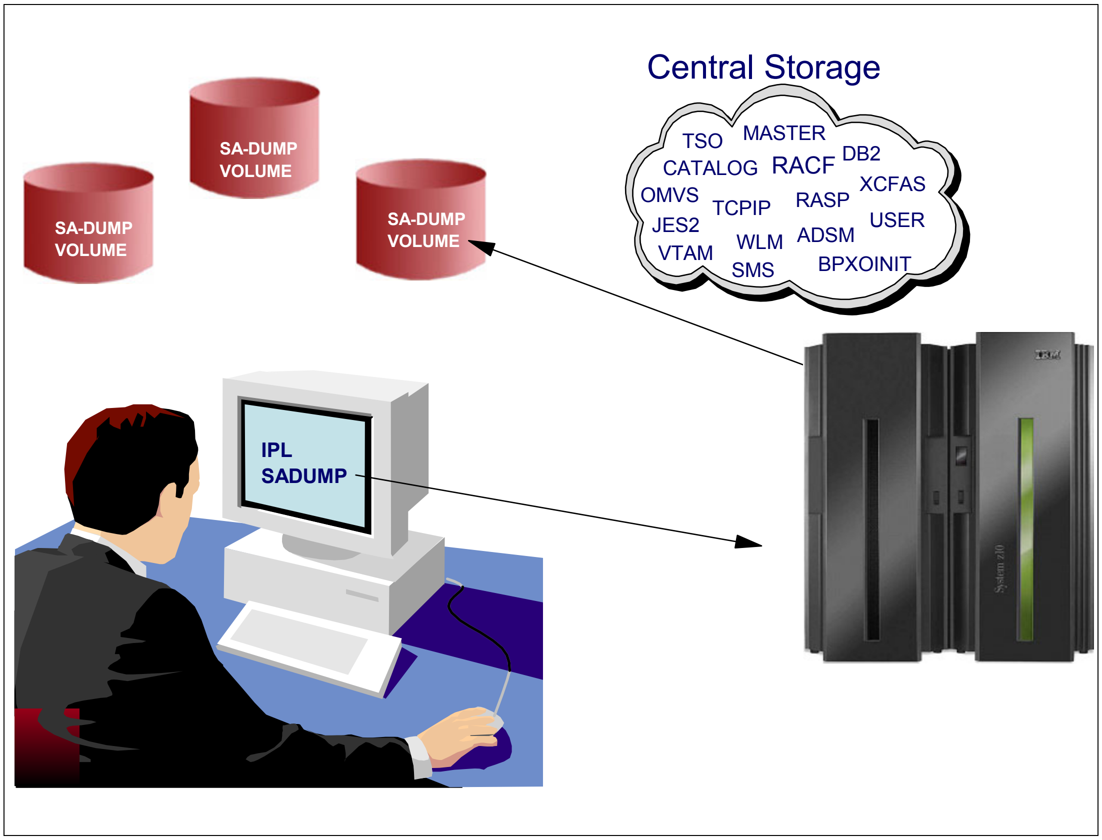

Figure 4-12 Standalone dump

Standalone dump

Standalone dumps are not produced by z/OS but by a program called SADMP, which is IPLed in place of z/OS. You need to provide an SA dump IPL program for each release. You should not take an SA dump from z/OS V1R12 to take an SA dump from a system running z/OS V1R13. When to use a standalone dump is shown in Figure 4-12.

The standalone dump program and the standalone dump together form what is known as the standalone dump service aid. The term standalone means that the dump is performed separately from normal system operations and does not require the system to be in a condition for normal operation. The standalone dump program produces a high-speed, unformatted dump of main storage and parts of paged-out virtual storage on a tape device or a direct access storage device (DASD). The standalone dump program, which you create, must reside on a storage device that can be used to IPL. Produce a standalone dump when the failure symptom is a wait state with a wait state code, a wait state with no processing, an instruction loop, or slow processing. Standalone dumps can be analyzed using IPCS.

Note: You can enable z/OS to automatically trigger a standalone dump using the automatic IPL (AutoIPL) function. AutoIPL is an automated function, defined in the DIAGxx parmlib member, that the system checks at wait state time. AutoIPL can re-IPL z/OS, or take a SADMP, or take a SADMP and have SADMP re-IPL z/OS when it finishes. For details, including the hard-coded table of wait state and reason codes, there is the wait state action table (WSAT), which triggers AutoIPL.

Planning a multivolume standalone dump

Plan a multivolume standalone dump data set that places each volume on a separate DASD volume on a separate control unit. You can achieve the best dump performance when the dump is taken to a multivolume DASD standalone dump data set. Standalone dump exploits multiple, independent volume paths to accelerate data recording. The dump data set is actually spread across all of the specified volumes, not each volume in succession. They should not be treated as multiple single data sets.

> **Note:** There are significant performance improvements when writing the data to a multivolume standalone dump data set, or to specific types of DASD.

Allocating the standalone dump data set

Prior to z/OS V1R7, in the SYS1.SAMPLIB data set, you can use the AMDSADDD REXX utility to allocate and initialize the SADMP dump data set. The dump data set must be both allocated and initialized using the AMDSADDD REXX or IPCS SADMP dump data set utilities panel created in z/OS V1R7, shown in Figure 4-13.

```
-------------------- SADMP DASD Dump Data Set Utility -------------------
Command ==>

Enter/verify parameters.
Use ENTER to perform function, END to terminate.

 Function  ==> R ( C - Clear, D - Define, R - Reallocate)
 DSNAME    ==>

 Volume serial numbers:  (1-32)
    1- 8  VOL001
    9-16
   17-24
   25-32

 Unit ==> 9345  (3380, 3390, or 9345)
 Cylinders ==> 500      (cylinders per volume)
 DSNTYPE(LARGE)  ==> N  (Y or N)

 Optional SMS classes:  (May be required by installation ACS routines)
 StorClas ==>            DataClas ==>            MgmtClas ==>
```

Figure 4-13 SADMP DASD Dump Data Set Utility panel

> **Note:** Beginning with z/OS v1R7, you can use the SADMP DASD dump data utility and select option 3.6 to use a panel to create, clear, and reallocate SADMP data sets on DASD. This utility performs the same functions associated with the AMDSADDD REXX utility. You can also use AMDSADDD, but references to the REXX utility in SYS1.SAMPLIB no longer exist. You must now refer to this utility in SYS1.SBLSCLIO. The data set is placed in SBLSCLI0 rather than SAMPLIB because it is no longer a sample.

You can EXEC this REXX utility from the ISPF data set utility option 3.4, and either VIEW (V), BROWSE (B) or EDIT (E) the data set. You can issue the following command from the ISPF option line and the utility prompts you as shown in Figure 4-14 on page 91.

```
EXEC 'SYS1.SBLSCLIO(AMDSADDD)'
```

```
What function do you want?
Please enter DEFINE if you want to allocate a new dump data set
Please enter CLEAR if you want to clear an existing dump data set
Please enter REALLOC if you want to reallocate and clear an existing
       dump data set
Please enter QUIT if you want to leave this procedure
define

 Please enter VOLSER or VOLSER(dump_dataset_name)
SDD01A(WTSCPLX1.SADMP.SDD01A)
 Please enter the device type for the dump data set
 Device type choices are 3380 or 3390 or 9345
3390
 Please enter the number of cylinders
10014
 Do you want the dump data set to be cataloged?
 Please respond Y or N
Y
 TIME-08:59:31 AM. CPU-00:00:03 SERVICE-549023 SESSION-01:18:42 APRIL 9,

 Initializing output dump data set with a null record:
 Dump data set has been successfully initialized

 Results of the DEFINE request:

   Dump data set Name   : WTSCPLX1.SADMP.SDD01A
   Volume               : SDD01A
   Device Type          : 3390
   Allocated Amount     : 10014
***
```

Figure 4-14 Prompts issued by the AMDSADDD REXX utility

Or, you can just enter this command and execute without prompts:

```
TSO EXEC 'SYS1.SBLSCLIO(AMDSADDD)''DEFINE SDD01A(WTSCPLX1.SADMP.SDD01A) 3390
10014 YES LARGE'
```

Note: The size used, 10014, and the data set type, LARGE, are new with z/OS V1R7. See **6.4, "IPCS support of large data sets" on page 155**.

4.7 The SADMP program

- Produces a high-speed unformatted dump
  - Central storage and parts of virtual storage
  - Dump to tape or DASD
  - Created with AMDSADM macro
- Default DASD device

Figure 4-15 SADMP processing of dumps

The SADMP program

The SADMP program produces a high-speed, unformatted dump of main storage and parts of paged-out virtual storage on a tape device or a direct access storage device (DASD). The SADMP program that you create must reside on a storage device that can be used to IPL.

Create the SADMP program by using the AMDSADM macro to produce the following:

- A SADMP program that resides on DASD, with output directed to a tape volume or to a DASD dump data set
- A SADMP program that resides on tape, with output directed to a tape volume or to a DASD dump data set

Create the SADMP program with the following JCL as an example.

```
//SADMPGEN JOB  MSGLEVEL=(1,1)
//OSG      EXEC PGM=AMDSAOSG
//SYSLIB   DD   DSN=SYS1.MACLIB,DISP=SHR
//         DD   DSN=SYS1.MODGEN,DISP=SHR
//DPLTEXT  DD   DSN=SYS1.NUCLEUS(AMDSADPL),DISP=SHR
//IPLTEXT  DD   DSN=SYS1.NUCLEUS(AMDSAIPD),DISP=SHR
//PGETEXT  DD   DSN=SYS1.NUCLEUS(AMDSAPGE),DISP=SHR
//GENPRINT DD   DSN=SADMP.LIST,DISP=OLD
//GENPARMS DD   *
         AMDSADMP IPL=DSYSDA,VOLSER=SPOOL2,                           X
               CONSOLE=(1A0,3277)
         END
/*
```

ADMSADMP macro

AMDSADMP processing does not allocate the data set or check to see that a valid MVS data set name has been provided. Therefore, you should ensure that:

- The AMDSADDD REXX utility is used to allocate and initialize the same data set name specified on the OUTPUT= keyword.
- The data set name specified should be fully qualified (without quotes).
- The necessary data set management steps are taken so that the SADMP dump data sets will not be placed into a migrated state or moved to a different volume.
- Alphabetic characters appearing in the dump data set name should be specified as capital letters.

You need to answer some questions when you plan for a standalone dump. Some typical questions are:

- Should I take a standalone dump to DASD or to tape?
- Can I use my current version of the standalone dump program to dump a new version of z/OS?

Default DASD device

If the default DASD device is to be used and no dump data set name is provided, the SADMP program will assume that the default dump data set name is SYS1.SADMP if the DDSPROMPT=NO parameter was also specified. Otherwise, if DDSPROMPT=YES was specified, the SADMP program will prompt the operator at run-time for a dump data set name to use.

- At run-time, only a null response to message AMD001A will cause the SADMP program to use the default device and/or dump data set name.
- Do not place a data set that is intended to contain a standalone dump on a volume that also contains a page or swap data set that the standalone dump program may need to dump. When SADMP initializes a page or swap volume for virtual dump processing, it checks to see if the output dump data set also exists on this volume. If it does, the SADMP program issues message AMD100I and does not retrieve any data from page or swap data sets on this volume. Thus, the dump may not contain all of the data that you requested. This lack of data may impair subsequent diagnosis.
- You cannot direct output to the SADMP residence volume.

4.8 Using standalone dumps

- Standalone dump steps
  - Select processor that stopped
  - Is a STORE STATUS required ?
  - Find a ready device (Tape or DASD)
  - IPLing SADMP
  - Select a console defined to AMDSADMP

Figure 4-16 SADMP steps to create the dump

Standalone dump procedure

Use the following procedure to initialize the SADMP program and dump storage:

1. Select a processor that was online when the system was stopped.
2. If the processor provides a function to IPL a standalone dump without performing a manual STORE STATUS, use this function to IPL SADMP. If you do not use such a function, perform a STORE STATUS before IPLing a standalone dump. If the operator does not store status, virtual storage is not dumped.

   The hardware store-status facility stores the current program status word (PSW), current registers, the processor timer, and the clock comparator into the unprefixed prefix save area (PSA). This PSA is the one used before the nucleus initialization program (NIP) initialized the prefix register.

   If you IPL the standalone dump program from the hardware console, it is not necessary to perform the STORE STATUS operation. Status is automatically stored when standalone dump is invoked from the hardware console and automatic store status is on.

   If the operator does not issue the STORE STATUS instruction before IPLing a standalone dump, the message `ONLY GENERAL PURPOSE REGS VALID` might appear on the formatted dump. The PSW, control registers, and so on, are not included in the dump.

> **Note:** Do not use the LOAD CLEAR option because it erases main storage, which means that you will not be able to diagnose the failure properly.

3. Make the residence device ready. If it is a tape, mount the volume on a device attached to the selected processor and ensure that the file-protect ring is in place. If it is a DASD volume, ensure that it is write-enabled.
4. IPL SADMP

   SADMP does not communicate with the operator console. Instead, SADMP loads an enabled wait PSW with wait reason code X' 3E0000'. The IPLing of the standalone dump program causes absolute storage (X'0' through X'18' and storage beginning at X'110') to be overlaid with CCWs. You should be aware of this and not consider it as a low storage overlay.

   Note: SADMP uses the PSW to communicate with the operator or systems programmer.

   SADMP waits for a console I/O interrupt or an external interrupt.
5. Select the system console or an operator console with a device address that is in the console list that you specified at SADMP generation time (in the CONSOLE keyword of AMDSADMP). At SADMP run time, the operator can choose either a console specified with the CONSOLE= keyword or the system console to control SADMP operation. If an operator console is chosen, press Attention or Enter on that console. (On some consoles, you might have to press Reset first.) This causes an interruption that informs SADMP of the console's address. Message AMD001A appears on the console.
   a. Make an output device ready. When you dump to devices that have both real and virtual addresses (for example, dumping a VM system), specify only the real address to the SADMP program. If you are dumping to tape, ensure that the tape cartridge is write-enabled. If you are dumping to DASD, ensure that the DASD data set has been initialized using the AMDSADDD REXX utility.
   b. Reply with the device number for the output device. If you are dumping to a DASD device and DDSPROMPT=YES was specified on the AMDSADMP macro, message AMD002A is issued to prompt the operator for a dump data set. If DDSPROMPT=NO was specified, message AMD002A is not issued and the SADMP program assumes that the dump data set name is SYS1.SADMP.

Note: Pressing Enter in response to message AMD001A will cause the SADMP program to use the default device specified on the OUTPUT= keyword of the AMDSADMP macro. If the default device is a DASD device, then pressing the Enter key in response to message AMD001A will cause the SADMP program to use both the default device and the dump data set specified on the OUTPUT= keyword of the AMDSADMP macro. If no dump data set name was provided on the OUTPUT= keyword and the DDSPROMPT=YES keyword was specified, message AMD002A is issued to prompt the operator for a dump data set. If DDSPROMPT=NO was specified, then the SADMP program assumes that the dump data set name is SYS1.SADMP.

If you reply with the device number of an attached device that is not of the required device type, or if the device causes certain types of I/O errors, SADMP might load a disabled wait PSW. When this occurs, use procedure B to restart SADMP.

4.9 SADMP processing

- Procedures for processing the dump
  - Specify a dump title
  - Respond to a prompt message - AMD011A
  - Ready the output device
    - Monitor AMD095I message issued every 30 seconds
  - Specifying PROMPT option on AMDSADMP macro
    - Is additional storage required to be dumped
- Considerations while taking the dump

Figure 4-17 SADMP processing considerations

Processing the SADMP

SADMP prompts you, with message AMD011A, for a dump title. When no console is available, run SADMP without a console.

- Ready the default output device that was specified on the OUTPUT parameter on the AMDSADMP macro. For tapes, ensure that the tape cartridge is write-enabled. For DASD, ensure that the dump data set has been initialized using the AMDSADDD REXX utility.

> **Note:** You can create different versions of the standalone dump program to dump different types and amounts of storage. You can do this by coding several AMDSADMP macros and varying the values of keywords on the macros.

- Enter an external interruption on the processor that SADMP was IPLed from. SADMP proceeds using the default output device and/or the default dump data set. No messages appear on any consoles; SADMP uses PSW wait reason codes to communicate to the operator.

Message AMD005I

When SADMP begins and finishes dumping main storage, it issues message AMD005I to display the status of the dump. SADMP may end at this step.

When SADMP begins dumping real storage it issues message AMD005I. Message AMD095I is issued every 30 seconds to indicate the progress of the dump. Message AMD005I will be issued as specific portions of real storage have been dumped, as well as upon completion of the real dump. SADMP may end at this step.

PROMPTs specified

If you specified PROMPT on the AMDSADMP macro, SADMP prompts you for additional storage that you want dumped by issuing message AMD059D.

SADMP dumps instruction trace data, paged-out virtual storage, the SADMP message log, and issues message AMD095I every 30 seconds to indicate the progress of the dump.

When SADMP completes processing, SADMP unloads the tape, if there is one, and enters a wait reason code X'410000'.

Considerations for taking the dump

Consider the following actions to take based on system availability and severity of problem:

- If I do dump to DASD, how much space do I need?
- Can I dump to multiple dump data sets?
- What can I name my DASD dump data sets?
- How much of the system should I dump?
- When should I specify the dump tailoring options?
- What type of security does the standalone dump program require?
- Should I use IEBGENER or the COPYDUMP subcommand to copy a dump to a dump to a data set?
- What is dumped when I run the standalone dump program?

4.10 SADMP support for EAV volumes

- SADMP provides a new function to fully support placement of dump data set in cylinder-managed space on extended access volumes
- In z/OS V1R12 the REXX exec AMDSADDD and IPCS utility Option 6, SADMP DASD dump data set utility
  - Is changed to provide support for SADMP data sets in cylinder-managed space
  - SADMP data sets must be defined as extended format sequential data sets and are fully supported by IPCS

Figure 4-18 SADMP support for EAV volumes

SADMP support for EAV volumes

The first stage of EAV support was shipped in z/OS V1R10. This EAV support allowed most VSAM objects to reside in cylinder-managed space on extended access volumes.

The second stage of EAV support in z/OS V1R11 adds the ability to place extended format sequential data sets in cylinder-managed space. The EAV support was largely implemented by the DFSMS of z/OS.

SADMP provides a new function to fully support placement of dump data sets in cylinder-managed space on extended access volumes. This was introduced in z/OS V1R11, but the supporting IPCS functions were not enhanced. In z/OS V1R12 the REXX exec AMDSADDD and IPCS utility Option 6, SADMP DASD Dump Data Set Utility, are changed to provide support for SADMP data sets in cylinder-managed space.

SADMP data sets defined as extended format sequential data sets can now be allocated in cylinder-managed space and are fully supported by IPCS.

4.11 SVC dumps

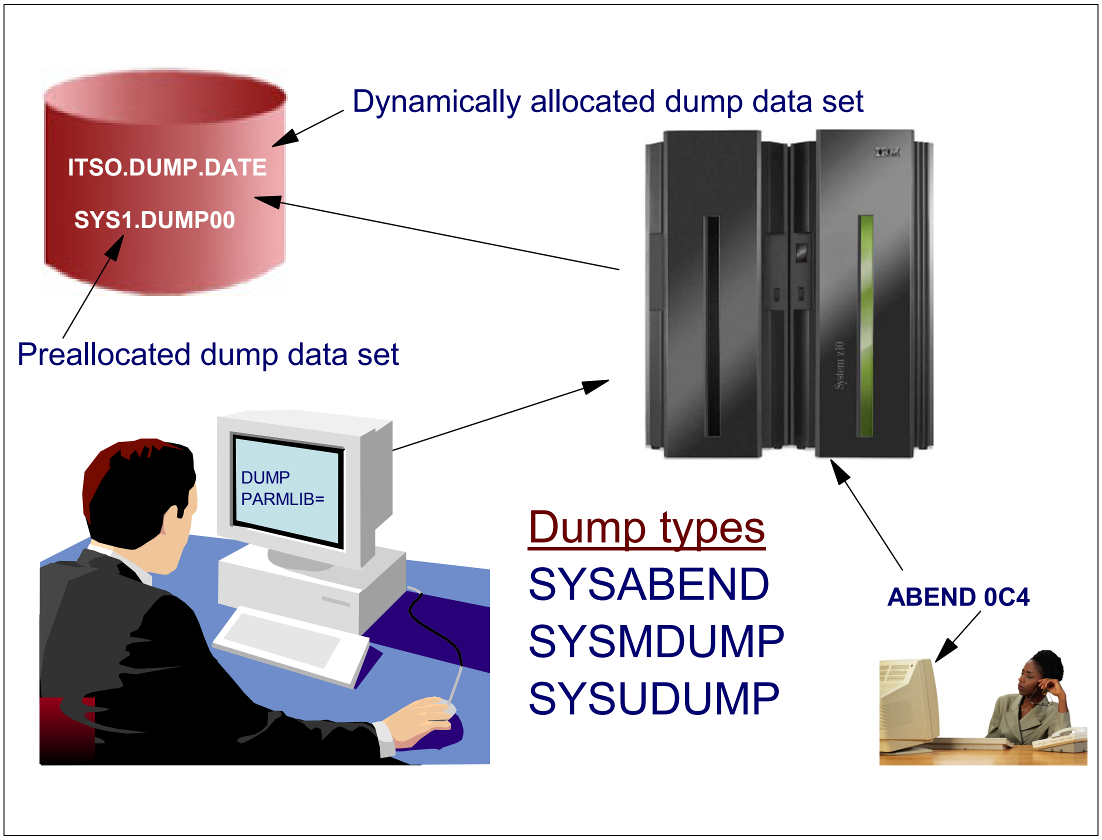

Figure 4-19 SVC dumps

SVC dump

An SVC dump provides a representation of the virtual storage for the system when an error occurs. Typically, a system component requests the dump from a recovery routine when an unexpected error occurs. However, an authorized program or the operator can also request an SVC dump when diagnostic dump data is needed to solve a problem.

SVC dumps can be used in different ways:

- Most commonly, a system component requests an SVC dump when an unexpected system error occurs, but the system can continue processing.
- An authorized program or the operator can also request an SVC dump (by using the SLIP or DUMP commands) when they need diagnostic data to solve a problem.

SVC dump contents

SVC dumps contain a summary dump, control blocks, and other system code, but the exact areas dumped depend on whether the dump was requested by a macro, command, or SLIP trap. SVC dumps can be analyzed using IPCS.

SVC dump processing stores data in dump data sets that you pre-allocate manually, or that the system allocates automatically, as needed. You can also use pre-allocated dump data sets as a back up in case the system is not able to allocate a data set automatically. To prepare your installation to receive SVC dumps, you need to provide SYS1.DUMPxx data sets. These data sets will hold the SVC dump information for later review and analysis. This section describes how to set up the SVC dump data sets.

Note: An incomplete dump, or partial dump, is 99 percent of the time, useless.

Dump data set size

When the z/OS operating system initiates, or is instructed to dump an address space, or multiple address spaces, the data will be written to a dump data set on a disk device. These data sets can be pre-allocated, as is the case with the traditional SYS1.DUMPxx data sets, or dynamically allocated, in which case a new data set is allocated whenever the system requests a dump.

In conjunction with the dump data set, the user-defined MAXSPACE parameter must be set to ensure that sufficient memory is allocated to retain the dump information in use by the address spaces and system areas. The default value is 500 megabytes. The value that can be specified may range from 1 to 99999999.

Application-related dumps can be written to a data set pointed to by the SYSMDUMP DD statement in the JCL. The data written to the SYSMDUMP data set is always required to diagnose application-related problems running under Language Environment control.

4.12 Allocating SYS1.DUMPxx data sets

- Name your SYS1.DUMPxx data sets - xx=00-99
- Blocksize must be 4160 bytes
  - RECFM=FBS (Fixed block spanned)
- Initialize with first record being an EOF
- Allocation requirements
  - UNIT - DISP - Volume - Space
- Managing SYS1.DUMPxx data sets
  - DUMPDS CLEAR,DSN=xx

Figure 4-20 Allocating the SYS1.DUMPxx data sets

Allocating SYS1.DUMPxx data sets

To prepare your installation to receive SVC dumps, you need to provide SYS1.DUMPxx data sets. These data sets will hold the SVC dump information for later review and analysis.

Allocate SYS1.DUMPxx data sets using the following requirements:

- Name the data set SYS1.DUMPxx, where xx is a decimal number of 00 through 99.
- Select a device with a track size of 4160 bytes. The system writes the dump in blocked records of 4160 bytes. If you want to increase the Block Size for the dump data set, you can do so as long as the blocking factor does not exceed 7, for example; 29120, and the Record Format (RECFM) must be Fixed Block Spanned (FBS).
- Initialize with an end of file (EOF) record as the first record.
- Allocate the data set before requesting a dump. Allocation requirements are:

  UNIT A permanently resident volume on a direct access device.

  DISP Catalog the data set (CATLG). Do not specify SHR.

  VOLUME Place the data set on only one volume. Allocating the dump data set on the same volume as the page data set could cause contention problems during dumping, as pages for the dumped address space are read from the page data set and written to the dump data set.

  SPACE An installation must consider the size of the page data set that will contain the dump data. The data set must be large enough to hold the amount of data as defined by the MAXSPACE parameter on the CHNGDUMP command, VIO pages, and pageable private area pages. SVC dump processing improves service by allowing secondary extents to be specified when large dump data sets are too large for the amount of DASD previously allocated. An installation can protect itself against truncated dumps by specifying secondary extents and by leaving sufficient space on volumes to allow for the expansion of the dump data sets. For the SPACE keyword, you can specify CONTIG to make reading and writing the data set faster. Request enough space in the primary extent to hold the smallest SVC dump expected. Request enough space in the secondary extent so that the primary plus the secondary extents can hold the largest SVC dump. The actual size of the dump depends on the dump options in effect when the system writes the dump.

Note: Approximately 250 cylinders will be sufficient for most single address space SVC dump requirements.

Making an SVC dump available

An SVC dump is taken to an SVC dump data set, either specified on the DCB parameter of the SDUMP or SDUMPX macro, available as SYS1.DUMPxx, or automatically allocated. SVC dump processing issues message IEA793A when the dump has been captured, but there are no available dump data sets. When a SYS1.DUMPxx data set is not available, the operator has the option either of deleting the captured dump by replying D or making another dump data set available to SVC dump processing. To make another dump data set available, the operator uses the DUMPDS command.

Managing SVC dump data sets

The system writes only one dump in each SYS1.DUMPxx data set. Before the data set can be used for another dump it can be cleared by using the DUMPDS command with the CLEAR keyword. The format if the command is:

```
DUMPDS CLEAR,DSN=xx
```

Where `xx` is the SYS1.DUMPxx identifier. You can abbreviate the DUMPDS command to DD, for example:

```
DD CLEAR,DSN=01
```

4.13 Automatic allocation of SVC dump data sets

- SVC dump supports automatic allocation:
  - Automatic allocation when system writes the dump
  - Allocates from a set of DASD volumes of SMS classes
  - Can specify in COMMNDxx parmlib member
  - By operator after IPL with DUMPDS command
- Steps to initiate automatic allocation
  - Create a user ID for DUMPSRV address space
  - Authorize user ID
  - Create data set naming pattern
  - Add resources for dump using DUMPDS command

Figure 4-21 Automatic allocation of SVC dump data sets

Automatic allocation

SVC dump processing supports automatic allocation of dump data sets at the time the system writes the dump to DASD. The dump can be allocated from a set of DASD volumes or SMS classes. When the system captures a dump, it allocates a data set of the correct size from the resources you specify. If automatic allocation fails, pre-allocated dump data sets are used. If no pre-allocated SYS1.DUMPnn data sets are available, message IEA793A is issued, and the dump remains in virtual storage. SVC dump periodically retries both automatic allocation and writing to a pre-allocated dump data set until successful or until the captured dump is deleted either by operator intervention or by the expiration of the CHNGDUMP MSGTIME parameter governing message IEA793A.

DASD volumes and SMS classes

Once active, allocation to SMS classes and DASD volumes is done starting from the first resource you added with the DUMPDS ADD command until unsuccessful, then the next resource is used. If you have defined both DASD volumes and SMS classes, SMS classes are used first. Allocation to DASD volumes is not multivolume or striped, while allocation to SMS classes can be multivolume or striped, depending on how the storage class is set up by the installation.

COMMNDxx parmlib member

You can specify the command instructions to enable or disable automatic allocation either in the COMMNDxx parmlib member, to take effect at IPL, or from the operator console at any time after the IPL, to dynamically modify automatic allocation settings.

If you use COMMNDxx, you may want to specify DUMP=NO in the IEASYSxx parmlib member to prevent dumps taken during IPL from being written to SYS1.DUMPxx data sets.

DUMPDS command

The DUMPDS command provides the following flexibility:

- Activate automatic allocation of dump data sets
- Add or delete allocation resources
- Direct automatic allocation to SMS or non-SMS managed storage
- Deactivate automatic allocation of dump data sets
- Reactivate automatic allocation of dump data sets
- Change the dump data set naming convention

Steps to initiate automatic allocation

Automatic allocation can be set up using the following steps:

- Set up allocation authority
- Establish a name pattern for the data sets
- Define resources for storing the data sets
- Activate automatic allocation

Add resources for dump using DUMPDS command

The steps to initiate automatic dump data set allocation are:

- Associate the DUMPSRV address space with a user ID.
- Authorize DUMPSRV's user ID to create new dump data sets.
- Set up your installation data set name pattern using the DUMPDS command:

```
DUMPDS NAME=SC68;.&JOBNAME;.Y&YR4;M&MON;.D&DAY;T&HR;&MIN;.S&SEQ;
```

- Add dump data set resources that can be used by the automatic allocation function:

```
DUMPDS ADD,VOL=(SCRTH1,HSM111)
DUMPDS ADD,SMS=(DUMPDA)
```

- Activate automatic dump data set allocation using the **DUMPDS** command:

```
DUMPDS ALLOC=ACTIVE
```

> **Note:** These steps can be performed after IPL using the DUMPDS command from an operator console, or early in IPL by putting the commands in the COMMNDxx parmlib member and pointing to the member from the IEASYSxx parmlib member using CMD=xx.

4.14 Dumping multiple address spaces in a sysplex

- Create a SYS1.PARMLIB member - IEADMCxx
  - Can create multiple members
- Requesting a dump
  - Dumping dataspaces
- Considerations using SLIP entries
  - SLIP examples
    - IEASLPxx examples

Figure 4-22 Considerations for dumping multiple address spaces in a sysplex

Multiple address space dumps

The standalone dump program allows a dump to be contained in multiple dump data sets. Therefore, when you want to view a standalone dump using IPCS, it is necessary to concatenate all of the dump data sets onto one DASD data set.

Use the following JCL to invoke the IPCS COPYDUMP subcommand to copy standalone dump output from three DASD dump data sets to another data set. Note that two of the dump data sets reside on the volume SADMP1, while the third resides on the volume SADMP2.

```
//SADCOPY  JOB MSGLEVEL=(1,1)
//COPY     EXEC PGM=IKJEFT01
//SYSTSPRT DD SYSOUT=A
//C1       DD DSN=SADMP1.DDS1,DISP=SHR,UNIT=DASD,VOL=SER=SADMP1
//C2       DD DSN=SADMP1.DDS2,DISP=SHR,UNIT=DASD,VOL=SER=SADMP1
//C3       DD DSN=SYS1.SADMP,DISP=SHR,UNIT=DASD,VOL=SER=SADMP2
//COPYTO   DD DSN=SADUMP.COPY,UNIT=DASD,
//            VOL=SER=SADCPY,DISP=(NEW,CATLG),
//            DCB=(RECFM=FBS,LRECL=4160,DSORG=PS),
//            SPACE=(4160,(8000,4000),RLSE)
//SYSTSIN DD  *
  IPCS NOPARM DEFER
  COPYDUMP OUTFILE(COPYTO) NOCONFIRM INFILE(C1, C2, C3)
  END
/*
```

Dumping multiple address spaces

To dump multiple address spaces in a sysplex environment, the following examples can be used as a guide. Create a SYS1.PARMLIB member using a IEADMCxx member containing the following DUMP parameters shown in Figure 4-23, as follows:

- job1 = IMS Control Region Jobname - job2 = IMS DLI region Jobname
- job3 = DBRC Region Jobname - job4 = IRLM Region Jobname (If IRLM DB Locking used)

```
JOBNAME=(job1,job2,job3,job4),
SDATA=(CSA,PSA,RGN,SQA,SUM,TRT,GRSQ),
REMOTE=(SYSLIST=*('job1','job2','job3','job4'),SDATA)
```

Figure 4-23 IEADMCI1 example

Figure 4-24 shows the creation of a second SYS1.PARMLIB member, IEADMCI2, containing the following DUMP parameters:

- job5 = CCTL Region 1 - job6 = CCTL Region 2 - job7 = CCTL Region 3

```
JOBNAME=(job5,job6,job7),
SDATA=(CSA,PSA,RGN,SQA,SUM,TRT,GRSQ,XESDATA),
REMOTE=(SYSLIST=*('job5','job6','job7'),SDATA)
```

Figure 4-24 IEADMCI2 example

Requesting a dump

To request a dump to be captured as per the IEADMCI1 and IEADMCI2 parmlib members, issue the following MVS command:

```
DUMP TITLE=(IMS/CCTL sysplex DUMPS),PARMLIB=(I1,I2)
```

If the data space DSPNAME parameter is specified, for example:

```
DSPNAME=('job1'.*)
```

Two dump data sets are created on each MVS image in the sysplex matching the REMOTE specifications for the JOBNAMEs. Then the same data space is dumped in the associated address spaces in the other systems if the DSPNAME parameter is included on the REMOTE statement. For example:

```
REMOTE=(SYSLIST=*('job1','job2','job3','job4'),SDATA,DSPNAME)
```

Considerations using SLIP entries

Figure 4-25 and Figure 4-26 shows and alternative where IEASLPxx has been used containing the following SLIP entries, using the IEASLPxx example, as follows:

- job1 = IMS Control Region Jobname
- job2 = IMS DLI region Jobname
- job3 = DBRC Region Jobname
- job4 = IRLM Region Jobname (If IRLM DB Locking is used)

```
SLIP SET,IF,N=(IEAVEDS0,00,FF),A=(SYNCSVCD,TARGETID),
SDATA=(CSA,PSA,RGN,SQA,SUM,TRT,GRSQ),
JOBLIST=(job1,job2,job3,job4),ID=IMS1,TARGETID=(IMS2),
REMOTE=(JOBLIST,SDATA),D,END
```

Figure 4-25 IEASLPxx example

- job5 = CCTL Region 1
- job6 = CCTL Region 2
- job7 = CCTL Region 3

```
SLIP SET,IF,N=(IEAVEDS0,00,FF),
JOBLIST=(job5,job6,job7),ID=IMS2,
SDATA=(CSA,PSA,RGN,SQA,SUM,TRT,XESDATA),
REMOTE=(JOBLIST,SDATA),
D,END
```

Figure 4-26 IEASLPxx example

Before activating the SLIP, ensure that any existing PER SLIP for each MVS image in the sysplex is disabled, as follows:

```
ROUTE *ALL,SLIP,MOD,DISABLE,ID=trapid
```

To activate the SLIP trap and trigger the associated SVC dumps, enter the following MVS commands:

```
SET SLIP=xx
SLIP MOD,ENABLE,ID=IMS1
```

Two dumps are then be captured on each MVS image in the sysplex matching the REMOTE specifications.

4.15 Managing taking a dump

- ❑ Tasks can be canceled with a dump using:
  - ➢ MVS CANCEL command
    - – CANCEL jobname,DUMP
- ❑ Dump analysis and elimination (DAE)
  - ➢ Suppressing dumps
    - – Using ADYSETxx parmlib member with SET DAE=xx
- ❑ Handling partial dumps

Figure 4-27 Ways to manage taking a dump

Canceling jobs with a dump

Cancelling a problem task can be initiated from either an MVS console or from an SDSF session running under TSO provided sufficient security privileges have been set up. The MVS console has the highest dispatching priority which allows commands to be issued at a sufficient level to handle most system loop or hang conditions. An IPL will be required if the problem task cannot be terminated using these procedures. Attempting to cancel a looping task via an SDSF session executing under TSO will often fail because the TSO session will have an insufficient dispatching priority to interrupt the loop process, but this is dependant on the severity of the looping process.

The CANCEL command can be performed as follows:

1. Issue the CANCEL jobname from the master console, where jobname is the looping task.
2. If the looping task is a TSO user, then issue, CANCEL U=tsouser.
3. Optionally, you might want to take a dump during the cancel. This is achieved by adding the DUMP option to the CANCEL command. For example,

   ```
   CANCEL jobname,DUMP
   ```

   It is recommended that a separate DUMP command be issued, and after this has been successfully processed, then CANCEL the task. This will dump according to the SYSABEND, SYSUDUMP, or SYSMDUMP DD statements specified in the JCL.

Dump analysis and elimination (DAE)

DAE suppresses dumps that match a dump you already have. Each time DAE suppresses a duplicate dump, the system does not collect data for the duplicate or write the duplicate to a data set. The ADYSETxx members in SYS1.PARMLIB control the DAE facility. If you find that dumps are being suppressed, as indicated by the following messages: IEA820I, IEA848I or IEA838I, please review DAE to ensure that you do not suppress this dump. A stop and start of DAE is required to reset the dump suppression count.

A stop of DAE is done by issuing a SET DAE=xx, where the xx in the ADYSETxx member contains a DAE=STOP,GLOBALSTOP command.

Restart DAE by SET DAE=xx, where xx is the active ADYSETxx parmlib member. This is often ADYSET00.

Partial dumps

How can you determine if the dump that has been captured is a complete dump? A partial, or incomplete dump will be missing some key areas of storage that in most cases will make the dump useless when it comes to efficient problem diagnosis.

The only other way to determine whether the dump is partial is to interrogate the dump using the Interactive Problem Control System (IPCS)—apart from the obvious message that will be generated in the z/OS system log that indicates a dump is partial, or that the dump MAXSPACE has been reached. Figure 4-28 shows an example of the IEA042I message.

```
IEA043I SVC DUMP REACHED MAXSPACE LIMIT - MAXSPACE=xxxxxxxx MEG or
IEA611I PARTIAL DUMP ON dsname
```

Figure 4-28 IEA611I message indicating partial dump

Figure 4-29 shows the result of the IPCS LOCATE command that can be issued to interrogate the storage, which will indicate if the dump taken was partial. In this case we are looking at storage at address x’E0’ for a length of 16 bytes.

```
Command ===> ip l e0. block(0) l(16)
*********************************************** TOP OF DATA **************
LIST E0. BLOCK(0) LENGTH(X'10') AREA
BLOCK(0) ADDRESS(E0.)
000000E0. 00000000 30000000 00000000 00000000 |................ |
***********************************************END OF DATA **************
```

Figure 4-29 IPCS Storage Address Locate for IEA611I reason

The 4 words found at location X'E0' contain partial dump reason codes. These codes are mapped by DSECT SDRSN, and can be found in the z/OS data areas manual. The flags are also listed in *z/OS MVS System Messages, Volume 6 (GOS-IEA)*, SA22-7636 under message IEA611I. The description listed under IEA611I for x'30000000' in the second word is:

```
20000000 -The system detected an error in the SVC dump task and gave recovery
control.
10000000 - The SVC dump task failed.
```

If the values displayed at location X’E0’ are all zero, then the dump is not partial.

4.16 Customizing dumps using SDATA options

- Customizing dumps
  - SVC, SYSABEND, SYSUDUMP, SYSMDUMP
- Checking SDATA options
  - Use operator command - d d,o
- Creating SDATA options
- IPCS and SDATA options

Figure 4-30 Options to customize dumps

Customizing SVC dumps

You can customize the contents of an SVC dump, SYSABEND, SYSUDUMP, and SYSMDUMP dumps, to meet the needs of your installation. For example, you might want to add areas to be dumped, reduce the dump size, or dump Hiperspaces. In most cases, you will customize the contents of an SVC dump or summary dump via the SDATA parameter of the SDUMP or SDUMPX macro or with operator commands.

SDATA options

To check the SDUMP (SDATA) options in your system, enter the D D,O command on the operator console. Figure 4-31 shows an example where we can see that the SDUMP options are the default ones.

```
RESPONSE=MCEVS1
 IEE857I 15.04.04 DUMP OPTION 796
   SYSABEND- ADD PARMLIB OPTIONS SDATA=(LSQA,TRT,CB,ENQ,DM,IO,ERR,SUM),
                         PDATA=(SA,REGS,LPA,JPA,PSW,SPLS)
   SYSUDUMP- ADD PARMLIB OPTIONS SDATA=(SUM), NO PDATA OPTIONS
   SYSMDUMP- ADD PARMLIB OPTIONS (NUC,SQA,LSQA,SWA,TRT,RGN,SUM)
   SDUMP- ADD OPTIONS (LSQA,TRT,XESDATA),BUFFERS=00000000K,
                        MAXSPACE=00000500M,MSGTIME=99999 MINUTES
```

Figure 4-31 Dump options

Creating SDATA options

If you need to add more options, you can use the following command:

```
CD SET,SDUMP=(PSA,LPA,RGN,SUM,SQA,CSA)
```

Enter D D,O again and you should see the update shown in Figure 4-32.

```
RESPONSE=MCEVS1
 IEE857I 15.24.13 DUMP OPTION 514
   SYSABEND- ADD PARMLIB OPTIONS SDATA=(LSQA,TRT,CB,ENQ,DM,IO,ERR,SUM),
                        PDATA=(SA,REGS,LPA,JPA,PSW,SPLS)
   SYSUDUMP- ADD PARMLIB OPTIONS SDATA=(SUM), NO PDATA OPTIONS
   SYSMDUMP- ADD PARMLIB OPTIONS (NUC,SQA,LSQA,SWA,TRT,RGN,SUM)
   SDUMP- ADD OPTIONS (PSA,SQA,LSQA,RGN,LPA,TRT,CSA,SUMDUMP,XESDATA),
                       BUFFERS=00000000K,MAXSPACE=00000500M,
                       MSGTIME=99999 MINUTES
   ABDUMP- TIMEENQ=0240 SECONDS
```

Figure 4-32 SDUMP options

IPCS and SDATA options

Figure 4-33 shows the result of the IPCS control block format of the CVT to interrogate the SDATA options that were in effect when the dump was taken. The command is:

```
IP CBF RTCT+9C? STR(SDUMP) VIEW(FLAGS)
```

```
SDUMP_PL: 00FB357C

   ==> FLAGS SET IN SDUFLAG0:
    Set system non-dispatchable while dumping global storage.

   ==> FLAGS SET IN SDUFLAG1:
    SYSMDUMP request.
    SUMLIST specified.
    Ignore CHNGDUMP parameters.
    TSO user extension is present.
    48+ byte parameter list.

   ==> FLAGS SET IN SDUSDATA:
    Dump SQA.
    Dump LSQA.
    Dump rgn-private area.
    Dump LPA mod. for rgn.
    Dump trace data.
    Dump SWA.
    Do not dump all PSA.
```

Figure 4-33 Example of IPCS “IP CBF RTCT+9C? STR(SDUMP) VIEW(FLAGS)” command

Even though the SDATA RGN parameter has been specified, the fact that some areas of RGN storage may have been paged out when the dump was taken can result in a “storage not available”.

4.17 Dump options and considerations

- IEADRM00 parmlib member
  - SDATA=(parms,.......)
    - SDATA=(NUC,SQA,LSQA,SWA,TRT,LPA,CSA,RGN,GRSQ,ALLNUC,NOSYM,SUM)
- SYSMDUMP considerations with z/OS UNIX
- CHNGDUMP command
  - CHNGDUMP DEL - Removing options from or resetting the system
  - CHNGDUMP RESET - Resetting dump mode to ADD and the dump options to initial values
  - CHNGDUMP SET - Setting the dump modes and options

Figure 4-34 Dump options in parmlib and commands

IEADMR00 parmlib member

IEADMR00 contains IBM defaults and/or installation parameters for ABDUMP, for use when an ABEND dump is written to a SYSMDUMP data set.

> **Note:** During an IPL, an informational message will notify the operator if IEADMR00 is invalid or cannot be found. No prompting of the operator will occur. If the member contains both valid and invalid parameters, an informational message will indicate the valid options that were accepted before the error occurred.

SYSMDUMP data set

ABDUMP parameters for a SYSMDUMP data set may be specified as follows:

- The dump request parameter list pointed to by the DUMPOPT keyword of an ABEND macro. The list can be built by using the list form of the SNAP macro.
- The initial system dump options specified in IEADMR00. These options are added to the options on the dump request parameter list.
- The system dump options as altered by the CHNGDUMP command. With the CHNGDUMP command, options can be added to or deleted from the system dump options list. The CHNGDUMP command can also cause the dump request parameters to be ignored.

4.18 Catalog address space (CAS) dumps

- DUMP command for CAS
  - F CATALOG,DUMPON
  - F CATALOG,DUMPON(aaa,bbb,cc)
  - F CATALOG,DUMPON(aaa,bbb,cc,nnn)
    - aaa The catalog rc in decimal (000-255), or ***
    - bbb The catalog rc in decimal (000-255), or ***
    - cc The catalog module identifier in CAS, or **
  - DUMPON option
  - DUMPOFF option

Figure 4-35 Catalog address space dumps

MODIFY CATALOG,DUMPON syntax

MODIFY or F CATALOG, DUMPON or DUMPOFF specifies whether CAS dynamic dumping is to occur. Dynamic dumping by CAS does not occur unless you specify DUMPON.

- MODIFY CATALOG,DUMPON
- MODIFY CATALOG,DUMPON(aaa,bbb,cc)
- MODIFY CATALOG,DUMPON(aaa,bbb,cc,nnn)

Where:

- aaa - The catalog return code in decimal (000-255), or ***
- bbb - The catalog reason code in decimal (000-255), or ***
- cc - The catalog module identifier in CAS, or **
- nnn - The limit number in decimal (000-999)

Options in parenthesis that follow the DUMPON parameter can be used to create a dump whenever a given return code, reason code, and module identifier occur. This dump can prove valuable to service personnel in solving problems. Normally, the return code, reason code, and module identifier are available on return from CAS and are printed by IDCAMS. The module identifier corresponds to the last two characters in the catalog module name. For example, the module identifier is A3 for IGG0CLA3. The return code, reason code, and module identifiers may be specified as a string of asterisks to indicate any value encountered will match the value of that field. This is referred to as a generic match. All three fields may not be simultaneously specified as asterisks. Whenever a generic match is specified for a particular field, it will be assumed that field always matches the value being returned by catalog for a catalog request. As an example:

```
MODIFY CATALOG,DUMPON(008,042,**)
```

This will create a dump for any return code 8, reason code 42, regardless of the module that detected the error. An option has been provided for a match count to obtain the nth occurrence of a return code, reason code, and module identifier. The match count decrements by one each time a return code, reason code, and module identifier is set in the catalog address space, If this option is not specified or is set to 000, then the first occurrence causes a dump.

Only one set of return codes, reason codes and module identifiers can be set at a time. Each entry overwrites the previous information. Once a match occurs, the information is cleared and the original DUMPON status is maintained. If DUMPON is entered without the additional options, certain conditions will produce dumps automatically. If then a DUMPON with options is entered, a match will cause a dump and the return code, reason code and module identifier will be cleared. The DUMPON status will remain on.

```
MODIFY CATALOG,REPORT,DUMP can be used to view the settings.
```

The header for the catalog dynamic dump will contain the return code and reason code in hex. For example:

```
CAS DYNAMIC DUMP-IGG0CLA9 RCX'00' RSNX'00'
```

5

z/OS trace processing

Another useful source of diagnostic data is the trace. Tracing collects information that identifies ongoing events that occur over a period of time. Some traces are running all the time so that trace data will be available in the event of a failure. Other traces must be explicitly started to trace a defined event.

In this chapter, the following trace activity is described:

- GTF trace
- Component trace
- Master trace
- GFS trace
- System trace
- SMS tracing

5.1 z/OS trace facilities

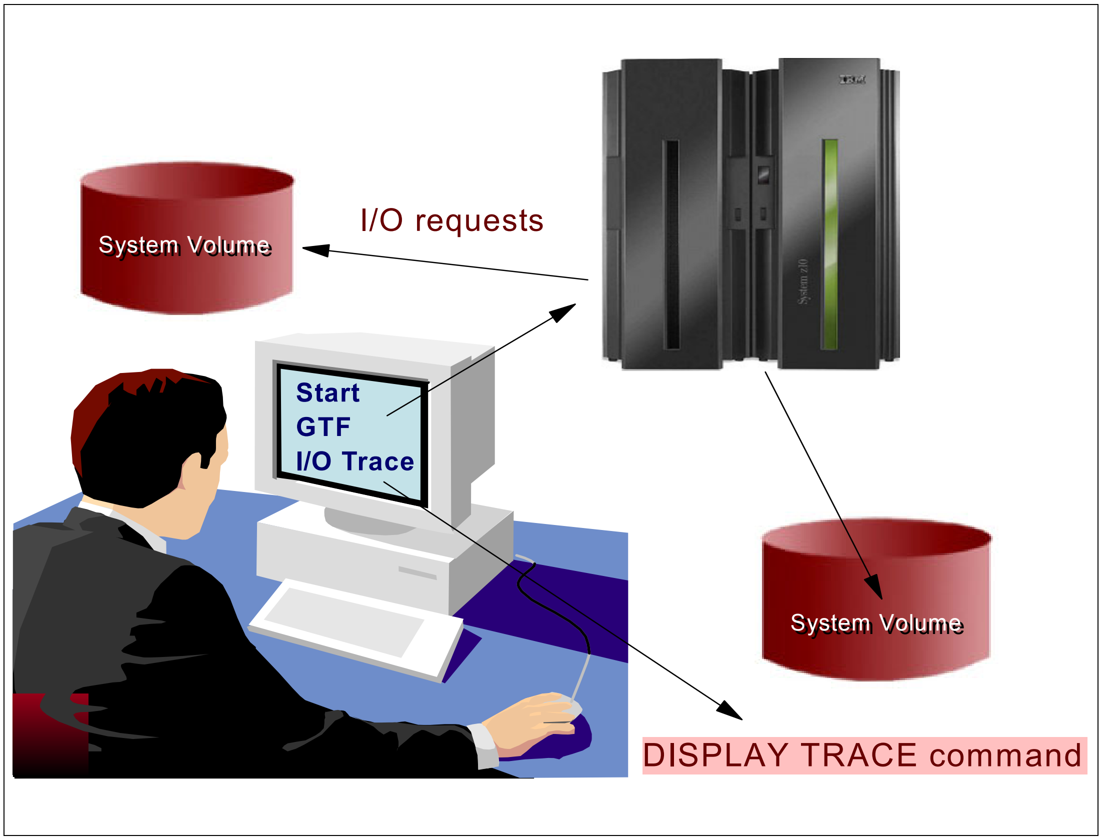

Figure 5-1 z/OS trace facilities

GTF trace facility

The generalized trace facility (GTF) is a service aid you can use to record and diagnose system and program problems. GTF is part of the MVS system product, and you must explicitly activate it by entering a `START GTF` command.

Use GTF to record a variety of system events and program events on all of the processors in your installation. If you use the IBM-supplied defaults, GTF lists many of the events that system trace lists, showing minimal data about them. However, because GTF uses more resources and processor time than system trace, IBM recommends that you use GTF when you experience a problem, selecting one or two events that you think might point to the source of your problem. This will give you detailed information that can help you diagnose the problem. You can trace combinations of events, specific incidences of one type of event, or user-defined program events that the GTRACE macro generates. For example, you can trace:

- Channel programs and associated data for start and resume subchannel operations, in combination with I/O interruptions
- I/O interruptions on one particular device
- System recovery routine operations

Note: The events that GTF traces are specified as options in a parmlib member. You can use the IBM supplied parmlib member or provide your own. Details of GTF operation, which include storage that is needed, where output goes, and recovery for GTF are defined in a cataloged procedure in SYS1.PROCLIB.

I/O trace

GTF builds an I/O record when an I/O interruption occurs and TRACE=SYSM, TRACE=SYS, TRACE=IO, or TRACE=IOP are the GTF options in effect. To trace PCI I/O interruptions, TRACE=PCI must also be in effect.

SYS1.TRACE

When you start GTF, a trace output data set is created and has the name SYS1.TRACE. The data set resides on a DASD that is large enough for the data set to contain 20 physical blocks. After completely filling the 20 physical blocks, GTF will overlay previously written records with new trace records, starting at the beginning of the output data set.

I/O requests

When you start GTF, one of the options is to trace I/O requests. GTF then requests recording of all nonprogram-controlled I/O interruptions. Unless you also specify the PCI trace option, GTF does not record program-controlled interruptions.

Using the DISPLAY TRACE command

To display the current trace option in effect issue the MVS D TRACE command. Figure 5-2 shows an example of the output generated by the D TRACE command. It shows that we have system trace (ST) enabled, with 256K allocated for the system trace table on each processor and 3584K allocated to the system trace table buffers. Address space (AS) tracing is ON and branch tracing is OFF, as is explicit software tracing. Master tracing is ON with a master trace table size of 24K. This also displays the status of component and sub-component traces.

```
IEE843I 19.30.33  TRACE DISPLAY 177
        SYSTEM STATUS INFORMATION
 ST=(ON,0256K,03584K) AS=ON  BR=OFF EX=ON  MT=(ON,024K)
 COMPONENT MODE  COMPONENT MODE  COMPONENT MODE  COMPONENT MODE
 --------------------------------------------------------------
 SYSGRS    MIN   SYSTCPRT  OFF   SYSJES2   OFF   SYSANT00  MIN
 SYSANT01  MIN   SYSRRS    MIN   SYSSPI    OFF   SYSJES    OFF
 SYSSMS    OFF   SYSOPS    ON    SYSXCF    ON    SYSLLA    MIN
 SYSXES    ON    SYSTTRC   OFF   SYSTCPDA  OFF   SYSRSM    OFF
 SYSAOM    OFF   SYSVLF    MIN   IRLM      OFF   SYSTCPIP  OFF
 SYSLOGR   ON    SYSOMVS   ON    SYSWLM    MIN   SYSTCPIS  OFF
 SYSTCPRE  OFF   SYSIOS    MIN   JRLM      OFF   SYSIEFAL  ON
```

Figure 5-2 Display trace command output

Issue D TRACE,COMP=SYSOMVS, and the output is shown in (Figure 5-3).

```
IEE843I 19.36.21  TRACE DISPLAY 490
        SYSTEM STATUS INFORMATION
 ST=(ON,0256K,03584K) AS=ON  BR=OFF EX=ON  MT=(ON,024K)
  COMPONENT     MODE BUFFER HEAD SUBS
 --------------------------------------------------------------
  SYSOMVS       ON   0004M
     ASIDS      *NONE*
     JOBNAMES   *NONE*
     OPTIONS    ALL
     WRITER     *NONE*
```

Figure 5-3 Display trace,comp=tracename output

5.2 GTF trace definitions

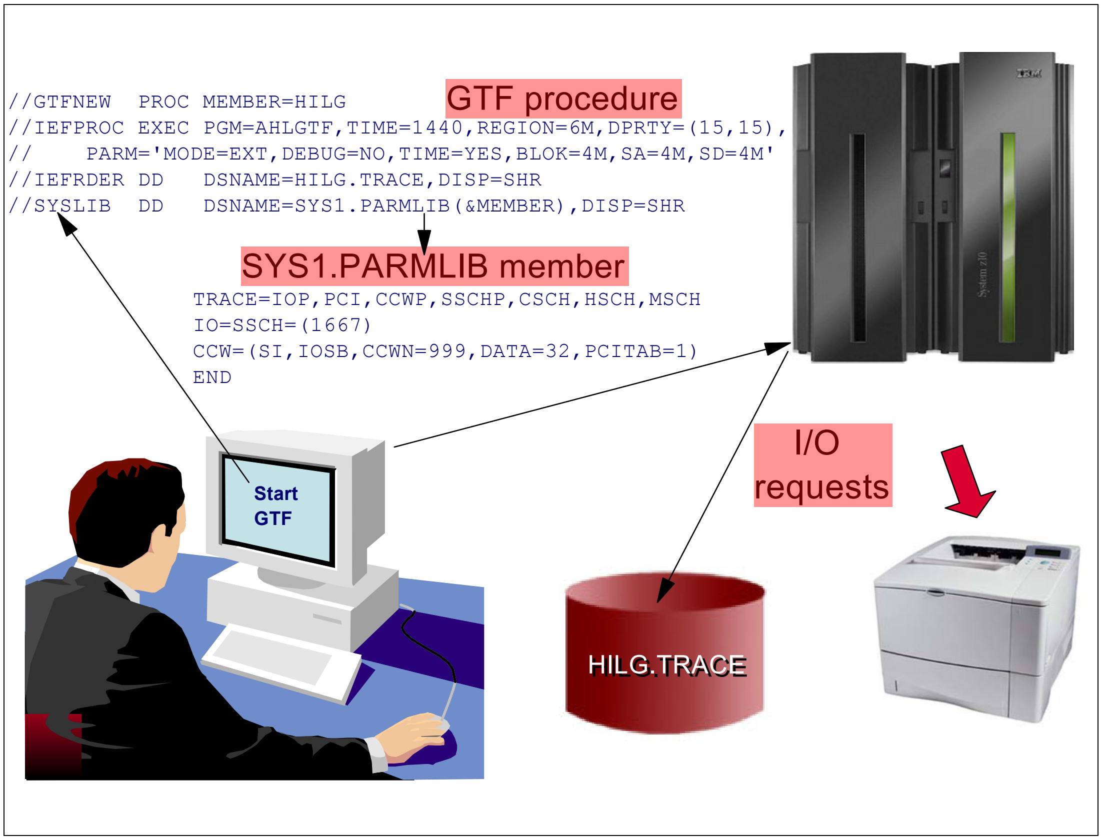

Figure 5-4 GTF processing

Start GTF trace

Use a GTF trace to show system processing through events occurring in the system over time. The installation controls which events are traced. GTF tracing uses more resources and processor time than a system trace. Use GTF when you are familiar enough with the problem to pinpoint the one or two events required to diagnose your system problem. GTF can be run to an external data set as well as a buffer.

GTF procedure

When you activate GTF, it operates as a system task, in its own address space. The only way to activate GTF is to enter a START GTF command from a console with master authority. Using this command, the operator selects either the IBM or your cataloged procedure for GTF. The cataloged procedure defines GTF operation; you can accept the defaults that the procedure establishes, or change the defaults by having the operator specify certain parameters on the START GTF command.

Because GTF sends messages to a console with master authority, enter the command only on a console that is eligible to be a console with master authority. Otherwise, you cannot view the messages from GTF that verify trace options and other operating information.

IBM supplies the GTF cataloged procedure, which resides in SYS1.PROCLIB. This procedure defines GTF operation, including storage needed, where output is to go, recovery for GTF, and the trace output data sets. Figure 5-5 on page 119 shows the format of the IBM-supplied GTF procedure.

```
//GTF PROC MEMBER=GTFPARM
//IEFPROC EXEC PGM=AHLGTF,PARM='MODE=EXT,DEBUG=NO,TIME=YES',
// TIME=1440,REGION=2880K
//IEFRDER DD DSNAME=SYS1.TRACE,UNIT=SYSDA,SPACE=(TRK,20),
// DISP=(NEW,KEEP)
//SYSLIB DD DSN=SYS1.PARMLIB(&MEMBER),DISP=SHR
```

Figure 5-5 GTF procedure

SYS1.PARMLIB member for GTF

GTFPARM provides default or installation-defined trace options to control the generalized trace facility (GTF). The member is read only when the operator (or an automatic command) issues START GTF. GTFPARM is not used during system initialization.

The member name on the START GTF command can be the same as the IBM-supplied cataloged procedure, GTF. The PROC statement of that procedure identifies GTFPARM as the member from which GTF will get its trace parameters. If the installation wants to place the GTFPARM member in a data set other than SYS1.PARMLIB, specify the alternate data set in the SYSLIB DD statement and then specify a member from that PDS using the MEMBER keyword, as shown in Figure 5-4 on page 118. If the installation wants to substitute another member in place of GTFPARM, as shown in the figure, the operator may enter the replacement member name on the START command with the MEMBER keyword.

Trace data to external devices

The two primary locations that are used to store GTF trace data are as follows:

- A data set on DASD
- Internal storage

The benefit of writing to internal storage is that if the trace is being taken to be reviewed in conjunction with a dump, the GTF in-storage buffers will be dumped along with the address space. You will have trace and dump data taken at the same time, and this can be reviewed using IPCS.

> **Note:** If you need to trace for an extended period of time, then writing to an external device is advisable.

5.3 Implementing GTF trace

- Defining GTF trace options
  - GTF procedure options
  - GTFPARM member options
  - GTF trace options
- Starting GTF
  - {START | S} {GTF | membername}.identifier
- Stopping GTF
  - {STOP | P} identifier
    - Display identifier - D A,LIST
- GTF tracing for reason code interrogation

Figure 5-6 Implementing GTF tracing

Defining the GTF trace options

Some GTF trace options also require keywords. If you specify options requiring keywords in the member or data set containing the predefined options, it must also contain the associated keywords. The GTF options can be specified through either system prompting in response to the START GTF command or in a predefined parmlib member or data set member. However, GTF will not use certain combinations of options. Figure 5-7 shows the GTF trace option meanings.

SYSM	Selected system events
USR	User data that the GTRACE macro passes to GTF
TRC	Trace events associated with GTF itself
DSP	Dispatchable units of work
PCI	Program-controlled I/O interruptions
SRM	Trace data associated with the system resource manager (RSM)

Figure 5-7 GTF trace options

Note: For these combinations, and regarding other GTF options, see *z/OS MVS Diagnosis: Tools and Service Aids*, SY28-1085.

GTF procedure options

We recommend that GTF be started with the following parameters, which are specified in the GTF procedure in SYS1.PROCLIB:

```
PARM='MODE(INT)' and REGION=2880K
```

Options specified on the PARM parameter specify where GTF writes trace data and the amount of storage needed for GTF to collect and save trace data in various dump types (Figure 5-8).

```
MODE={INT|EXT|DEFER}
SADMP={nnnnnnK|nnnnnnM|40K}
SDUMP={nnnnnnK|nnnnnnM|40K}
NOPROMPT
ABDUMP={nnnnnnK|nnnnnnM|0K}
BLOK={nnnnn|nnnnnK|nnnnnM|40K}
SIZE = {nnnnnnK|nnnnnnM|1024K}
TIME=YES
DEBUG={YES|NO}
```

Figure 5-8 GTF parameters on the PARM= in the GTF procedure

The GTF parameters SADMP, SDUMP, ABDUMP and BLOK parameters should all be set to at least 10 MB.

GTFPARM member

Figure 5-7 on page 120 shows the IBM-supplied GTFPARM parmlib member, which contains the GTF trace options, as follows:

```
TRACE=SYSM,USR,TRC,DSP,PCI,SRM
```

Note: The member containing predefined trace options does not have to reside in the parmlib member. GTF will accept any data set specified in the SYSLIB DD statement of the cataloged procedure, or in the START command, as long as that data set's attributes are compatible with those of SYS1.PARMLIB.

Starting GTF

To invoke GTF, the operator issues the following START command:

```
{START|S}{GTF|membername}.identifier
```

After the operator enters the START command, GTF issues message AHL100A or AHL125A to allow the operator either to specify or to change trace options. If the cataloged procedure or START command did not contain a member of predefined options, GTF issues message AHL100A so the operator may enter the trace options you want GTF to use. If the procedure or command did include a member of predefined options, GTF identifies those options by issuing the console messages AHL121I and AHL103I. Then you can either accept these options, or reject them and have the operator respecify new options. Figure 5-9 on page 122 shows the sequence of messages that appear on the console when starting GTF.

```
START GTF.EXAMPLE1
AHL121I TRACE OPTION INPUT INDICATED FROM MEMBER GTFPARM OF PDS SYS1.PARMLIB
TRACE=SYSM,USR,TRC,DSP,PCI,SRM
AHL103I TRACE OPTIONS SELECTED--SYSM,USR,TRC,DSP,PCI,SRM
*451 AHL125A RESPECIFY TRACE OPTIONS OR REPLY U
REPLY 451,U
AHL031I GTF INITIALIZATION COMPLETE
```

Figure 5-9 GTF start-up messages

Stopping GTF

The operator can enter the STOP command at any time during GTF processing. The amount of time you let GTF run depends on your installation and the problem you are trying to capture, but a common time is between 15 and 30 minutes.

To stop GTF processing, have the operator enter the STOP command. This command must include either the GTF identifier specified on the START command, or the device number of the GTF trace data set if you specified MODE=EXT or MODE=DEFER to direct output to a data set.

If you are not sure of the identifier, or the device number of the trace data set, ask the operator to enter the DISPLAY A,LIST command. Figure 5-10 shows the result of this command and the GTF identifier displayed is EVENT1.

```
DISPLAY A,LIST
IEE114I 14.51.49 2005.181 ACTIVITY FRAME LAST F E SYS=SY1
JOBS M/S TS USERS SYSAS INITS ACTIVE/MAX VTAM OAS
00000 00003 00000 00016 00000 00000/00000 00000
LLA LLA LLA NSW S VLF VLF VLF NSW S
JES2 JES2 IEFPROC NSW S
GTF EVENT1 IEFPROC NSW S
.....................
```

Figure 5-10 D A,LIST command

The operator must enter the STOP command at a console with master authority. The general format of the command is:

```
{STOP|P} identifier
```

When the STOP command takes effect, the system issues message AHL006I. If the system does not issue this message, then GTF tracing continues, remaining active until a STOP command takes effect, or until the next initial program load (IPL). When this happens, you will not be able to restart GTF tracing. In this case, you can use the FORCE ARM command to stop GTF. If there were several functions started with the same identifier on the START command, using the same identifier on the STOP command will stop all those functions.

GTF tracing for reason code interrogation

In some instances your software support provider may ask you to capture a GTF trace that will contain all the reason codes issued by a particular job. This is more likely if the reason code is not reported externally. If you choose to look at such a GTF trace, be aware that many reason codes are issued validly and do not represent real errors (that is, reason codes that indicate file not found are usually quite valid).

Prior to setting the slip below you would need to start GTF with options TRACE=SLIP. The slip that would be set is:

```
SLIP SET,IF,A=TRACE,RANGE=(10?+8C?+F0?+1f4?),TRDATA=(13R??+B0,+B3),END
```

After recreating the problem, stop GTF and format the output using the IPCS command GTFTRACE.

Another way to stop GTF is provided by our slip processing as follows:

```
SL SET,IF,L=(IGC0003E,0), A=(SVCD,STOPGTF), DATA=(10%+64%+22C,EQ,00000000), END
```

This slip will take a dump when we enter module IGC0003E at offset 0 and the compare statement in the DATA option is fulfilled. In addition it will stop the GTF process. If you have more than one GTF active you need to provide the GTF process name

If we have a problem in our system which is not related to only one component, it is important to get the docs for all components in question. Have a look at Figure 5-11 on page 124, which shows how to gather documentation for a TCPIP and USS related problem.

```
1. TURN ON CTRACE for TCPIP

   TRACE CT,ON,COMP=SYSTCPIP,SUB=(tcpipprocname)
       R XX,OPTIONS=(PFS,TCP,SOCKET,SOCKAPI,INTERNET),END

2. TURN ON PACKET TRACE

   TRACE CT,ON,COMP=SYSTCPDA,SUB=(tcpipprocname, tsouserid)
   Reply to the following message:
   ITT006A SPECIFY OPERAND(S) FOR TRACE CT COMMAND
   r xx,end
   V TCPIP,tcpipprocname,PKT,ON,IP=xx.xx.xx.xx

3. TURN ON OMVS CTRACE

TRACE CT,64M,COMP=SYSOMVS
   R xx,OPTIONS=(ALL),END

4.  Setup Dump of TSOUSerid, TCPIP,OMVS and their dataspaces:

       DUMP COMM=(Dump Title)
    R xx,SDATA=(ALLNUC,CSA,LPA,LSQA,RGN,SWA,SQA,TRT),CONT
    R xx,JOBNAME=(tcpproc,tsouserid,OMVS),CONT
    R xx,DSPNAME=('OMVS'.*,'tcpproc'.TCPIPDS1),CONT
    this will leave an outstanding WTOR that we will reply to
    take the dump

5.   recreate problem.

6.   Immediately reply to take the dump

R xx,END


7.  TURN OFF PACKET TRACE

    V TCPIP,tcpipprocname,PKT,OFF,IP=xx.xx.xx.xx
    TRACE CT,OFF,COMP=SYSTCPDA,SUB=(tcpipprocname)

8.  Stop Ctrace comp(SYSTCPIP):

    TRACE CT,OFF,COMP=SYSTCPIP,SUB=(tcpipprocname)

9.  Stop OMVS CTRACE

    TRACE CT,OFF,COMP=SYSOMVS
```

Figure 5-11 TCPIP and USS documentation collection

5.4 Component trace (CTRACE)

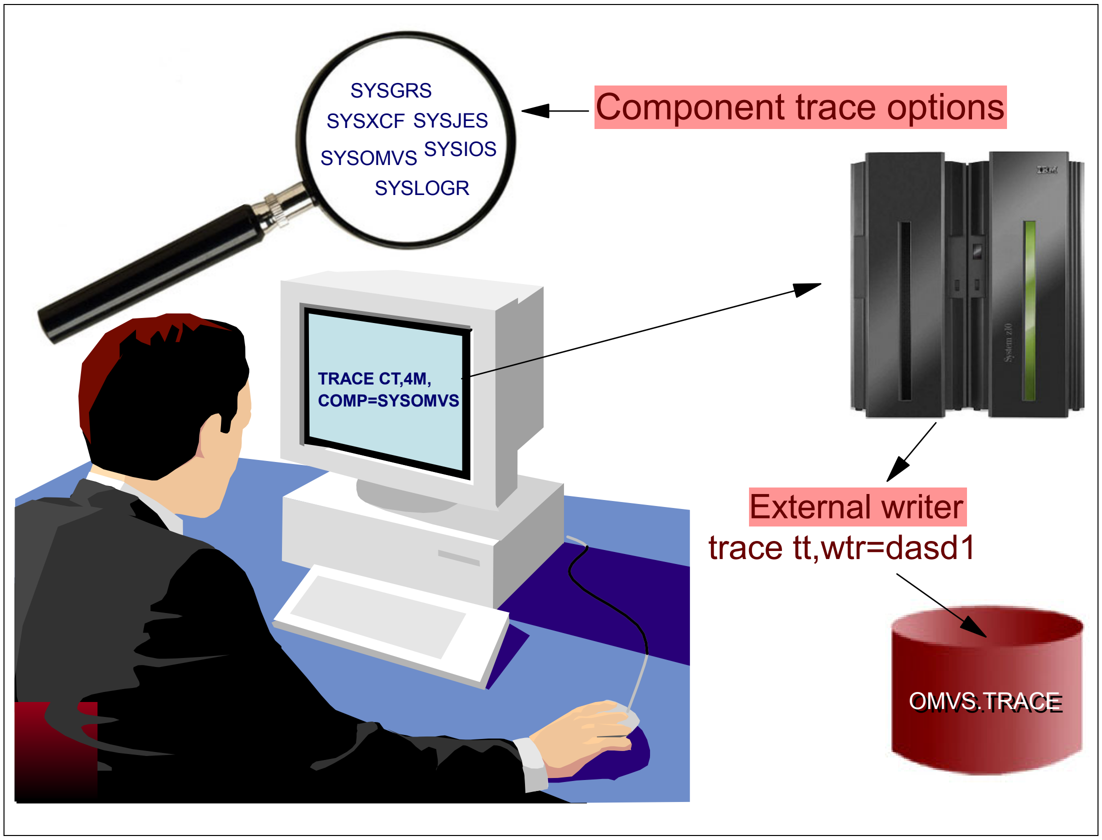

Figure 5-12 Implementing component trace (CTRACE)

Component trace

The component trace service provides a way for MVS components to collect problem data about events. Each component that uses the component trace service has set up its trace in a way that provides the unique data needed for the component.

A component trace provides data about events that occur in the component. The trace data is intended for the IBM Support Center, which can use the trace to:

- Diagnose problems in the component
- See how the component is running

If the IBM Support Center requests a trace, the Center might specify the options, if the component trace uses an OPTIONS parameter in its parmlib member or REPLY for the TRACE CT command. Several options are:

```
SYSAPPC SYSDLF SYSDSOM SYSGRS SYSIEFA SYSIOS SYSJES SYSjes2 SYSLLA SYSLOGR
SYSOMVS SYSOPS SYSRRS SYSRSM SYSTTRC SYSSPI SYSVLF SYSWLM SYSXCF SYSXES
```

You will typically use component trace while recreating a problem. The installation, with advice from the IBM Support Center, controls which events are traced for a system component. GTF does not have to be active to run a component trace.

External writer for tracing

Transaction trace supports the use of an external writer for processing transaction trace records. An external writer can be specified on the initial command that activates transaction trace, or specified standalone while transaction trace is active. Transaction trace uses the MVS **TRACE** command with the TT keyword to start an external writer. For example:

```
trace tt,wtr=prt1
```

Component trace messages are issued in response to this command. Transaction trace writes trace data in a transaction trace data space in the trace address space. If an external writer has been defined, the record is also written to the external writer. IPCS is used to view the transaction trace records.

Transaction trace external writer processing can be stopped with the use of the WTR=OFF keyword. For example:

```
trace tt,wtr=off
```

Component trace messages are issued in response to this command.

The transaction trace TRACE TT command allows the transaction trace data space size to be changed. The data space can be from 16 K to 999 K or 1 MB to 32 MB. For example:

```
trace tt,bufsiz=2m
```

The following message is issued:

```
ITZ002I 'BUFSIZ' IS SET TO 0002M
```

Note: In the example in Figure 5-12 on page 125, the operator is requesting a component trace for SYSOMVS and the external writer writes the data to a DASD data set named OMVS.TRACE

5.5 Implementing component trace

- SYS1.PARMLIB definitions
  - IBM-supplied CTIITT00 member
  - PARM=CTIITT00 can be specified on a TRACE CT command
- Specifying trace options
- Collecting trace records
- Starting component trace

Figure 5-13 Options for implementing component trace

Parmlib member definitions

The CTncccx parmlib member specifies component trace options. There is a table in *z/OS MVS Diagnosis: Tools and Service Aids*, SY28-1085, that shows whether a component has a parmlib member. It indicates whether the member is a default member needed at system or component initialization, and whether the component has default tracing. Some components run default tracing at all times when the component is running; default tracing is usually minimal and covers only unexpected events. Other components run traces only when requested. When preparing your production SYS1.PARMLIB system library, do the following:

- Make sure the parmlib contains all default members identified in the table. If the parmlib does not contain the default members at initialization, the system issues messages. The table contains the following members:

```
SYSAPPC SYSDLF SYSDSOM SYSGRS SYSIEFA SYSIOS SYSJES SYSjes2 SYSLLA SYSLOGR
SYSOMVS SYSOPS SYSRRS SYSRSM SYSTTRC SYSSPI SYSVLF SYSWLM SYSXCF SYSXES
```

- Make sure that the IBM-supplied CTIITT00 member is in the parmlib. PARM=CTIITT00 can be specified on a TRACE CT command for a component trace that does not have a parmlib member; CTIITT00 prevents the system from prompting for a REPLY after the TRACE CT command. In a sysplex, CTIITT00 is useful to prevent each system from requesting a reply.

Trace options for support center

If the IBM Support Center requests a trace, the Center might specify the options, if the component trace uses an OPTIONS parameter in its parmlib member, or REPLY for the **TRACE**

`CT` command. You must specify all options you would like to have in effect when you start a trace. Options specified for a previous trace of the same component do not continue to be in effect when the trace is started again. If the component has default tracing started at initialization by a parmlib member without an OPTIONS parameter, you can return to the default by doing one of the following:

- Stop the tracing with a TRACE CT,OFF command.
- Specify OPTIONS() in the REPLY for the TRACE CT command or in the CTncccxx member.

Collecting trace records

Depending on the component, the potential locations of the trace data are:

- In address-space buffers, which are obtained in a dump
- In data-space buffers, which are obtained in a dump
- In a trace data set or sets, if supported by the component trace

If the trace records of the trace you want to run can be placed in more than one location, you need to select the location. For a component that supports trace data sets, you should choose trace data sets for the following reasons:

- Because you expect a large number of trace records
- To avoid interrupting processing with a dump of the trace data
- To keep the buffer size from limiting the amount of trace data
- To avoid increasing the buffer size

Starting component trace

Select how the operator is to request the trace. The component trace is started by either of the following:

- A TRACE CT operator command without a PARM parameter, followed by a reply containing the options
- A TRACE CT operator command with a PARM parameter that specifies a CTncccxx parmlib member containing the options

To start a component trace, the operator enters a TRACE operator command on the console with MVS master authority. The operator replies with the options that you specified. Instead of using ON on the START command you can provide a trace buffer size, depending on the component you would like to start the trace, as follows:

```
trace ct,on,comp=sysxcf
* 21 ITT006A ....
r 21,options=(serial,status),end
```

This example requests the same trace using parmlib member CTWXCF03. When TRACE CT specifies a parmlib member, the system does not issue message ITT006A.

```
trace ct,on,comp=sysxcf,parm=ctwxcf03
```

It is possible to provide the CTRACE buffer size request on the start command. The following shows the START TRACE command for USS requesting 64 MB:

```
trace ct,64M,comp=sysomvs
```

5.6 Component trace for System Logger

- PARMLIB member example
  - CTncccxx - Parmlib member skeleton
  - CTILOG00 - System Logger parmlib member
- System Logger trace as an example
- Set up CTRACE options
- Operator command to display trace status
- SYS1.PARMLIB defintions
- Starting the trace

Figure 5-14 Setting up component trace for System Logger

Parmlib member example

`Use a CTnLOGxx parmlib member to specify the Logger ctrace options and create the CTnLOGxx parmlib member on each system in the plex. Use the SAME NAME parmlib member on each system.`

An example for a parmlib definition for System Logger follows:

```
Start the SYSLOGR trace:
TRACE CT,ON,COMP=SYSLOGR,PARM=CTnLOGxx
```

Where:

`LOG` is the `ccc`, 00 is the `xx`, and `L` is the `n`. For some components, you need to identify the component's CTncccxx member in another parmlib member. See the parmlib member listed in the default member column in the table in *z/OS MVS Diagnosis: Tools and Service Aids*, SY28-1085.

Tracing System Logger

More subsystems are now using the z/OS System Logger for logging activity that can be used during unit-of-recovery processing. This data was previously managed by the subsystems, such as CICS, DB2, and MQ, but now the System Logger address space (IXGLOGR) manages the system and subsystem log data. This can reside in a Coupling Facility, or on DASD.

CTRACE options

Problems with Logger process will often require some additional trace data, which can be collected by setting up the CTRACE for System Logger data as follows:

- Issue the following command to display the current SYSLOGR trace status:

  ```
  D TRACE,COMP=SYSLOGR
  ```

- To update the CTRACE component for the z/OS System Logger, edit the SYS1.PARMLIB member CTILOGxx. CTILOG00 is the supplied Logger CTRACE member.
- Recommended Logger CTRACE options:
- TRACEOPTSON
- BUFSIZE(256M)
- OPTIONS('CONNECT','DATASET','SERIAL','STORAGE',
- 'LOGSTRM',MISC','RECOVERY','LOCBUFF')

Parmlib definitions

Figure 5-15 shows the CTILOGxx parmlib member and the specified options.

```
TRACEOPTS ON
BUFSIZE(8M)
OPTIONS('CONNECT','DATASET','SERIAL','STORAGE',
'LOGSTRM','MISC','RECOVERY','LOCBUFF')
```

Figure 5-15 CTILOGxx parmlib member

For CTRACE, we recommend a 10 MB buffer size. The default is 2 MB.

Operator command to display status

Figure 5-16 shows the results of the **DISPLAY TRACE** command for component SYSLOGR.

```
IEE843I 01.11.36  TRACE DISPLAY 967
        SYSTEM STATUS INFORMATION
 ST=(ON,0064K,00128K) AS=ON  BR=OFF EX=ON  MT=(ON,024K)
  COMPONENT     MODE BUFFER HEAD SUBS
 --------------------------------------------------------------
  SYSLOGR       MIN  0002M
     ASIDS      *NONE*
     JOBNAMES   *NOT SUPPORTED*
     OPTIONS    MINIMAL TRACING ONLY
     WRITER     *NONE*
```

Figure 5-16 DISPLAY TRACE,COMP=SYSLOGR output

Take a dump

Often times, a dump of the Logger address space is required to diagnose a hang or other non-abend conditions. Logger provides sample IEADMCxx members that can be copied over to SYS1.PARMLIB for dumping Logger and other associated address spaces:

- IEADMCLC - Suspected problem area in Logger/CICS
- IEADMCLG - Suspected problem area in Logger/GRS
- IEADMCLS - General Logger problem

– IEADMCLX - Suspected problem area in Logger/XCF

Starting the trace

This parmlib member will be used when you issue the following command:

```
TRACE CT,COMP=SYSLOGR,PARM=CTILOGxx
```

There is minimal overhead with the MVS Logger CTRACE.

To start the CTRACE for the z/OS Logger and change the trace parameters or buffer size, you can issue:

```
TRACE CT,8M,COMP=SYSLOGR
```

```
R xx,OPTIONS=(ALL),END
```

Taking a dump

```
SYS1.SAMPLIB(IEADMCLC)

TITLE=(DUMP OF LOGGER, RLS AND CICS),
JOBNAME=(IXGLOGR,PCAUTH,SMSVSAM,IYOT*,XCFAS),
DSPNAME=('SMSVSAM'.*,'IXGLOGR'.*,'XCFAS'.*),
SDATA=(COUPLE,ALLNUC,LPA,LSQA,PSA,SWA,RGN,SQA,
       TRT,CSA,GRSQ,XESDATA,SUM)

to get dumps from remote systems

TITLE=(DUMP OF LOGGER AND GRS ACROSS SYSPLEX),
JOBNAME=(IXGLOGR,XCFAS,GRS),
DSPNAME=('IXGLOGR'.*,'XCFAS'.*,'GRS'.*),
SDATA=(COUPLE,ALLNUC,LPA,LSQA,PSA,SWA,RGN,SQA,
       TRT,CSA,GRSQ,XESDATA,SUM),
REMOTE=(SYSLIST=*('IXGLOGR','XCFAS','GRS'),DSPNAME,SDATA)
```

5.7 Master trace

- Parmlib defintions
  - SCHEDxx member in SYS1.PARMLIB
- Starting the master trace
  - Change the trace table size and then start
    - TRACE MT,500K
    - TRACE MT
    - TRACE MT,OFF
- Master trace table output with IPCS

Figure 5-17 Master trace

Master trace

Master trace maintains a table of the system messages that are routed to the hardcopy log. This creates a log of external system activity, while the other traces log internal system activity. Master trace is activated automatically at system initialization, but you can turn it on or off using the TRACE command.

Master trace can help you diagnose a problem by providing a log of the most recently issued system messages. For example, master trace output in a dump contains system messages that may be more pertinent to your problem than the usual component messages issued with a dump.

Use the master trace to show the messages to and from the master console. Master trace is useful because it provides a log of the most recently-issued messages. These can be more pertinent to your problem than the messages accompanying the dump itself. Master tracing is usually activated at IPL time and the data can be reviewed with IPCS and is saved when an SVC dump or stand-alone dump is taken.

Parmlib definitions

At initialization, the master scheduler sets up a master trace table of 24 kilobytes. A 24-kilobyte table holds about 336 messages, assuming an average length of 40 characters.You can change the size of the master trace table or specify that no trace table be used by changing the parameters in the SCHEDxx member in SYS1.PARMLIB.

Starting the master trace

You can change the size of the master trace table using the TRACE command. For example, to change the trace table size to 500 kilobytes, enter:

```
TRACE MT,500K
```

Start, change, or stop master tracing by entering a TRACE operator command from a console with master authority. For example, to start the master tracing:

```
TRACE MT
```

To stop master tracing:

```
TRACE MT,OFF
```

You can also use the TRACE command to obtain the current status of the master trace. The system displays the status in message IEE839I. For example, to ask for the status of the trace, enter:

```
TRACE STATUS
```

Master trace table output

The following shows a sample of the master trace table. This is an in-storage copy of the system log (SYSLOG) and the amount of data contained in the table is dependant on the size of the table. Figure 5-18 shows a sample of the data contained in the Master Trace (MTRACE).

```
2003062 03:48:04.21 STC08076 00000090  ITSO10 SYS 1: READY FOR COMMUNICATION
2003062 03:48:33.24 STC04022 00000094 >+CSQX500I =MQU1 CSQXRCTL Channel MQM1.ITSO810 started
2003062 03:49:03.39 STC04022 00000094 >+CSQX202E =MQU1 CSQXRCTL Connection or remote listener
152 00000094 > channel MQM1.ITSO810,
152 00000094 > connection 9.9.9.90,
152 00000094 > TRPTYPE=TCP RC=00000468
2003062 03:49:03.42 STC04022 00000094 >+CSQX599E =MQM1 CSQXRCTL Channel MQM1.ITSO810 ended
2003062 03:50:01.85 ZZ4NM002 00000294  $RALL,R=*,D=W91A.*,Q=789
2003062 03:50:01.89 ZZ4NM002 00000084  $HASP683 NO JOBS OR DATA SETS REROUTED
```

Figure 5-18 IPCS MTRACE output

5.8 GFS trace

- ❑ DIAGxx parmlib member
  - ➢ Defines GFS trace control parameters
    - – VSM TRACE GETFREE (ON) ASID (3, 5-9) LENGTH (24) DATA (ALL)
- ❑ Starting a GTF trace for GFS data
  - ➢ Use a GTF cataloged procedure
- ❑ Stopping GTS trace
  - ➢ Create a DIAGxx parmlib member
    - – VSM TRACE GETFREE(OFF)
- ❑ Obtaining GFS trace data
  - ➢ Use IPCS GTFTRACE command

Figure 5-19 GFS trace

GFS trace

GFS trace is a diagnostic tool that collects information about the use of the GETMAIN, FREEMAIN, or STORAGE macro. You can use GFS trace to analyze the allocation of virtual storage and identify users of large amounts of virtual storage. Use the generalized trace facility (GTF) to get the GFS trace data output.

DIAGxx parmlib member

The DIAGxx parmlib member syntax is shown in Appendix C.1.1, "DIAGxx parmlib member syntax" on page 362.

IBM provides the following parmlib members:

DIAG00 (default) Sets storage tracking on and GFS trace off.

DIAG01 Sets storage tracking on but does not change GFS trace settings.

DIAG02 Sets storage tracking off but does not change GFS trace settings.

The following procedure explains how to request a GFS trace:

1. In the DIAGxx parmlib member, set the VSM TRACE GETFREE parameter to ON and define the GFS trace control data.
   a. The following DIAGxx parmlib member starts GFS trace and limits the trace output to requests to obtain or release virtual storage that is 24 bytes long and resides in address spaces 3, 5, 6, 7, 8, and 9, as follows:

```
VSM TRACE GETFREE (ON)  ASID (3, 5-9)  LENGTH (24)  DATA (ALL)
```

> **Note:** If you want the IPCS GTFTRACE output to be formatted, you must include the TYPE and FLAGS data items on the DATA keyword specification of the DIAGxx parmlib member.

You will need another DIAGxx parmlib member defined to stop GFS tracing specifying:

```
VSM TRACE GETFREE (OFF)
```

2. Ask the operator to enter the SET DIAG=xx command to activate GFS trace using the definitions in the DIAGxx parmlib member.
3. Start a GTF trace (ask the operator to enter a START membername command on the master console). The membername is the name of the member that contains the source JCL (either a cataloged procedure or a job). Tell the operator to specify a user event identifier X'F65' to trace GTF user trace records.

Starting a GTF trace for GFS data

The operator starts GTF tracing with cataloged procedure GTFPROC to get GFS data in the GTF trace output. The contents of cataloged procedure GTFPROC are shown in Figure 5-20.

The operator then replies to messages AHL100A with the USRP option. When message AHL101A prompts the operator for the keywords for option USRP, the operator replies with USR=(F65) to get the GFS user trace records in the GTF trace output.

```
//GTF     PROC MEMBER=GTFPROC
//* Starts GTF
//IEFPROC EXEC PGM=AHLGTF,REGION=32M,TIME=YES,
//  PARM='MODE=EXT,DEBUG=NO,TIME=YES,BLOK=40K,SD=0K,SA=40K'
//IEFRDER DD DSN=MY.GTF.TRACE,
//           DISP=SHR,UNIT=3390,VOL=SER=VOL001
```

Figure 5-20 GTF procedure for GFS trace

Stopping GTF trace

To stop the GTF trace, ask the operator to enter a STOP procname command on the master console. To stop GFS trace, create a DIAGxx parmlib member with:

```
VSM TRACE GETFREE(OFF)
```

The operator then enters the SET DIAG=xx command, where xx points to the created DIAGxx parmlib member.

Obtaining GFS trace data

GTF places the GFS trace data in a user trace record with event identifier X' F65'. To obtain GFS trace data, do one of the following:

1. When GTF writes the trace data to a data set, format and print the trace data with the IPCS GTFTRACE subcommand.
2. When GTF writes trace data only in the GTF address space, use IPCS to see the data in an SVC dump. Request the GTF trace data in the dump through the SDATA=TRT dump option.
3. Issue the IPCS GTFTRACE subcommand to format and see the trace in an unformatted dump. See the output in Appendix C.1.2, “GFS trace data” on page 362.

5.9 System trace

- Using system trace
- Controlling trace table size
  - TRACE ST,256K
- Tracing branch instructions
  - TRACE ST,BR=ON
    - Such as BALR, BASR, BASSM, and BAKR
- Problem determination
  - System tracing will be captured in all dump situations by default, except during a SNAP dump
    - SDATA=TRT must be specified

Figure 5-21 System trace

System trace

System trace provides an ongoing record of hardware and software events occurring during system initialization and operation. The system activates system tracing at initialization and the tracing runs continuously, unless your installation has changed the IBM-supplied system tracing. After system initialization, you can use the TRACE operator command on a console with master authority to customize system tracing.

Because system trace usually runs all the time, it is very useful for problem determination. While system trace and the general trace facility (GTF) list many of the same system events, system trace also lists events occurring during system initialization, before GTF tracing can be started. System trace also traces branches and cross-memory instructions, which GTF cannot do.

System trace writes trace data in system trace tables in the trace address space. It maintains a trace table for each processor. You can obtain the trace data in a dump that includes option SDATA=TRT.

Using system trace

Use system trace to see system processing through events occurring in the system over time. System tracing is activated at initialization and, typically, runs continuously. It records many system events, with minimal detail about each. The events traced are predetermined, except for branch tracing. This trace uses fewer resources and is faster than a GTF trace.

System trace tables reside in fixed storage on each processor. The default trace table size is 64 kilobytes per processor, but you can change it using the TRACE ST command. We do not recommend running with trace tables smaller than the default 64 kilobytes.

Controlling trace table size

You might, however, want to increase the size of the system trace table from the default 64 kilobytes. Issue the following command to increase the system trace table size to 256K:

```
TRACE ST,2M
```

Tracing branch instructions

System tracing allows you the option of tracing branch instructions, such as BALR, BASR, BASSM, and BAKR, along with other system events. If you want to trace branch instructions, use the BR=ON option on the TRACE ST command when you start tracing, as follows:

```
TRACE ST,BR=ON
```

Note: With branch tracing on, this can affect your system performance and use very large amounts of storage. Do not use branch tracing as the default for system tracing on your system. You should only use it for short periods of time to solve a specific problem. The default system tracing does not include branch instructions.

Problem determination

Because system trace usually runs all the time, it is very useful for problem determination. While system trace and the general trace facility (GTF) lists many of the same system events, system trace also lists events occurring during system initialization, before GTF tracing can be started. System trace also traces branches and cross-memory instructions, which GTF cannot do.

System tracing will be captured in all dump situations by default, except during a SNAP dump where SDATA=TRT must be specified. Figure 5-22 trace table shows a program check occurring in an environment where no FRRs (Functional Recovery Routine) are defined. RTM1 passes control on to RTM2 via an SVC D.

no FRRs are defined. RTM1 passes control to RTM2 via an SVC D.

```
01 000A 00AEF430   SVCR   7B 070C0000 868985D2  00000000 00000000 04379238
01 000A 00AEF430   PGM   011 070C2000 868985F2  00040011 12004000

01 000A 00AEF430  *RCVY PROG                    940C4000 00000011 00000000

01 000A 00AEF430   SSRV  12D          813DE814  00AEF430 000C8000 FF3A0000
                                                00000000
01 000A 00AEF430   SSRV  12D          813DE830  00AEF430 000B8000 00000000
                                                00000000
01 000A 00AEF430   DSP       070C2000 812FADEA  00000000 00FD0E20 12004780
01 000A 00AEF430  *SVC     D 070C2000 812FADEC  00000000 00FD0E20 12004780
01 000A 00AEF430   SSRV   78          86A0A4AE  0000FF50 000000C8 00AFB5D8
```

Figure 5-22 IPCS SYSTRACE output

The *SVC D entries shows RTM1 sets up PSW to point to an SVC D instruction in order to force entry into RTM2

5.10 SMS tracing

- Start and stop SMS tracing
  - SETSMS TRACE (ON or OFF)
- Control size of SMS trace table
  - SETSMS SIZE(255M)
- SMS tracing by jobname

SETSMS TRACE(ON),TYPE(ALL),SIZE(1M),DESELECT(ALL),SELECT(ALL),JOBNAME(SMS)

- Diagnosing SMS problems
  - Take a dump of the SMS address space
- Using IPCS for SMS
  - VERBX SMSDATA 'TRACE'

Figure 5-23 SMS tracing

SMS tracing

If you need to trace the interaction between a data set allocation and SMS, collecting SMS trace data may be of assistance. The procedures to collect and review SMS trace data are as follows. To start and stop SMS tracing, use:

```
SETSMS TRACE (ON or OFF)
```

Control size of SMS trace table

The SIZE parameter specifies the size of the trace table in kilobytes. If you omit K or M, the default unit is K. The default value is 128K. The maximum is 255000K or 255M. This value is rounded up to the nearest 4K. Issue the following MVS command:

```
SETSMS SIZE(255M)
```

Select SMS tracing by jobname

You can select tracing by jobname and this limits SMS to tracing to the specified address space. If you enter jobname(*), all address spaces are traced. If you specify ASID, omit jobname. Issue the following MVS command:

```
SETSMS TRACE(ON),TYPE(ALL),SIZE(1M),DESELECT(ALL),SELECT(ALL),JOBNAME(SMS)
```

Diagnosing SMS problems

Take a dump of the SMS address space. For example:

```
DUMP COMM=(any dump title you desire)
R #,JOBNAME=SMS,CONT
R #,SDATA=(LPA,CSA,ALLNUC,GRSQ,LSQA,SWA,PSA,SQA,TRT, RGN,SUM)
```

Using IPCS for SMS

The SMS IPCS verb exit (SMSDATA) is intended for the use of diagnostic programmers who are working with the IBM Support Center to resolve an SMS-related problem. Invoke IPCS and review the SMS trace by issuing the following IPCS command:

```
VERBX SMSDATA 'TRACE'
```

The SMSDATA verb exit performs the following functions:

- Validates control block chains in the SMS address space.
- Formats the control blocks in the SMS address space.
- Formats the trace table in the SMS address space.
- Formats the control blocks associated with the SMS automatic data areas.

5.11 Trace data using an external writer

- Obtaining trace data with the external writer
  - Trace data set on DASD or tape rather than requesting a dump
- Creating the external writer

```
//CTWTR PROC
 //IEFPROC   EXEC PGM=ITTTRCWR
 //TRCOUT01 DD DSNAME=ibmuser.ctrace1,VOL=SER=xxxxxx,UNIT=xxxx,
 //          SPACE=(CYL,(xxx),,CONTIG),DISP=NEW,CATLG)
 //SYSPRINT DD SYSOUT=*
```

- External writer example
  - TRACE CT,WTRSTART=ctwrtt
  - TRACE CT,ON,COMP=SYSTCPIP,SUB=(tcpproc)

Figure 5-24 Collecting trace data with an external writer

Obtaining trace data with the external writer

By using the external writer, you can write application trace buffers directly to a trace data set on DASD or tape rather than requesting a dump. While you might still view your trace buffers by requesting a dump, the advantages of using the external writer are:

- You do not need to code a component trace buffer find exit routine for IPCS processing.
- Depending on the size of the trace data set, you can capture more trace data without using valuable system resources such as central or auxiliary storage.

> **Note:** While component trace runs under the master scheduler address space, you need to verify that the priority of the external writer is at least equal to, and preferably greater than the priority of the component being traced. For example, if you are tracing COMP(SYSXES) for JOBNAME(IRLMA), the dispatching priority of the external writer should be equal to or greater than that assigned to IRLMA.

Creating the external writer

Create source JCL to invoke an external writer, which will send the component trace output to one or more trace data sets. Add a procedure to the SYS1.PROCLIB system library or a job as a member of the data set in the IEFJOBS or IEFPDSI concatenation.

An external writer is not specific for a component but can be used by any application. So you can use the same source JCL, shown in Figure 5-25 on page 141, again for other tracing later, if needed.

```
//CTWTR PROC
 //IEFPROC  EXEC PGM=ITTTRCWR
 //TRCOUT01 DD DSNAME=ibmuser.ctrace1,VOL=SER=xxxxxx,UNIT=xxxx,
 //         SPACE=(CYL,(xxx),,CONTIG),DISP=NEW,CATLG)
 //SYSPRINT DD SYSOUT=*
```

Figure 5-25 External writer procedure

External writer example

The following shows an example for TCPIP CTRACE to an external writer:

- Start the writer for TCPIP CTRACE where ctwrtt is a writer for CTRACE

  ```
  TRACE CT,WTRSTART=ctwrtt
  ```

- Start CTRACE

  ```
  TRACE CT,ON,COMP=SYSTCPIP,SUB=(tcpproc)
  R xx,JOBNAME=(tcpproc,otherappljobname),options=(validoptions),WTR=ctwrtt,END
  ```

  Note: Where validoptions=(PFS,TCP,SOCKET,ENGINE,SOCKAPI) for z/OS systems.

6

IPCS dump debugging

IPCS provides an interactive, online facility for diagnosing software failures. Using data sets and active system storage, IPCS analyzes information and produces reports that can be viewed at a Time Sharing Option Extensions (TSO/E) terminal, or can be printed.

SVC dumps, standalone dumps, and some traces are unformatted and need to be formatted before any analysis can begin. IPCS provides the tools to format dumps and traces in both an online and batch environment. IPCS provides you with commands that will let you interrogate specific components of the operating system and allows you to review storage locations associated with an individual task or control block. IPCS allows you to quickly review and isolate key information that will assist with your problem determination process

Some dumps, such as CEEDUMP, are in a readable format. To debug these dumps you have to browse them.

Dumps produced by an MVS system fall into two categories:

- Formatted dumps: SYSABEND and SYSUDUMP ABEND dumps and SNAP dumps. IPCS cannot be used with formatted dumps.
- Unformatted dumps: SVC dumps, SYSMDUMP ABEND dumps, and standalone dumps. IPCS formats and analyzes unformatted dumps.

When you submit unformatted dump data sets to IPCS, it simulates dynamic address translation (DAT) and other storage management functions to recreate the system environment at the time of the dump. IPCS reads the unformatted dump data and translates it into words. For example, IPCS can identify the following:

- Jobs with error return codes
- Resource contention in the system
- Control block overlays

IPCS also helps your own dump analysis. For example, you can:

- Format control blocks. IPCS inserts field names into the output and displays the data in columns by field.
- Browse unformatted dump storage. IPCS allows you to easily follow pointers to other locations in the dump. It also retains addresses of certain locations in the dump.

- Reduce the size of a standalone dump. You can reduce the size of a standalone dump as you transfer it from tape to a direct access storage device (DASD) for IPCS processing.

This chapter gives a brief overview of how to work with IPCS and get at least a useful search argument looking for known problems or asking for IBM support, as follows:

- Setting IPCS defaults
- ASIDs to be dumped
- The VERBX MTRACE command
- The IPCS SUMMARY command
- IPCS virtual storage commands
- Using IPCS to browse dumps
- Searching IBM problem databases

6.1 IPCS dump debugging

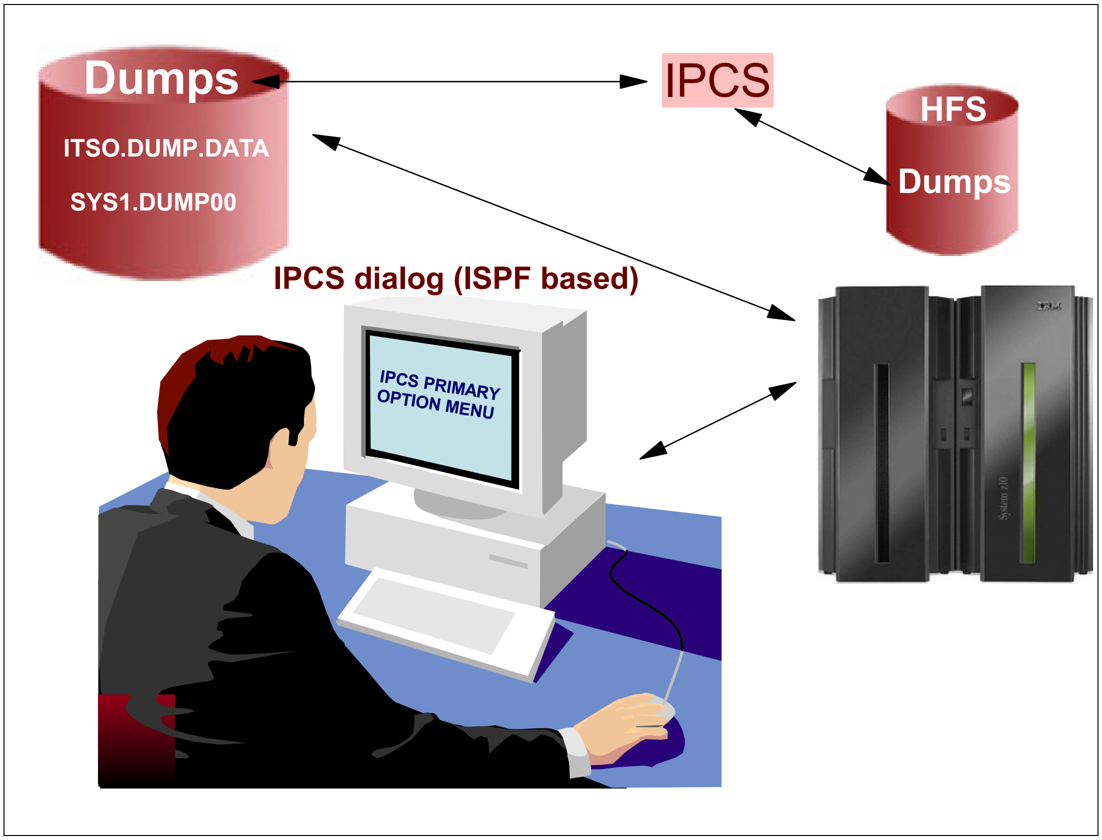

Figure 6-1 IPCS dump debugging

IPCS dump debugging

The interactive problem control system (IPCS) is a tool provided in the MVS system to aid in diagnosing software failures. IPCS provides formatting and analysis support for dumps and traces produced by MVS, other program products, and applications that run on MVS.

IPCS decides whether the source data set should be treated as a system dump by comparing the data set to the following criteria.

The dump data must be stored on a data set with sequential (PS), direct (DA), or unidentified (*) organization. With z/OS V1R2 and higher, IPCS also allows data stored on hierarchical file systems (HFS) to be accessed.

IPCS dialog

IPCS provides a full-screen dialog through the Interactive System Productivity Facility (ISPF). This mode, known as the IPCS dialog, runs on top of ISPF and the IPCS command processor. The IPCS dialog is an interactive dialog that you use at a terminal. The IPCS dialog organizes the problem analysis process into seven options:

- Set IPCS defaults.
- View formatted dump data.
- Generate and edit dump analysis reports.
- Submit dump analysis jobs for batch processing.

- Run IPCS subcommands, CLISTs, and REXX execs.
- Copy dump and trace data from one data set to another.
- Manage dump and trace data set sources.

IPCS Primary Option Menu

As part of customizing access to IPCS, IBM recommends that you or your installation provide an option for starting the IPCS dialog from an ISPF selection panel, usually the ISPF Primary Option Menu. To start the IPCS dialog from such an ISPF panel, select the option for IPCS.

After you select the IPCS option and press Enter, the system displays the IPCS Primary Option Menu. Figure 6-15 on page 157 shows the IPCS Primary Option Menu panel.

DUMPs on DASD and HFS

Dumps produced by an MVS system fall into two categories:

Formatted dumps SYSABEND and SYSUDUMP ABEND dumps and SNAP dumps. IPCS cannot be used with formatted dumps.

Unformatted dumps SVC dumps, SYSMDUMP ABEND dumps, and standalone dumps. IPCS formats and analyzes unformatted dumps.

When you submit unformatted dump data sets to IPCS, it simulates dynamic address translation (DAT) and other storage management functions to recreate the system environment at the time of the dump. IPCS reads the unformatted dump data and translates it into words. For example, IPCS can identify the following:

- Jobs with error return codes
- Resource contention in the system
- Control block overlays
- Loop
- Processor utilization

6.2 IPCS command processing

- IPCS processes commands, subcommands, CLISTs, and REXX execs
  - TSO/E commands for IPCS
  - IPCS subcommands
  - IPCS primary and line commands
  - REXX EXECs and CLISTs
  - ISPF primary commands

Figure 6-2 IPCS command processing

IPCS and commands

IPCS is a problem-state, key 8 program that runs in a TSO/E user's address space. IPCS operates in interactive and batch environments supported by TSO/E. The base of IPCS is a TSO/E command processor. The TSO/E command "IPCS" activates the IPCS command processor. All commands used to perform IPCS functions are "subcommands" of the IPCS command. You can use IPCS functions from any TSO/E line mode session.

TSO/E commands for IPCS

IPCS provides three commands to be invoked from the TSO/E READY prompt. Other TSO/E commands may have unique processing features when issued from an IPCS dialog session. The commands are:

- IPCS
- IPCSDDIR
- SYSDSCAN

IPCS subcommands

Once you enter the IPCS command to begin an IPCS session, the IPCS subcommands are your main tools for performing dump and trace analysis. These commands allow you to analyze, format, view, retrieve, and copy dump and trace data, and to maintain an IPCS session. You may use subcommands in any mode.

IPCS primary and line commands

An additional set of IPCS commands are available for use in the full-screen dialog. These commands control various panel functions. The primary commands are entered on the COMMAND or OPTION line of the IPCS dialog. The line commands are used in the prefix area of an IPCS dialog.

Use the IPCS primary command to invoke an IPCS subcommand, CLIST, or REXX exec from any of the panels of the IPCS dialog. The subcommand, CLIST, or REXX EXEC is entered exactly as though it was being invoked under IPCS in line mode. If the subcommand, CLIST, or REXX EXEC sends a report to the terminal, you view the report using the dump display reporter panel. The syntax is as follows:

```
IPCS     { subcommand }
IP       { clist      }
         { rexx-exec  }
```

REXX EXECs and CLISTs

You can invoke REXX EXECs and CLISTs from an IPCS session. These procedures can enter subcommands or use other REXX and CLIST functions to analyze dumps and traces. IPCS provides functions to store data in REXX or CLIST variables and to print data to the IPCS dialog or print data set.

Delete IPCS dump directory before initializing the SA dump

To get a better initialization SA dump performance you should delete your IPCS dump directory, which will automatically be allocated during IPCS access. If the original dump directory is used, it may take hours, depending on the dump size, to have the dump available for debug.

```
DELETE   PHILGER.DDIR                                                                       *VSAM*
         PHILGER.DDIR.D                                                                     SBOXFJ
         PHILGER.DDIR.I                                                                     SBOXFJ
```

Figure 6-3 Delete IPCS dump directory

ISPF primary commands

For interactive use, the IPCS dialog uses ISPF dialog support to run as an interactive, full-screen application. This application uses the IPCS command processor. z/OS IPCS exploits data spaces, if permitted, to free virtual storage to allow large, complex analysis routines to function.

6.3 IPCS dump debug example

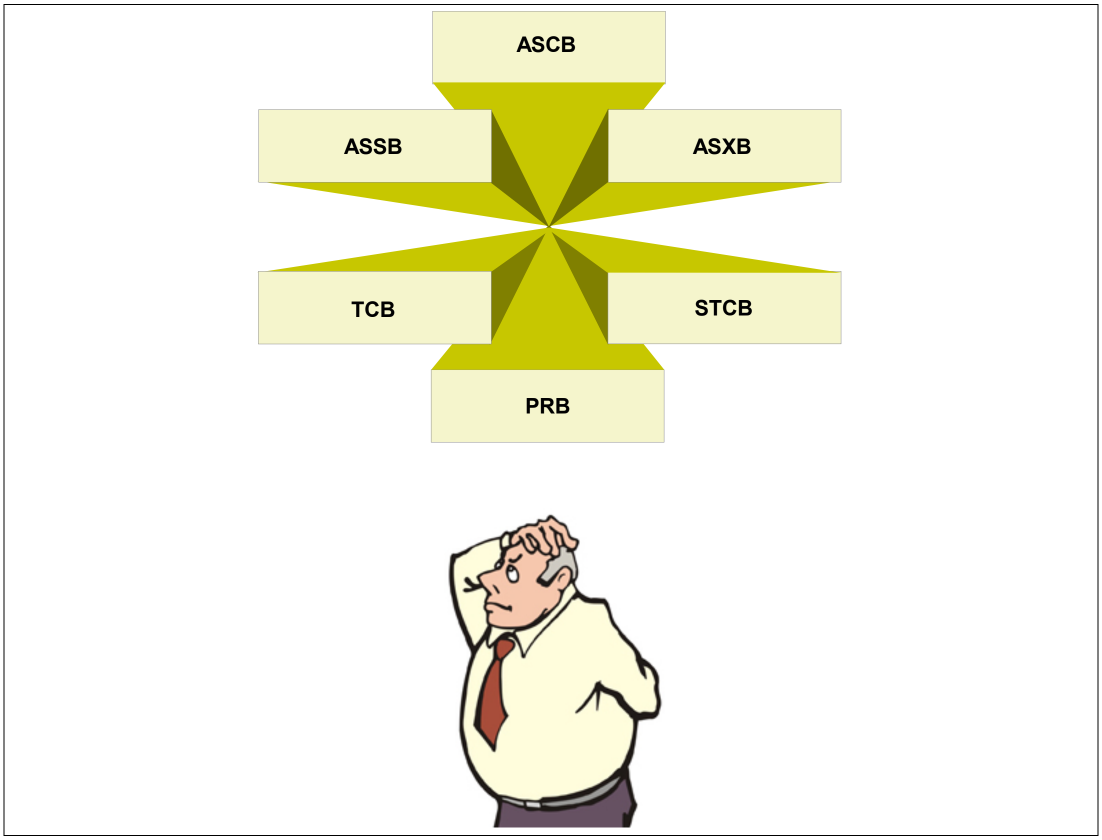

Figure 6-4 Dump debug

Dump debug example

Digging in a dump like one from UNIX System Services is like walking through New York without a map. And if you have a map you might get lost anyway. This chapter provides steps for how to start looking at a dump. It describes IPCS commands used to debug a UNIX. A dump was taken because we got an ICH408I message. What does this dump provide?

```
ICH408I USER(HILGER  ) GROUP(SYS1    ) NAME(PETER HILGER        ) 720
  /etc/peter CL(DIRACC  ) FID(01E2C2D6E7F1C2004B08000000000003)
  INSUFFICIENT AUTHORITY TO OPEN
  ACCESS INTENT(-W-)  ACCESS ALLOWED(OTHER      R-X)
  EFFECTIVE UID(0000001210)  EFFECTIVE GID(0000000002)
```

Figure 6-5 ICH408I Permission denied message

IPCS dump commands

After the dump has been initialized by IPCS, check whether the dump is a complete one by issuing the following IPCS command:

```
Command ===> ip l e0. block(0) l(16)
LIST E0. BLOCK(0) LENGTH(X'10') AREA
E0. LENGTH(X'10')==>All bytes contain X'00'
```

Get the dump status information

```
Command ===> ip st
Dump Title: SLIP DUMP ID=PHIL

CPU Model 2094 Version 00 Serial no. 06991E Address 003
Date: 11/14/2011     Time: 13:34:58.554366 Local

Original dump dataset: DUMP.D111114.H18.SC64.HILGER.S00025

SYSTEM RELATED DATA

CVT  SNAME (154) SC64
```

List the dumped address spaces

```
Command ===> ip cbf rtct;f astb
ASTB

    SDAS  SDF4  SDF5
    ----  ----  ----
001 005B  80    00
002 0010  80    00
```

Get the jobnames for address space 10 and 5B

```
Command ===> IP SELECT ASID(X'10',X'5B')
ASID JOBNAME  ASCBADDR  SELECTION CRITERIA
---- -------- --------  ------------------
0010 OMVS     00F55280  ASID
005B HILGER   00F8C280  ASID
```

Get PSW and registers at time dump was taken

```
Command ===> ip st regs
CPU STATUS:
PSW=07043000 80000000 00000000 01A5DFCE
    (Running in PRIMARY, key 0, AMODE 31, DAT ON)
    Disabled for PER
   ASID(X'0010') 01A5DFCE. IEANUC01.IEAVTSMG+04EE IN READ ONLY NUCLEUS
  ASCB91 at F8C280, JOB(HILGER), for the home ASID
  ASXB91 at 7FDB60 and TCB91K at 7AE560 for the home ASID
  HOME ASID: 005B PRIMARY ASID: 0010 SECONDARY ASID: 005B

  General purpose register values
    Left halves of all registers contain zeros
     0-3  02B51000  0406F000  02B4FA18  02B4FA20
     4-7  00000007  00000006  00000C40  02B4F480
     8-11 00000000  00FB1390  00000008  02B4FA18
    12-15 01A5E458  02B4FAA0  81A5DC12  00000008
```

The IP ST command shows that the problem occurred in TCB 7AE560. You need to look now for this TCB in the IP SUMM FO ASID(X'5B') output.

The IPCS SUMMARY FORMAT command

To format the control block fields, use the SUMMARY FORMAT subcommand. Format specifies a report containing the major control blocks associated with the specified address space as follows:

- ASCB Address Space Control Block
- TCBTask Control Block
- STCBSecondary TCB
- RBRequest Block
- XSBeXtended requeSt Block
- SRBService Request Block
- SSRBSuspended SRB
- WEBWork Element Block (IHAWEB)
- IHSAInterrupt Handler Save Area
- LSELinkage Stack Entry

```
   Command ===> IP SUMM FO ASID(X'5B')

   The end of the output shows the TCB summary

JOB HILGER   ASID 005B ASCB 00F8C280 FWDP 00F9A700 BWDP 00F8C700 PAGE
00000006
    TCB AT    CMP      NTC      OTC      LTC      TCB      BACK     PAGE
   007FE040 00000000 00000000 00000000 007FF890 007FD0C0 00000000 00000056
   007FD0C0 00000000 00000000 007FE040 00000000 007FF890 007FE040 00000061
   007FF890 00000000 007FD0C0 007FE040 007FF070 007FF070 007FD0C0 00000066
   007FF070 00000000 00000000 007FF890 007DE930 007DE930 007FF890 00000075
   007DE930 00000000 00000000 007FF070 007DE6A0 007DE6A0 007FF070 00000091
   007DE6A0 00000000 00000000 007DE930 007DE508 007DE508 007DE930 00000099
   007DE508 00000000 00000000 007DE6A0 007AE060 007DE1E0 007DE6A0 00000107
   007DE1E0 00000000 00000000 007DE508 00000000 007AE060 007DE508 00000123
   007AE060 00000000 007DE1E0 007DE508 007AE560 007AE988 007DE1E0 00000134
   007AE988 00000000 00000000 007AE060 00000000 007AE560 007AE060 00000144
   007AE560 00000000 007AE988 007AE060 007AE2D0 007AE2D0 007AE988 00000154
   007AE2D0 00000000 00000000 007AE560 00000000 00000000 007AE560 00000167
```

Figure 6-6 The SUMMARY FORMAT subcommand

Due to the fact that there is no entry in the CMP column, there is no unexpected error indication. You then need to have a look at the TCB pointed to by the IP ST output.

```
TCB: 007AE560
   +0000  RBP...... 007AE768  PIE...... 00000000  DEB...... 00000000
   +000C  TIO...... 007CBFD0  CMP...... 00000000  TRN...... 40000000
   +0018  MSS...... 7F662358  PKF...... 80        FLGS..... 00000000  01
   +0022  LMP...... FF        DSP...... FE        LLS...... 007AE738
   +0028  JLB...... 0000C4F0  JPQ...... 00000000
```

Figure 6-7 TCB partial output shown

If a user or program needs USS services, a syscall depending on the request is issued. In our case an open was requested like the one in the first linkage stack belonging to our TCB. Linkage stacks are save areas that are provided by the hardware.

```
LINKAGE STACK ENTRY  01  FROM TCB.  LSED: 7F65F518
 LSE: 7F65F3F8
    GENERAL PURPOSE REGISTER VALUES
    00-01.... 00000000  00000026  00000000  24D9D7B4
    02-03.... 00000000  01380548  00000000  24B201F6
    04-05.... 00000000  00000000  00000000  24D9D6B8
    06-07.... 00000000  01A93660  00000000  00FDCA48
    08-09.... 00000000  000000D5  00000000  24C222C4
    10-11.... 00000000  24D9A6B8  00000000  24B15260
    12-13.... 00000000  24D9A008  00000000  24D9A6B8
    14-15.... 00000000  A4B202CC  00000000  00001300
    ACCESS REGISTER VALUES
    00-03.... 00000000  00000000  00000000  00000000
    04-07.... 00000000  00000000  00000000  00000000
    08-11.... 00000000  00000000  00000000  00000000
    12-15.... 00000000  00000000  00000000  00000000
    PKM...... 00C0      SASN..... 005B      SINS..... 00000045
    EAX...... 0000      PASN..... 005B      PINS..... 00000045
    PSW...... 07851000  80000000            PSWE..... 00000000  01380EAC
    TARG..... 00100001  00001314            MSTA..... 27C090C8  27C0A508
    TYPE..... 0D
```

Figure 6-8 First linkage stack in the TCB structure

Register 0 shows the syscall 00000026 >>> open request. Register 1 shows the parameter list. The layout can be found in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*, SA22-7803.

Browse the storage for asid(x'5B') and locate the area pointed to by Register 1.

```
Storage area browsed shows:
24D9D7B4              24D9D7B0   24D8F040   24D9D7AC
24D9D7C0   24D9D7A8   24D9A760   24D9A764   A4D9A768
```

Figure 6-9 Parameter list for syscall request open

In Figure 6-9, the first address in our storage area should show a length indication, as follows:

```
24D9D7B0    0000000A
```

A parameter list should be read as shown in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*, SA22-7803.

```
 CALL BPX1OPN,(Pathname_length,
               Pathname,
               Options,
               Mode,
               Return_value,
               Return_code,
               Reason_code)
```

Figure 6-10 Parameter list layout for open request

In Figure 6-10 on page 152, the second address is the pathname, as follows:

```
24D8F040 6185A383   619785A3   85990000   00000000   ! /etc/peter...... !
```

This shows that somebody tried to access, allocate or delete this `/peter` file or directory.

A USS Ctrace will provide detailed information about the request, as follows:

```
Command ===> ip ctrace comp(sysomvs) full asid(x'5b')
```

The last entry, `24D9D7AC`, is shown in Figure 6-11.

```
SC64      FILE      05610109  18:34:57.741236  CALL TO VN_CREATE

    ASID..005B      USERID....HILGER    STACK§....27C090C8
    TCB...007AE560  EUID......000004BA  PID.......0204003E
   +0000  E5E5E540  00969C30  004A1CA8  00000003  ! VVV .o...Ä.y.... !
   +0010  27C09E40  27C09C10  27C09B90  00000000  ! .ä. .ä...ä...... !
   +0020  00000005  9785A385  99404040  40404040  ! ....peter        !
   +0030  40404040  40404040  40404040  40404040  !                  !
   +0040  40404040  C1E3E3D9  000000E0  03000000  !     ATTR...Ö.... !
   +0050  00000000  00000000  00000000  00000000  ! ................ !
   +0060  00000000  00000000  00000000  00000000  ! ................ !
   +0070  00000000  00000000  00000000  00000000  ! ................ !
   +0080  00000000  B4D5C400  0000A008  00000000  ! .....ND......... !
```

Figure 6-11 Address 24D9D7AC display

In this example, user HILGER tried to create the file `peter` and got permission denied. The syslog or IP VERBX MTRACE command should show the ICH408I message. The syslog and MTRACE may also show the message. There might be the possibility that the ICH408I messages are suppressed by the syscall requestor. WebSphere is doing this for some requests. Have a look at the MTRACE in the dump, by issuing the following command:

```
Command ===> ip verbx mtrace
```

Message ICH408i can be seen, as shown in Figure 6-12.

```
ICH408I USER(HILGER  ) GROUP(SYS1    ) NAME(PETER HILGER

  /etc/peter CL(DIRACC  ) FID(01E2C2D6E

  INSUFFICIENT AUTHORITY TO OPEN
  ACCESS INTENT(-W-)  ACCESS ALLOWED(OTHER      R-X)
  EFFECTIVE UID(0000001210)  EFFECTIVE GID(0000000002)
IEA992I SLIP TRAP ID=PHIL MATCHED.  JOBNAME=HILGER  ,
```

Figure 6-12 ICH408I IBM RACF® message

To get information about active USS processes at the time the dump was taken, use (see Figure 6-13 on page 154):

```
Command ===> ip omvsdata
```

```
Process     Userid     Asid     Parent      Process     Session    Status
  ID                              PID       Group ID      ID
------------------------------------------------------------------------------
00000001    OMVSKERN   0058     00000000    00000001    00000001   -
00040002    STC        001A     00000001    00040002    00040002   -
05040039    PHILGER    0088     00000001    05040039    05040039   -
0304003A    PHILGER    0088     05040039    05040039    05040039   -
0204003E    HILGER     005B     00000001    0204003E    0204003E   -
0004003F    STC        0061     00000001    0004003F    0004003F   -
01040040    HILGER     005B     0204003E    0204003E    0204003E   -
```

Figure 6-13 USS process list

To get detailed process information, use:

```
Command ===> ip omvsdata detail
```

6.4 IPCS support of large data sets

- DSNTYPE=LARGE supported
  - Dumps
  - Traces
  - Other data sets viewed via RBA or BLOCK(n)
  - Print file
  - Table of contents file
- Growth and complexity makes performance a concern
  - Dumps and traces blocked, compressed, and striped
  - Dump directory with large CISIZE, large BUFSPACE, and striped
- Operational considerations

Figure 6-14 IPCS and large data sets

IPCS large data sets

Files directly supported by IPCS may have the DSNTYPE=LARGE attribute in z/OS V1R7. If you are planning to run larger LPARs, it makes sense to set aside some time to plan for larger dumps and traces.

DSNTYPE=LARGE

The DSNTYPE=LARGE is supported in:

- Dumps
- Traces
- Other data sets viewed via RBA or BLOCK(n)
- Print file
- Table of contents file

Large dumps and traces

Large dumps and traces make performance more of a concern. So consider the following:

- Large BLKSIZEs, compression, and striping are all supported. Each can make a significant difference.
- Good allocation for dump directories can make a significant difference in IPCS efficiency. Compression is not recommended because directories are updated very rapidly during

IPCS analysis, but focusing on primary space, secondary space, CISIZE, BUFSPACE, and striping can really help. If you anticipate the need to work with really large media, the VSAM extended addressing option should be used.

- Ensure large CISIZE for the DATA portion. BLSCDDIR CLIST is updated to help. A DSNTYPE=LARGE data set can only be used if the dump is both written and processed on a V1R7 system or a later release. A VSAM linear data set with either an extended format or conventional format with a control interval size (CISIZE) of 32K can be substituted. Neither extended sequential nor VSAM data sets, other than linear data sets with the required CISIZE, should be used.
- In addition, consider the following options:
  - Ensure large (but not excessive) BUFSPACE for the directory.
  - Consider striping.
  - Avoid compression because of intensive updating during IPCS analysis.

Operational considerations

SADMP runs very much the same way as prior releases. From the perspective of the operator who runs SADMP, DSNTYPE=LARGE data sets are treated just the same as the ones used previously. The operational changes are as follows:

- SADMP tries harder to ensure that data needed to process every SADMP is written to it early. Several page data set pages may be brought in concurrently to achieve this acceleration if independent paths are available.
- An alteration of some messages tells the operator about progress through the three phases, and, if the operator is sensitive to such things, a modest acceleration of capturing data from page data sets may be sensed. Some messages are changed to reflect the following logic and inform the operator about the phases, as follows:
  - Primary phase dumps vital MVS data (PSAs, CVT, and so forth).
  - Second phase dumps ASIDs 1-4.
  - Third phase dumps the rest.

If installation priorities mandate cutting the dumping process short, this makes it more likely that the truncated dump will be useful. We do not recommend truncation, but we recognize that your specific business priorities may require it.

6.5 Setting the IPCS defaults

- When you choose Option 0, the IPCS Default Option panel is displayed and you modify the following fields:

```
------------------- z/OS 01.13.00 IPCS PRIMARY OPTION MENU  -------------------
OPTION  ===>
                                                               ********************
   0  DEFAULTS     - Specify default dump and options          * USERID  - ROGERS
   1  BROWSE       - Browse dump data set                      * DATE    - 12/01/01
   2  ANALYSIS     - Analyze dump contents                     * JULIAN  - 12.001
   3  UTILITY      - Perform utility functions                 * TIME    - 19:34
   4  INVENTORY    - Inventory of problem data                 * PREFIX  - ROGERS
   5  SUBMIT       - Submit problem analysis job to batch      * TERMINAL- 3278
   6  COMMAND      - Enter subcommand, CLIST or REXX exec      * PF KEYS - 24
   T  TUTORIAL     - Learn how to use the IPCS dialog          ********************
   X  EXIT         - Terminate using log and list defaults

Enter END command to terminate IPCS dialog
```

```
Source   ==> DSNAME('DUMP.D100626.H20.SC75.JES3.S00001')
Address Space   ==> ASID(X'001E')
Message Routing ==> NOPRINT TERMINAL NOPDS
Message Control ==> CONFIRM VERIFY FLAG(WARNING)
Display Content ==> NOMACHINE REMARK REQUEST NOSTORAGE SYMBOL
```

Figure 6-15 Selecting the IPCS default options

Setting the IPCS defaults

Selecting Option 0 from the Primary Option Menu enables you to identify the data set that contains the dump you will be analyzing. Figure 6-16 shows the part of the IPCS default option menu that you change to gain access to the dump you want to process.

You may change any of the defaults listed in Figure 6-16. The defaults shown before any changes are LOCAL. Change scope to GLOBAL to display global defaults. If you change to BOTH, dump data set will be kept until you initialize a new dump.

```
Scope    ==> LOCAL    (LOCAL, GLOBAL, or BOTH)
```

If you change the Source default, IPCS will display the current default Address Space for the new source and will ignore any data entered in the Address Space field.

Creating the defaults

The initial display will show Source ==> NODSNAME and no value in Address Space. When you enter your dump DSNAME (in single quotes), you must manually change the NODSNAME for DSNAME. Pressing Enter will then update the Address Space field with the primary ASID for the dump.

```
BLSPSETD ---------------- IPCS Default Values --------------------------------
Command ===>

  You may change any of the defaults listed below.  The defaults shown before
  any changes are LOCAL.  Change scope to GLOBAL to display global defaults.

  Scope   ==> LOCAL   (LOCAL, GLOBAL, or BOTH)

  If you change the Source default, IPCS will display the current default
  Address Space for the new source and will ignore any data entered in
  the Address Space field.

  Source  ==> DSNAME('DUMP.D100626.H20.SC75.JES3.S00001')
  Address Space   ==> ASID(X'001E')
  Message Routing ==> NOPRINT TERMINAL NOPDS
  Message Control ==> CONFIRM VERIFY FLAG(WARNING)
  Display Content ==> NOMACHINE REMARK REQUEST NOSTORAGE SYMBOL

Press ENTER to update defaults.

Use the END command to exit without an update.
```

Figure 6-16 IPCS Default Option Panel

If the dump was captured via the DUMP COMM command, the ASID will always equal x'0001', the Master Address space, but the dump data set will also include any address spaces that you requested to be dumped.

You will be able to change the Address Space ASID when you know what ASID dump date you need to review.

After setting the IPCS defaults, return to the IPCS Primary Option menu (Figure 6-15 on page 157) and select Option 6, Command. The first IPCS command you enter will start the initialization process for the dump you have specified.

Figure 6-17 shows the messages that are issued during the initialization process.

```
 TIME-03:04:25 PM. CPU-00:00:04 SERVICE-328514 SESSION-08:03:50 NOVEMBER
14,2011
 Initialization in progress for DSNAME('DUMP.D111114.H18.SC64.HILGER.S00025')
 TITLE=SLIP DUMP ID=PHIL
 Dump written by z/OS 01.13.00 SLIP - level same as IPCS level
 z/Architecture mode system
 May summary dump data be used by dump access?  Enter Y to use, N to bypass.
y
 125,496 blocks, 522,063,360 bytes, in
DSNAME('DUMP.D111114.H18.SC64.HILGER.S000
25')
 TIME-03:04:37 PM. CPU-00:00:05 SERVICE-346504 SESSION-08:04:02 NOVEMBER
14,2011
 Dump of z/OS 01.13.00 - level same as IPCS level
 ***
```

Figure 6-17 IPCS Dump Initialization messages

After the initialization process, the address space field in the IPCS Default Values panel will now contain the address space identifier (ASID) information stored in the dump data set DUMP.D111114.H18.SC64.HILGER.S00025. For example:

```
Address Space ==> ASID(X'0010')
```

6.6 IPCS utility menu

- New Option 6 with z/OS V1R12
  - SADMP dump data set utility
- The panel allows you to clear, define, or reallocate a SADMP dump data set

```
BLSPUTIL ------------------------ IPCS UTILITY MENU  --------------------------
OPTION  ===>
                                                           ********************
   1  COPYDDIR    - Copy dump directory data               * USERID  - ROGERS
   2  COPYDUMP    - Copy a dump data set                   * DATE    - 12/01/01
   3  COPYTRC     - Copy trace data                        * JULIAN  - 12.001
   4  DSLIST      - Process list of data set names         * TIME    - 20:12
   5  DAE         - Process DAE data                       * PREFIX  - ROGERS
   6  SADMP       - SADMP dump data set utility            * TERMINAL- 3278
                                                           * PF KEYS - 24
Enter END command to terminate                             ********************
```

Figure 6-18 New option on IPCS UTILITY MENU - SADMP

IPCS utility panel

When you select Option 3 from the IPCS panel shown in Figure 6-15 on page 157, you receive the panel shown in Figure 6-18. The IPCS Utility Menu panel provides three options for copying data, an option for listing the names of your source data sets, and an option for the dump analysis and elimination (DAE) data set. To invoke it, select Option 3 (Utility) from the IPCS Primary Option Menu panel.

SADMP option

When you choose Option 6, the new SADMP DASD Dump Data Set Utility panel shown in Figure 6-19 on page 161 is displayed. Use the SADMP option to perform the tasks associated with creating, clearing, and reallocating of SADMP data sets on DASD.

Note: This new option was available beginning with z/OS V1R12.

6.7 SADMP dump data set utility

```
AMDSAPUT ----------- SADMP DASD Dump Data Set Utility ------------------
Command ==>

Enter/verify parameters. Use ENTER to perform function, END to terminate

 Function   ==> R ( C - Clear, D - Define, R - Reallocate)
 DSNAME     ==>
 Volume serial numbers:  (1-32)
    1- 8  VOL001
    9-16
   17-24
   25-32
 Unit ==> 3390  (3380, 3390, or 9345)
 Cylinders ==> 500      (cylinders per volume)
 DSNTYPE ==> E ( B - Basic, L - Large, E - ExtReq)
 CATALOG ==> Y (Y or N)
 EATTR ==> O ( N - No, O - Optional)

 Optional SMS classes: (May be required by installation ACS routines)
 StorClas ==>            DataClas ==>            MgmtClas ==>
```

Figure 6-19 Panel to define SADMP processing

SADMP panel

This panel was updated to support EAV volumes in z/OS V1R12. The highlighted options are new in Figure 6-19.

This utility performs the same functions associated with the AMDSADDD REXX utility. You can also use AMDSADDD, but references to SAMPLIB must now refer to ABLSCLI0. The data set is placed in SBLSCLI0 rather than SAMPLIB because it is no longer a sample.

Note: Systems and the applications that they support tend to get larger and more complex over time. This impacts the dumps and traces that they produce and, in turn, may create problems for you when you attempt to analyze problems using IPCS.

New options with z/OS V1R12

The panel now supports DSNTYPE=EXTREQ DASD dump data sets (extended-format data set (**E**)) with no operational changes required. The placement of the dump data set on an EAV relies upon the DSNTYPE and EATTR options and the BreakPointValue (BPV). EATTR indicates the extended attributes of the dump data set. EATTR=OPT indicates that extended attributes are optional for the dump data set. EATTR=NO indicates that extended attributes are not requested for the dump data set.

These are the expected results for the different combinations of EATTR and the size of the data set when DSNTYPE=EXTREQ is requested:

- DSNTYPE=EXTREQ,EATTR=OPT - Cylinders requested is more than BPV

  Result: Data set in cylinder-managed space (format 8 DSCB)
- DSNTYPE=EXTREQ,EATTR=OPT - Cylinders requested is less than BPV

  Result: Data set in track-managed space (Format 8 DSCB)
- DSNTYPE=EXTREQ,EATTR=NO

  Result: Data set in track-managed space (Format 1 DSCB)

Use the EATTR parameter to indicate whether the data set can support extended attributes (format 8 and 9 DSCBs) or not. To create such data sets, you can include extended address volumes (EAVs) in specific storage groups or specify an EAV on the request or direct the allocation to an esoteric containing EAV devices.

EATTR = OPT - Extended attributes are optional. The data set can have extended attributes and reside in EAS. This is the default value for VSAM data sets.

EATTR = NO - No extended attributes. The data set cannot have extended attributes (format 8 and 9 DSCBs) or reside in EAS. This is the default value for non-VSAM data sets.

REXX utility AMDSADDD

The REXX utility AMDSADDD resides in SYS1.SBLSCLI0. You can use the AMDSADDD REXX utility to:

- Allocate and initialize the SADMP data set.
- Clear (reinitialize) the data set.
- Reallocate and initialize the data set.

The IPCS SADMP dump data set utility panel, shown in Figure 6-19 on page 161, performs the same functions as the AMDSADDD REXX utility.

6.8 Using IPCS subcommands

- IPCS Primary Option menu - Option 6
- STATUS subcommand
  - STATUS FAILDATA subcommand and output
    - Locates instruction that failed causing the dump

```
BLSPDSLE ---------------- IPCS Subcommand Entry ------------------------------
Enter a free-form IPCS subcommand or a CLIST or REXX exec invocation below:

===>


----------------------- IPCS Subcommands and Abbreviations -------------------
ADDDUMP            | DROPDUMP, DROPD   | LISTDUMP, LDMP    | RENUM,    REN
ANALYZE            | DROPMAP,  DROPM   | LISTMAP,  LMAP    | RUNCHAIN, RUNC
ARCHECK            | DROPSYM,  DROPS   | LISTSYM,  LSYM    | SCAN
ASCBEXIT, ASCBX    | EPTRACE           | LISTUCB,  LISTU   | SELECT
ASMCHECK, ASMK     | EQUATE,   EQU, EQ | LITERAL           | SETDEF,   SETD
CBFORMAT, CBF      | FIND,     F       | LPAMAP            | STACK
CBSTAT             | FINDMOD,  FMOD    | MERGE             | STATUS,   ST
CLOSE              | FINDUCB,  FINDU   | NAME              | SUMMARY,  SUMM
COPYDDIR           | GTFTRACE, GTF     | NAMETOKN          | SYSTRACE
COPYDUMP           | INTEGER           | NOTE,     N       | TCBEXIT,  TCBX
COPYTRC            | IPCS HELP, H      | OPEN              | VERBEXIT, VERBX
CTRACE             | LIST,     L       | PROFILE,  PROF    | WHERE,    W
```

Figure 6-20 IPCS subcommands

Select the IPCS subcommand entry panel

Once you enter the IPCS command to begin an IPCS session, the IPCS subcommands are your main tools for performing dump and trace analysis. These commands allow you to analyze, format, view, retrieve, and copy dump and trace data, and to maintain an IPCS session. You may use subcommands in any mode.

Return to the IPCS Primary Option menu and select Option 6. When you press Enter, the IPCS Subcommand Entry panel is displayed.

STATUS subcommand

Use the STATUS subcommand to display data usually examined during the initial part of the problem determination process.

STATUS produces different diagnostic information depending on the report type parameter or parameters entered: SYSTEM, CPU, WORKSHEET, and FAILDATA.

Locate failing instruction

Use the IPCS subcommand STATUS FAILDATA to locate the specific instruction that failed and to format all the data in an SVC dump related to the software failure. This report gives information about the CSECT involved in the failure, the component identifier, and the PSW address at the time of the error.

Diagnostic report output

The IPCS STATUS FAILDATA command shows a diagnostic report that summarizes the failure. The following show the FAILDATA information. Figure 6-21 shows an example of the IPCS STATUS FAILDATA partial report. A client can use this information to look for same or similar problems already known in the IBM problem data base.

```
SEARCH ARGUMENT ABSTRACT

  RIDS/CEEPLPKA#L RIDS/#UNKNOWN AB/U4083 PRCS/00000002 REGS/0E012 REGS/B01D8

  Symptom            Description
  -------            -----------
  RIDS/CEEPLPKA#L    Load module name: CEEPLPKA
  RIDS/#UNKNOWN      Csect name: #UNKNOWN
  AB/U4083           User Abend code: 4083
  PRCS/00000002      Abend reason code: 00000002

Time of Error Information

  PSW: 07851400 80000000 00000000 0B916CB8
  Instruction length: 02   Interrupt code: 000D
  Failing instruction text: 00181610 0A0D9500 C39DA774

  Breaking event address: 00000000_00000000
  Registers 0-15

  Home ASID: 0020    Primary ASID: 0020    Secondary ASID: 0020
  PKM: 00C0          AX: 0000              EAX: 0000
  This Task's ASID/TCB: 0020/007FF3A0
  This Task's ASID/TCB: 0020/007FF3A0
  RTM was entered because a task requested ABEND via SVC 13.
  PSW and registers are the same as those from the time of error.

RECOVERY ENVIRONMENT
  Recovery routine type: ESTAE recovery routine
  Recovery routine entry point: 0B917CA0
  An SVC dump was scheduled by a previous recovery routine.
  User requested no I/O processing.
```

Figure 6-21 IPCS STATUS FAILDATA output

> **Note:** The STATUS FAILDATA data in this case shows that the load module that was pointed to by the program status word (PSW) was CEEPLPKA, the CSECT within that load module could not be determined, the abend code (U4083), and the abend reason code (002). This information is also displayed during the initialization of the dump data set but is not formatted as it is here.

With the information we currently have we could perform a search of the IBM problem databases for a possible solution, but in this instance we will pursue the problem using IPCS to help you develop a better understanding of problem analysis techniques. To get the CSECT module name you need an AMBLIST from LMOD CEEPLPKA.

6.9 SADMP analysis and COPYDUMP

- IPCS analysis of dump in place not recommended for multi-volume dumps to DASD
- IEBGENER and similar programs not recommended for transcription of multi-volume dumps to DASD
- IPCS COPYDUMP recognizes SADMP “striping”
  - Now has ability to merge the records from a multi-volume SADMP and recapture the prioritized order used by SADMP to get the most important data into the dump data sets first
- Use compressed extended sequential data set as a target - IBM testing has seen roughly 40% saving of DASD for these large data sets

Figure 6-22 SADMP analysis

SADMP analysis considerations

When doing SADMP analysis, consider the following when processing dumps:

- IPCS analysis of dumps in place is not recommended for multi-volume dumps to DASD.
- Use IPCS COPYDUMP since it produces a dump that IPCS can process more efficiently than one copied by IEBGENER or similar programs. This subcommand, COPYDUMP, can be issued from the panel shown in Figure 6-20 on page 163.

Dump testing with CISIZE

Use a compressed extended sequential data set as a target. This could save about 40% of DASD for large data sets. Figure 6-23 on page 166 shows an 87 GB dump, with SADMP, unloaded using IEBGENER. This performance test was to see whether dump directory performance could be improved by simply striping it. Appropriate SMS classes, with a dump directory striped 5 ways, was used to try to improve performance. The result was a dump initialization that completed in 36 minutes.

The version of IPCS with which all preceding runs had taken place was z/OS V1R6 IPCS. A dump directory striped 5 ways and using z/OS V1R7 IPCS resulted in a one third reduction in initialization time and brought it down to 24 minutes.

Dump intializtion elapsed Time (minutes)	IPCSDDIR Characteristics
3600	4K CISIZE, V1R6 IPCS
54	24K CISIZE, V1R6 IPCS
36	24K CISIZE, 5 stripes, V1R6 IPCS
24	24K CISIZE, 5 stripes, V1R7 IPCS

Figure 6-23 Improvement in dump directory size for performance

Striping support

Striping spreads sections, or stripes, of a data set across multiple volumes and uses independent paths, if available, to those volumes. The multiple volumes and independent paths accelerate sequential reading and writing of the data set, reducing the time during which dump I/O competes with production I/O.

It is recommended that the number of stripes match the number of volumes you use. This combination will yield the best performance because MVS data management allows random access to any record as though it appeared on a single volume. This is particularly useful during an IPCS analysis of a dump. The savings when loading the data set are real but smaller, the result of reducing the number of times end of volume processing comes into play.

In a striped data set, when the last volume receives a stripe, the next stripes are placed on the first volume, the second volume, the third, and so on to the last volume, then back to the first volume.

Merge a striped SA dump

To make a striped SA dump ready for IPCS debug, you need to merge it. According to data set naming you can use the job in Figure 6-24.

```
//HILGAA   JOB 7904,HILGER,MSGLEVEL=(1,1),MSGCLASS=K,CLASS=A,
//    NOTIFY=HILG
//COPY     EXEC PGM=IKJEFT01
//IPCSDDIR DD DISP=SHR,DSN=HILG.ZOS1A.DIRECTRY
//SYSTSPRT DD SYSOUT=A
//COPYFROM DD DSN=ONTOP.GS019.P87894.C866.SADMP1,DISP=SHR
//         DD DSN=ONTOP.GS019.P87894.C866.SADMP2,DISP=SHR
//         DD DSN=ONTOP.GS019.P87894.C866.SADMP3,DISP=SHR
//COPYTO   DD DSN=ONTOP.GS019.P87894.C866.SADMP.MERGED,
//            DISP=(NEW,CATLG),
//            DCB=(RECFM=FBS,LRECL=4160,BLKSIZE=24960),
//            SPACE=(CYL,(3000,500),RLSE)
//SYSTSIN DD  *
IPCS NOPARM
  COPYDUMP OUTFILE(COPYTO) INFILE(COPYFROM) NOCONFIRM
  END
```

Figure 6-24 How to merge an SA dump

6.10 IPCS COPYDUMP

- ❑ Use COPYDUMP to copy the SADMP dump data sets from the data sets that they were initially written into
- ❑ Creates a second type of extended format dump data set
  - ➢ This makes the special repositories that an installation tends to set aside for SADMP use maximally available for reuse
    - – This produces a dump data set that IPCS can process more efficiently

Figure 6-25 Using the IPCS COPYDUMP subcommand

IPCS COPYDUMP

IPCS COPYDUMP is the recommended method to copy an SADMP dump data set. IPCS COPYDUMP can run without a dump directory being employed. IPCS COPYDUMP is enhanced with z/OS V1R7 as follows:

- Input may be a list of ddnames or dsnames to accommodate SADMP overflow. SADMP can fill one dump data set, ask the operator for another, and write overflow records to the second. It can also go from a 2nd to a 3rd and so on. IPCS COPYDUMP has been updated to accept a list of input data sets to bring such dumps back together for analysis.
- Original multi-volume SADMP detected:
  - All volumes accessed in parallel.
  - Records merged to recover SADMP placement of important data first.
  - DSNTYPE=LARGE supported for input and output.

Use COPYDUMP to copy the SADMP dump data sets from the data sets which they were initially written into to a second type of extended format dump data set. This makes the special repositories that the installation tends to set aside for SADMP use maximally available for reuse, and produces a dump data set that IPCS can process more efficiently. SADMP sees a multi-volume dump data set as though it were volume-count separate sequential repositories. DFSMS sees all records on volume 1 followed by all records on volume 2, and so on. Transcription multi-volume SADMPs using COPYDUMP reconciles the two views and produces a data set where the most important records appear early in the dump data set, not scattered across N volumes

6.11 Using subcommands

- ❑ SELECT ALL command
  - ➢ What ASIDs have been dumped
- ❑ SELECT CURRENT command
  - ➢ Display address space executing when dump is taken
- ❑ SUMMARY FORMAT and VERBEXIT LOGDATA
  - ➢ Use for SLIP dumps and DUMPs from a console

Figure 6-26 Using subcommands

What ASIDs have been dumped

The SELECT ALL command shows what address spaces were *active* when the dump was taken. It *does not show* what address spaces are included in the dump. Figure 6-29 on page 169 shows an example of the IPCS **SELECT ALL** command.

SELECT CURRENT command

The SELECT CURRENT command displays the address space that was executing at the point in time the dump was initiated. If the dump was issued via a console dump command, the SELECT CURRENT command will display the Master scheduler address space. Figure 6-27 shows the IPCS SELECT CURRENT output.

```
ASID JOBNAME  ASCBADDR  SELECTION CRITERIA
---- -------- --------  ------------------
0020 BCDRUN   00FCAE80  CURRENT
```

Figure 6-27 IPCS SELECT CURRENT output

This shows that the BCDRUN ASID was dispatched at the time of the abend.

If the dump was taken while in cross-memory mode, both address spaces involved in the cross-memory operation will be included in the dump. Figure 6-28 on page 169 shows the IPCS SELECT CURRENT output, showing the ASIDs involved in the cross-memory function.

```
ASID JOBNAME ASCBADDR SELECTION CRITERIA
---- -------- -------- ------------------
0033 CICSFILE 00F4E680 CURRENT
008E CICSJG03 00ED8100 CURRENT
```

Figure 6-28 IPCS SELECT CURRENT cross-memory output

SLIP and console dumps

For SLIP dumps or dumps initiated from consoles, use SUMMARY FORMAT or VERBEXIT LOGDATA instead of STATUS FAILDATA. Any valid IPCS command would have started the initialization process and the related display that results after initialization. It should be noted that the dump is only initialized the first time it is referenced via IPCS, and will only be initialized again if the dump is deleted from the IPCS inventory.

```
ASID JOBNAME  ASCBADDR  SELECTION CRITERIA
---- -------- --------  ------------------
0001 *MASTER* 00FD1480  ALL
0002 PCAUTH   00FBDB80  ALL
0003 RASP     00FBDA00  ALL
0004 TRACE    00FBD880  ALL
0005 DUMPSRV  00FBD700  ALL
0006 XCFAS    00FB4700  ALL
0007 GRS      00FB4580  ALL
0008 SMSPDSE  00FA1480  ALL
0009 SMSVSAM  00FA1300  ALL
000A CONSOLE  00FB4400  ALL
000B WLM      00FB4280  ALL
000C ANTMAIN  00FB4100  ALL
000D ANTAS000 00FA3780  ALL
000E OMVS     00FAF080  ALL
0010 IEFSCHAS 00FBFE80  ALL
0011 JESXCF   00FBFD00  ALL
0012 ALLOCAS  00FBF300  ALL
0013 IOSAS    00FBF180  ALL
0014 IXGLOGR  00FA3600  ALL
0015 SMF      00FA3480  ALL
007C CMAS     00F43400  ALL
007D CAS      00F43580  ALL
007E EYUX140  00F43280  ALL
0080 MQT1CHIN 00F45700  ALL
0081 MQC1CHIN 00F38500  ALL
0082 NETMOPS  00F57B80  ALL
0084 NETMSNA  00F57880  ALL
0086 IOAOMON1 00F57580  ALL
0087 XCOM     00F57280  ALL
0088 CICSCCTR 00F57100  ALL
0089 DWTSPAS  00F63B80  ALL
008B CICSUA1B 00F4E280  ALL
008C CICSCA3B 00F47A00  ALL
008D CICSTA3B 00F47880  ALL
```

Figure 6-29 IPCS SELECT ALL output

IP SUMMARY FORMAT

The IP SUMMARY FORMAT output will provide major control blocks living in an address space.

ASCB	Address Space Control Block
TCB	Task Control Block
STCB	Secondary TCB
RB	Request Block
XSB	eXtended requeSt Block
SRB	Service Request Block
SSRB	Suspended SRB
WEB	Work Element Block (IHAWEB)
IHSA	Interrupt Handler Save Area
LSE	Linkage Stack Entry

ASCB - Address Space Control Block

An address space typically represents a system application or function, as follows:

- Provides dispatchability information about address spaces
- Provides address space-related queue anchors and data
- Provides information about an address space's local lock

TCB and STCB

TCB - Task Control Block

- Represents a task within an address space.
- A task represents a subfunction within an application.
- Each task is an independent, dispatchable unit of work.
- Provides dispatchability information.
- Used to save task status.

STCB - Secondary TCB

- Associated with a TCB
- Used to save task-related status

RB and XSB

RB - Request Block

- Used to save status as interrupts occur under a task
- Provides some dispatchability information
- Different types of RBs
  - PRB - Program Request Block
  - SVRB - Supervisor Request Block
  - IRB - Interrupt Request Block

XSB - Extended Request Block

- Associated with an RB
- Provides additional area for saving status

SRB and SSRB

SRB - Service Request Block

- Provides information for high priority, asynchronous, non-preemptible execution of work.
  - Non-preemptible means that the SRB will be given back the same processor immediately after an interrupt.
- Address space-related, but not task-related.
- See next page for SRB exceptions.

SSRB - Suspended SRB

Holds status information when an SRB gets suspended

- Page fault processing
- Requesting suspend lock (local, CML, or CMS)

6.12 Analyzing dumps

- ❑ Identifying address spaces in a dump
  - ➢ CBFORMAT command to format control blocks
    - – CBF CVT
  - ➢ FIND command to locate words
    - – CBF RTCT
  - ➢ RTCT to locate ASIDs
    - – FIND ASTB
- ❑ SELECT ASIDLIST command
  - ➢ select asidlist(x'3eb',x'45f',x'445',x'8a',x'10f')

Figure 6-30 Analyzing dumps

Identify address spaces in a dump

To identify which address spaces are contained in the dump, you can also use IPCS as follows:

1. Format the CVT (IPCS command CBF CVT)

   Use the CBFORMAT (CBF) primary command to format a control block. CBF CVT formats the CVT control block which contains the ASIDs that are in the dump.

2. Issue a FIND command for RTCT to locate the address of the Recovery Termination Control Table (RTCT).

   Use the FIND primary command to search through all dump output for a single occurrence of a specified value.

3. At offset +x'10C' in the RTCT begins a list of 1-word entries for the address spaces in the dump. The first half of the word contains the ASID.

```
268      (10C)    CHARACTER       64     RTCTASTB      SVC DUMP ASID TABLE
```

To shorten this scenario you can use IP CBF RTCT+9C? STR(SDUMP) VIEW(FLAGS)

Figure 6-31 on page 173 shows the commands required to determine what address spaces are contained in the dump. The field SDAS contains the ASIDs that are present in the dump.

```
cbf rtct;f astb
ASTB

    SDAS  SDF4  SDF5
    ----  ----  ----
001 03EB  F8    00
002 045F  F8    00
003 0445  F8    00
004 008A  F8    00
005 010F  F8    00
006 0000  00    00
007 0000  00    00
```

Figure 6-31 IPCS control block format output of RTCT for the ASTB (SVC DUMP ASID TABLE)

SELECT ASIDLIST command

The select address space identifier (ASID) service scans the ASCBs in a dump by following the pointers in the ASVT and then generates a list of entries for selected address spaces within that dump. The select ASID service returns a list of ASCBs meeting selection criteria. The ASID service also creates storage maps entries for ASCBs, which indirectly improve performance.

Figure 6-32 shows the result of the following IPCS SELECT ASIDLIST command where you use the ASID values returned in the previous format of the RTCT ASTB shown in Figure 6-31. In Figure 6-32, the ASIDs and associated JOBNAMEs that are contained in the dump are displayed.

```
select asidlist(x'3eb',x'45f',x'445',x'8a',x'10f')
```

```
ASID JOBNAME  ASCBADDR  SELECTION CRITERIA
---- -------- --------  ------------------
008A MQT1CHIN 00ED8A00  ASID
010F IMSTFAFM 00F0E280  ASID
03EB IMSTCTL  00F60D00  ASID
0445 MQT1MSTR 00F17700  ASID
045F IMSTDLI  00FA2B80  ASID :
```

Figure 6-32 IPCS SELECT ASIDLIST command output

Get z/OS release information

If you are browsing the storage using IPCS, enter the following command to get the release level:

```
IPCS LIST CVT
IP L CVT
```

```
-00028 00FDCA20. E2D7F74B F14BF340 C8C2C2F7 F7F8F040 !SP7.1.3 HBB7780 !
```

6.13 IPCS trace commands - MTRACE

- Tracing master trace table
  - VERBX MTRACE subcommand
  - IPCS Trace Processing panel
    - Option 3 - MTRACE
  - IPCS MVS Dump Component Data Analysis panel
    - MTRACE option

Figure 6-33 Tracing the master trace table with IPCS

VERBX MTRACE subcommand

The VERBEXIT MTRACE subcommand has no parameters. Specify the MTRACE verb name on the VERBEXIT subcommand to display.

Figure 6-34 on page 175 shows an example of the VERBX MTRACE output display the master trace table which is similar to the SYSLOG output.

The VERBX MTRACE command displays the following:

- The master trace table entries for the dumped system. This table is a wraparound data area that holds the most recently issued console messages in a first-in, first-out order.

  The MTRACE output in Figure 6-35 on page 175 shows a small sample of what is contained in the MTRACE. In this sample we see details of the symptom dump for our problem.

  All data that is displayed on the MVS master console will be captured in the master trace table. The amount of data kept is related to the master trace table buffer size.
- The NIP hard-copy message buffer
- The branch entry and NIP time messages on the delayed issue queue

```
00000090 IEA995I SYMPTOM DUMP OUTPUT
137 00000090 SYSTEM COMPLETION CODE=0F4 REASON CODE=00000024
137 00000090 TIME=17.21.42 SEQ=00084 CPU=0000 ASID=0008
137 00000090 PSW AT TIME OF ERROR 075C2000 82CC5BCC ILC 2 INTC 0D
137 00000090 NO ACTIVE MODULE FOUND
137 00000090 NAME=UNKNOWN
137 00000090 DATA AT PSW 02CC5BC6 - 41F00024 0A0D5880 D19C5840
137 00000090 GPR 0-3 12088C0C 440F4000 00000008 00000583
137 00000090 GPR 4-7 00FD1060 12088C0C 06BA3998 7F7697C8
137 00000090 GPR 8-11 00FD102C 02CC79A5 02CC69A6 02CC59A7
137 00000090 GPR 12-15 82CC49A8 7F769B48 82CC5BC0 00000024
137 00000090 END OF SYMPTOM DUMP
```

Figure 6-34 IPCS VERBX MTRACE output

IPCS Trace Processing panel

The MTRACE can also be obtained by using the IPCS Trace Processing panel. The IPCS Trace Processing panel, shown in Figure 6-35, displays a menu of trace formatting options. Invoke it by selecting option 7 (TRACE) from the Analysis of Dump Contents panel or by entering option 2.7 from the IPCS Primary Option Menu panel, shown in Figure 6-15 on page 157.

After choosing a trace processing option (and specifying parameters for certain options), IPCS processes the request for the current default source and displays the formatted trace data on a dump display reporter panel.

```
BLSPTRC1 ------------------ IPCS Trace Processing -----------------------------
 OPTION  ===>

 To display trace information, enter the corresponding option number.

    1  CTRACE      - Component trace
    2  GTFTRACE    - Generalized trace facility
    3  MTRACE      - Master trace
    4  SYSTRACE    - System traces
    5  MERGE       - Merge multiple traces
    T  TUTORIAL    - Details on these traces

 Enter END command to terminate IPCS trace processing.
```

Figure 6-35 Using IPCS Trace Processing panel for trace information in the dump

IPCS MVS Dump Component Data Analysis panel

Entering 2.6 on the IPCS primary option menu panel displays the Dump Component Data Analysis panel, bypassing the Analysis of Dump Contents Menu panel. From this IPCS panel you can specify the MTRACE option. For a display of this panel, see Figure C-2 on page 364.

Using IPCS command to browse CTRACE

You can use the IPCS command to browse CTRACE information. Figure 6-36 on page 176 shows the short form of USS CTRACE output provided by IP CTRACE COMP(SYSOMVS).

You can use the IP CTRACE COMP(xxxxxxx) command for all components providing ctrace information.

```
COMPONENT TRACE SHORT FORMAT
COMP(SYSOMVS)
**** 11/14/2011

SYSNAME   MNEMONIC  ENTRY ID    TIME STAMP     DESCRIPTION
-------   --------  --------  ---------------  -------------

SC64      SYSCALL   0F080001  18:28:13.263661  STANDARD SYSCALL ENTRY TRACE

SC64      FILE      05700103  18:28:13.263662  CALL TO VN_RDWR
```

Figure 6-36 IP CTRACE COMP(SYSOMVS) output

If you would like to get detailed information for all active processes, you should use the IPCS command IP CTRACE COMP(SYSOMVS) FULL.

To select a special address space, use IP CTRACE COMP(SYSOMVS) FULL ASID(X'5B') Output shown in Figure 6-37.

```
SC64      FILE      05940208  18:34:57.741233  RETURN FROM VN_LOOKUP

    ASID..005B      USERID....HILGER    STACK§....27C090C8
    TCB...007AE560  EUID......000004BA  PID.......0204003E
   +0000  D9D9D940  FFFFFFFF  00000081  0654003D ! RRR .......a$... !
   +0010  C3D1C1D9  00000040  00000000  7F753000  ! CJAR... ...."... !
   +0020  00000000  7EE12D20  00000000  7E9FAD00  ! ....=.......=... !
   +0030  00000000  00000000                      ! ........         !
```

Figure 6-37 CTRACE full output entry

This ctrace entry shows a bad return code. To get information why it was issued use the IPCS command IP BPXMTEXT 0654003D. The output is shown in Figure 6-38.

```
Notice: unknown modid, reason text may be incorrect
JRDirNotFound: A directory in the pathname was not found

Action: One of the directories specified was not found.  Verify that the name
specified is spelled correctly.
```

Figure 6-38 IP BPXMTEXT output

6.14 SYSTRACE command

- Examining the system trace
- SYSTRACE command
  - SYSTRACE ALL TIME(LOCAL)
- Reviewing system trace data
  - Use FIND command to locate *SVC
    - Locate the trace entry that indicates the abend

Figure 6-39 Using the system trace with the SYSTRACE command

Examining the system trace

The system trace table describes the events in the system leading up to the error. The trace table is helpful when the PSW does not point to the failing instruction, and to indicate what sequence of events preceded the abend. You can increase the system trace table using the console command TRACE ST,2M.

Because system trace usually runs all the time, it is very useful for problem determination. While system trace and the general trace facility (GTF) lists many of the same system events, system trace also list events occurring during system initialization, before GTF tracing can be started. System trace also traces branches and cross-memory instructions, which GTF cannot do.

SYSTRACE command

The system trace can be examined by issuing the SYSTRACE command from the IPCS subcommand entry panel shown in the visual. Issuing the SYSTRACE command on its own will display trace entries associated with the dumped ASID only. Issuing the SYSTRACE ALL command will display all system trace entries. To display the time field in local time, add the TIME(LOCAL) parameter. A complete system trace command is as follows:

```
SYSTRACE ALL TIME(LOCAL)
```

Reviewing system trace data

Figure 6-40 on page 178 shows a small sample of the system trace. The time stamps would appear on the right-hand side of the display but have been removed for presentation reasons.

The system trace report marks important or significant entries with an asterisk (*). The system trace data can be best reviewed by going to the end of the trace output, and issuing a FIND “*SVC” PREV command. This should help you locate the trace entry that indicates the abend. Another useful trace point to search for is *RCVY, which indicates a recovery action. Entries prior to this can assist with problem diagnosis. An SVC D is the abend SVC. Note that the PSW, which is the same as identified in previous steps will point to the next instruction to be processed.

The SVC trace entries are as follows:

- An SVC trace entry is for processing of a Supervisor Call (SVC) instruction.
- An SVCE trace entry is for an error during processing of an SVC instruction.
- An SVCR trace entry is for return from SVC instruction processing.

```
                     SYSTRACE Example 1 (*SVC)
-------------------------------------------------------------------
CP ASID   TCB      TRACE ID         PSW           R15       R0   R1
--|----|--------|-----------|-----------------|---------|--------|-
00 0008 007FD720  *SVC     D 075C2000 82CC5BCC  00000024 12088C0C
00 0008 007FD720   SSRV   78          828BC3F0  0000FF50 000000C8
                                                00080000
00 0008 007FD720   SSRV   78          828BC41A  0000FF70 00000FB0
                                                00080000
00 0008 007FD720   EXT  1005 070C0000 813B54AC  00001005
-------------------------------------------------------------------
                    SYSTRACE Example 2 (*RCVY)
-------------------------------------------------------------------
00 0153 008DA530   SSRV   78          40E5269C  4050E612 000002B8
                                                01530000
00 0153 008DA530   SSRV   78          80E52704  4050E612 00000080
                                                01530000
02 0013 008C5E88  *RCVY PROG                    940C4000 00000011

02 0013 008C5E88   SSRV   78          8109CADC  4000EF50 00000818
                                                00010000
02 0013 008C5E88  *RCVY FRR  070C0000 9056FBE8  940C4000 00000011
```

Figure 6-40 IPCS SYSTRACE ALL output

The actual SVC identified in the SYSTRACE is the hexadecimal identification. This must be converted to decimal to enable the correct research, for example:

> The SYSTRACE entry for SVC 78 would convert to a decimal SVC number of 120, which, when referencing *z/OS MVS Diagnosis Reference*, SY28-1084, would identify the GETMAIN/FREEMAIN SVC.

This is an example of just one of the many trace entries that are created during the life of a z/OS task. For a further explanation of other trace entries, you can reference *z/OS Diagnosis: Tools and Service Aids*, SY28-1085.

Systrace detailed information

When analyzing a dump by looking at the IP SYSTRACE output, it may be that the triggering error took place long before and could not be located in the systrace. Some dumps keep additional systrace information. You can check this with the IP SYSTRACE TTCH(LIST) TIME(LOCAL) command, which will provide the information shown in Figure 6-41.

```
No address spaces with the ERROR attribute were found
TTCH      ASID  TCB       TIME
7F72C000  0001  00000000  11/14/2011 13:34:57.783440
```

Figure 6-41 IP SYSTRACE TTCH(LIST) TIME(LOCAL) output

This output shows only one entry that belongs to the systrace you get using the IP SYSTRACE command. If you have additional entries, IP SYSTRACE TTCH(x'7F2B000') for example, will format trace entries in this TTCH.

Common system trace entries

The system trace entries are formatted by IPCS and displayed in an SVC dump. Note that system trace data in an abend dump has the same format. The subcommand is issued from the IPCS Subcommand Entry panel, SYSTRACE. The entries are:

- Cross Memory entries
  - PC - Program Call
  - PT - Program Transfer
  - PR - Program Return
  - SSAR - Set Secondary Address Space Number
- I/O entries
  - SSCH - Start Subchannel
  - MSCH - Modify Subchannel
  - HSCH - Halt Subchannel
  - RSCH - Resume Subchannel
- Dispatcher related entries
  - DSP - TCB Dispatch
  - SRB - Initial SRB Dispatch
  - SSRB - Suspended SRB Dispatch
  - WAIT - Dummy (No-work) Wait Dispatch
- Interrupt entries
  - SVC, SVCR, SVCE - SVC issuance, SVC return, SVC error
  - I/O - Input/Output
  - CLKC, EMS, EXT, CALL, SS - External interrupts such as Clock Comparator, Emergency Signal, General External, External Call, Service Signal
  - PGM - Program Check
  - MCH - Machine Check
  - RST - Restart

- Recovery entries
  - RCVY - Recovery
  - ACR - Alternate CPU Recovery
- Additional entries
  - SSRV - System Service entered through a PC or branch
  - SUSP - Lock suspension
  - BR - Branch Trace entry
  - MODE - Mode Trace entry
  - BSG - Branch to Subspace Group
- Exception entries
  - *PGM
  - *SVCE D
  - *RCVY
  - *RST
  - *ACR
  - *I/O
- Using wrong IPCS migration library

If you are debugging for example a 1.13 dump using the 1.12 IPCS migration library level, you will not get all entries in a systrace output displayed correctly, as shown in Figure 6-42.

```
02 0607 006C1468 ?EXPL  000F                    7B0052FC FE9BE0E4 0008000F
                                                006C1468 00000607 00040004
                                                47044001 80000000 00000000
                                                01757286 00000000 00040300
                                                00800000 00000001 00FA6580
02 0607 006C1468 ?EXPL  0003                    7A0052FC FEDBC5C2 00080003
                                                006C1468 00000607 00040004
                                                47044001 80000000 00000000
                                                01757286 00001005 00000001
                                                00FA6580 00000000
02 0607 006C1468 ?EXPL  000F                    7B0052FC FEDC205A 0008000F
                                                006C1468 00000607 00040004
                                                47044001 80000000 00000000
                                                01757286 00000000 00040300
                                                00800000 00000001 00FA6580
```

Figure 6-42 Bad systrace entries due to wrong IPCS migration library

Systrace output examination

The systrace output in Figure 6-43 on page 181 shows an error indication followed by Functional Recovery Routines (FRRs) calls. RTM1 is entered due to a program check. An FRR receives control and requests retry.

```
PR ASID WU-ADDR-  IDENT CD/D PSW----- ADDRESS-  UNIQUE-1 UNIQUE-2 UNIQUE-3
                                                UNIQUE-4 UNIQUE-5 UNIQUE-6
00 0001 009A8A10   PGM   011 070C4000 94111D9E  00020011 00000000
                                                         00002001
00 0001 009A8A10  *RCVY PROG                    940C4000 00000011 00000000

00 0001 009A8A10   SSRV   78          811CB9EA  4000EF50 00000970 00F9D690
                                                00010000
00 0001 009A8A10  *RCVY FRR  070C0000 94111E94  940C4000 00000011 00000000
                                                                  00000001
00 0001 009A8A10  *RCVY RTRY 070C0000 94111E7C  140C4000 00000011 00000000
                                                                  00000001
00 0001 009A8A10   SSRV   78          811C5158  0000EF03 00000970 00F9D690
                                                00010000
00 0001 009A8A10   PR    ...   0      06E95C7C  14111E7C
```

Figure 6-43 Systrace error entry

Figure 6-43 displays the following:

```
*RCVY FRR  070C0000 94111E94 entry: RTM1 gives control to an FRR at 14111E94
*RCVY RTRY 070C0000 94111E7C entry: The FRR requestsretry to 14111E7C
 SSRV   78          811C5158 entry: RTM1 freeing an SDWA
```

The error could be fixed by an FRR. An FRR is delivered by the application program. Figure 6-44 shows a failing scenario that could not be recovered.

```
PR ASID WU-ADDR-  IDENT CD/D PSW----- ADDRESS-  UNIQUE-1 UNIQUE-2 UNIQUE-3
                                                UNIQUE-4 UNIQUE-5 UNIQUE-6
02-0035 006CB220   PGM   011 078D1400 92436C78  00040011 00000000
                                                         456F8000
02-0035 006CB220  *RCVY PROG                    940C4000 00000011 00000000

02-0035 006CB220   SSRV  12D          814159E8  006CB220 000C8000 FF3A0000
                                                00000000
02-0035 006CB220   SSRV  12D          81415A04  006CB220 000B8000 00000000
                                                00000000
02-0035 006CB220   DSP       078D1400 8130C79A  00000000 3FE69D50 40FE9B8C
02-0035 006CB220  *SVC     D 078D1400 8130C79C  00000000 3FE69D50 40FE9B8C
02-0035 006CB220   SSRV   78          83C174AE  0000FF50 000000C8 006BF000
                                                00350000
02-0035 006CB220   SSRV   78          83C174E4  0000FF70 00001210 7F267DF0
                                                00350000
```

Figure 6-44 Non-recoverable error

If the System Trace Table is not available, the problem could be:

- Using wrong level of IPCS
- Problem with the dump data set
- TRT is not requested in SDATA of SVC Dump (LZ command against the dump will show whether ASID 4 is dumped)
- A major control block (for example CVT) is overlayed and IPCS cannot get to the System Trace Table.

6.15 IPCS SUMMARY subcommand

- SUMMARY subcommand
  - SUMMARY subcommand parameters
  - SUMMARY FORMAT
    - Displays task control block (TCB) and other control block information
  - TCB summary
    - RTM2WA area

Figure 6-45 Using SUMMARY subcommand to locate failing TCB

SUMMARY subcommand

Use the SUMMARY subcommand to display or print dump data associated with one or more specified address spaces.

Using SUMMARY produces different diagnostic reports depending on the report type parameter, FORMAT, KEYFIELD, JOBSUMMARY, and TCBSUMMARY, and the address space selection parameters, ALL, CURRENT, ERROR, TCBERROR, ASIDLIST, and JOBLIST. Specify different parameters to selectively display the information you want to see. See Figure C-3 on page 365 for a display of all the parameters with the SUMMARY subcommand.

> **Note:** Installation exit routines can be invoked at the system, address space, and task level for each of the parameters in the SUMMARY subcommand.

SUMMARY FORMAT command

The SUMMARY FORMAT command displays task control block (TCB) and other control block information. By issuing the MAX DOWN, or M PF8 command the TCB summary will be located.

TCB summary

The TCB summary can be located at the end of an IPCS summary format report as shown in the following example. By reviewing the data in the CMP field, we see that TCB 007FD588 has a non-zero CMP field that reflects the 440F44000 abend. Figure 6-46 shows the TCB Summary.

```
* * * * T C B S U M M A R Y * *
JOB SMXC ASID 0008 ASCB 00FBC580 FWDP 00FBC400 BWDP 00F4E600 PAGE
TCB AT CMP NTC OTC LTC TCB BACK PAGE
007FE240 00000000 00000000 00000000 007FDE88 007FF1D8 00000000 000014
007FF1D8 00000000 00000000 007FE240 00000000 007FDE88 007FE240 000018
007FDE88 00000000 007FF1D8 007FE240 007FD588 007FDB70 007FF1D8 000021
007FDB70 00000000 00000000 007FDE88 00000000 007FD588 007FDE88 000024
007FD588 440F4000 02000000 00000000 00000000 00000000 007FBFB8 000026
```

Figure 6-46 TCB Summary at the bottom of the SUMMARY FORMAT display

RTM2WA area

By issuing a FIND “TCB: 007FD588” prev command, the failing TCB data is displayed in the Summary Format display. From this point, you can locate the RTM2WA area. This can contain information that in many cases identifies the failing program.

In the TCB summary, find the task control block (TCB) for the failing task. This TCB has the abend code as its completion code in the CMP field. In the TCB summary, obtain the address of the recovery termination manager 2 (RTM2) work area (RTM2WA) for the TCB.

In the RTM2WA summary, obtain the registers at the time of the error and the name and address of the abending program.

If the RTM2WA summary does not give the abending program name and address, probably an SVC instruction abnormally ended.

If the RTM2WA summary gives a previous RTM2WA for recursion, the abend for this dump occurred while an ESTAE or other recovery routine was processing another, original abend. In recursive abends, more than one RTM2WA may be created. Use the previous RTM2WA to diagnose the original problem.

If IP SUMM FORMAT shows a non-zero completion code in the CMP column but you do not see a RTM2 work area for this TCB, the error was recovered.

6.16 What is VERBX

- ❑ IPCS VERBEXIT subcommand
  - ➢ Supports a product-specific exit routine
- ❑ VERBX example for CICS
  - ➢ Format the CICS dispatcher data in the dump
- ❑ Verb exit routine
  - ➢ Generates a unique diagnostic report
  - ➢ Can process:
    - – Installation application storage
    - – IBM component data areas and storage
- ❑ Define verb exit routine

```
EXIT EP(name) VERB(verb_name) AMASK(X'aaFFFFFF')
ABSTRACT('text') HELP(helppanel)
```

Figure 6-47 VERBEXIT subcommand for exit routines

IPCS VERBEXIT subcommand

You use the VERBEXIT subcommand to run an installation-supplied or IBM-supplied verb exit routine. One of the more common IPCS commands is VERBEXIT (VERBX). VERBX supports a product-specific exit routine that can be used to format the dump. See Figure C-4 on page 366.

VERBX example

For example, to format dump data for CICS/TS Release 1.3 we would use the exit routine DFHPD530. This program is supplied with CICS/TS Release 1.3 to enable you to format the CICS/TS-specific data.

For example, the commands could be used as follows:

- Format the CICS Dispatcher data contained in the dump.

  ```
  VERBX DFHPD660 ‘DS=1’
  ```

- Format the IMS save area.

  ```
  VERBX IMSDUMP ‘imsjobname FMTIMS savearea’
  ```

- Format the DB2 thread data.

  ```
  VERBX DSNWDMP ‘verbx dsnwdmp 'sumdump=no,subsys=itso,ds=1'
  ```

Verb exit routine

A verb exit routine can generate a unique diagnostic report that is not currently available in IPCS. A verb exit routine can process either:

- Installation application storage
- IBM component data areas and storage

Verb exit routines can be defined in BLSCUSER, in the IPCSPARM concatenation data set, or invoked by name. Define the verb exit routine in the BLSCUSER parmlib member with the following statement:

```
EXIT EP(name) VERB(verb_name) AMASK(X'aaFFFFFF')
ABSTRACT('text') HELP(helppanel)
```

The variables are as follows:

name The exit routine name.

verb_name The exit routine verb name.

aa Can be either:

- 00 - Indicates 24-bit storage accessing.
- 7F - Indicates 31-bit storage accessing.

text The abstract shown on the component data analysis panel entry associated with this verb exit.

Figure 6-48 shows a list of all VERBX options that can be used. A detailed description is shown in *z/OS MVS IPCS Commands*, SA22-7594.

```
ALCWAIT AOMDATA ASMDATA AVMDATA BLSAIPST CBFATA CICSDATA DAEDATA DSNWDMP
GRSTRACE HASMFMTM IEAVTSFS IEFIVAWT IEFIVIGD IMSDUMP IRLM JESXCF JES3
LEDATA LOGDATA MMSDATA MTRACE NUCMAP SADMPMSG SMSDATA SMSXDATA SRMDATA
SUMDUMP SYMPTOM TSODATA VSMDATA VTAMMAP
```

Figure 6-48 VERBX options

6.17 IPCS VERBX LOGDATA command

- LOGDATA verb name in VERBEXIT subcommand
- LOGDATA report
- Examining the LOGREC buffer
- Viewing the LOGDATA report
- LOGREC reports

Figure 6-49 VERBEXIT LOGDATA subcommand and LOGREC reports

LOGDATA verb

Specify the LOGDATA verb name on the VERBEXIT subcommand to format the LOGREC buffer records that were in storage when the dump was generated. LOGDATA locates the LOGREC records in the LOGREC recording buffer and invokes the EREP program to format and print the LOGREC records. The records are formatted as an EREP detail edit report.

LOGDATA report

Use the LOGDATA report to examine the system errors that occurred just before the error that caused the dump to be requested.

Examining the LOGREC buffer

Use the IPCS subcommand VERBEXIT LOGDATA to view the LOGREC buffer in a dump. This report might repeat much of the information contained in the STATUS FAILDATA report, but it helps to identify occasions when multiple error events caused the software failure.

Viewing the LOGDATA report

When viewing the VERBEXIT LOGDATA report, skip the hardware records to view the software records. Search for the first software record. Figure 6-50 on page 187 shows the start of the last error log entry displayed.

```
TYPE:  SYMPTOM RECORD      REPORT:  SOFTWARE EDIT REPORT          DAY YEAR
                                                     REPORT DATE: 319  11
SCP:   VS 2 REL 3                                     ERROR DATE: 314  11
                           MODEL:  2094                           HH MM SS.T
                           SERIAL: 06991E                   TIME: 06:07:39.8

SEARCH ARGUMENT ABSTRACT:

    PIDS/5752SCLOG RIDS/IXGC4CWO RIDS/IXGINPVT#L LVLS/770
    FLDS/RETCODE VALU/H0000000C FLDS/REASON VALU/H03190001

------- -----------
Hardware record

DEVICE NUMBER:  006138               REPORT:  OUTBOARD (LONG)        DAY YEA
                                     SCP:     VS 2 REL.   3     DATE: 316  11
DEVICE NED:     002105.000.IBM.75.000000021968.0138
DEVICE TYPE:    3390
                                     MODEL:   2094                   HH MM S
ERROR PATH:     9B-6138             CPU ID:   06991E            TIME: 12 57 2

RECORD IS:      TEMPORARY

MODE IS:        370XA

                  CC    CA     FL CT
FAILING CCW:      AF 1DA15BF0 00 000C

                  K  FLAGS     CA     US SS  CT
SCSW:             05 824417 02746BF0 02 00 000C
```

Figure 6-50 VERBX LOGDATA output Soft and Hardware entries

System error log

Another valuable source of diagnostic information in the dump are the system error log entries, which are created for all hardware and software error conditions. To review these records the VERBX LOGDATA command can be used and the last records should relate to the abend. This is not always the case, but reviewing this data from the last entry and moving backwards in time can often present information that relates to the problem or may indicate what the cause was. This may indicate a hardware or software error. In our case, the logdata does include records for our problem and is representative of data already found.

6.18 Using the SYS1.LOGREC

- Viewing SYS1.LOGREC
  - Batch job - EXEC PGM=IFCEREP1
- LOGREC data in a CF log stream
  - Batch job accessing the log stream
- LOGREC data in a log stream
  - Contains records for all systems in a sysplex
  - Component information

Figure 6-51 Using SYS1.LOGREC data

Viewing SYS1.LOGREC

The system error log can also be interrogated via a batch utility. The program used to extract this data from either the online error log data set, SYS1.LOGREC, or a historical error log data set is, IFCEREP1. This program can be used to produce hardware and software failure reports in both a summary and detailed format. Figure 6-52 shows the JCL required to process a software summary report.

```
//LOGREC JOB,..........
//STEP1 EXEC PGM=IFCEREP1,PARM=CARD
//SYSPRINT DD SYSOUT=*
//SERLOG DD DSN=SYS1.LOGREC,DISP=SHR
//DIRECTWK DD UNIT=SYSDA,SPACE=(CYL,5,,CONTIG)
//EREPPT DD SYSOUT=(*,DCB=BLKSIZE=133)
//TOURIST DD SYSOUT=(*,DCB=BLKSIZE=133)
//SYSIN DD *
PRINT=PS
TYPE=SIE
ACC=N
TABSIZE=512K
ENDPARM
//
```

Figure 6-52 IFCEREP1 sample JCL

LOGREC data in a CF

If your LOGREC data is stored in a Coupling Facility (CF) log stream data set you can use the IFCEREP1 program to access this. Figure 6-53 shows the JCL that will enable you to produce error log reports from the log stream data set.

```
//LOGREC1 JOB,.........
//EREPLOG EXEC PGM=IFCEREP1,REGION=4M,
// PARM=(¢ HIST,ACC=N,TABSIZE=512K,PRINT=PS,TYPE=SIE¢ )
//ACCIN DD DSN=sysplex.LOGREC.ALLRECS,
// DISP=SHR,
// SUBSYS=(LOGR,IFBSEXIT,¢ FROM=(1999/125),TO=YOUNGEST¢ ,
// ¢ SYSTEM=SC42¢ ) ,
// DCB=(RECFM=VB,BLKSIZE=4000)
//DIRECTWK DD UNIT=SYSDA,SPACE=(CYL,5,,CONTIG)
//TOURIST DD SYSOUT=*,DCB=BLKSIZE=133
//EREPPT DD SYSOUT=*,DCB=BLKSIZE=133
//SYSABEND DD SYSOUT=*
//SYSIN DD DUMMY
```

Figure 6-53 IFCEREP1 JCL to format Coupling Facility LOGREC data

LOGREC reports

When generating error log reports from log stream data it should be remembered that the log stream data set contains error information for all systems in the sysplex connected to the Coupling Facility. You should use the SYSTEM option of the SUBSYS parameter to filter the log stream records. Date and time parameters will also assist with the filtering.

Component information

Other information is included in the error log information in the component data. This can assist with isolating the specific product that is being affected and the maintenance level of the module that detected the failure. The maintenance level or service release level is also known as the PTF level, or you might be requested for the replacement modification identifier (RMID). It should be noted that the maintenance level of the failing load module is not necessarily the maintenance level of the failing CSECT, or module, within the load module.

Figure 6-54 shows some of the component data that can be located in the system error log.

```
COMPONENT INFORMATION:
COMPONENT ID: 5695DF115
COMPONENT RELEASE LEVEL: 1B0
PID NUMBER: 5695DF1
PID RELEASE LEVEL: V1R2
SERVICE RELEASE LEVEL: UW04733
DESCRIPTION OF FUNCTION: PDSE LATCH SUPPORT
PROBLEM ID: IGW00000
SUBSYSTEM ID: SMS
```

Figure 6-54 LOGREC error component data

6.19 IPCS virtual storage commands

- Virtual storage information
  - Obtain by using VERBX VSMDATA subcommand

VERBX VSMDATA 'LOG SUMMARY'

```
Summary of Key Information from LDA (Local Data Area) :

STRTA  =    34000  (ADDRESS of start of private storage area)
SIZA   =   BCC000  (SIZE of private storage area)
CRGTP  =    B6000  (ADDRESS of current top of user region)
LIMIT  =   BCC000  (Maximum SIZE of user region)
LOAL   =    8E000  (TOTAL bytes allocated to user region)
HIAL   =    4E000  (TOTAL bytes allocated to LSQA/SWA/229/230 region)
SMFL   = FFFFFFFF  (IEFUSI specification of LIMIT)
SMFR   = FFFFFFFF  (IEFUSI specification of VVRG)

ESTRA  =  CE00000  (ADDRESS of start of extended private storage area)
ESIZA  = 73200000  (SIZE of extended private storage area)
ERGTP  =  CE63000  (ADDRESS of current top of extended user region)
ELIM   = 73200000  (Maximum SIZE of extended user region)
ELOAL  =    61000  (TOTAL bytes allocated to extended user region)
EHIAL  =   388000  (TOTAL bytes allocated to extended LSQA/SWA/229/230)
SMFEL  = FFFFFFFF  (IEFUSI specification of ELIM)
SMFER  = FFFFFFFF  (IEFUSI specification of EVVRG)
```

Figure 6-55 Virtual storage data

Virtual storage information

Interrogating Virtual Storage usage in a dump is achieved by using the IPCS VERBX VSMDATA command. Some examples of this command are:

```
VERBX VSMDATA ‘LOG SUMMARY’
VERBX VSMDATA 'OWNCOMM'      (Check Common Storage Tracking)
VERBX VSMDATA 'OWNCOMM DETAIL ALL SORTBY(ASIDADDR)'
VERBX VSMDATA 'OWNCOMM DETAIL ASID(ddd) SORTBY(TIME)'
VERBX VSMDATA 'NOGLOBAL,JOBNAME(xxxxDBM1)'
```

The VERBX VSMDATA parameters are shown in Figure C-5 on page 366.

The VERBX VSMDATA command also supports a SUMMARY parameter, which provides a more concise report designed specifically for diagnosis of out of storage conditions. This report, generated by the VERBEXIT VSMDATA 'SUMMARY' subcommand, formats key data from the following VSM control blocks:

- Address queue anchor table (AQAT)
- Allocated element (AE)
- Double free element (DFE)
- Descriptor queue element (DQE)
- Free block queue element (FBQE)
- Free queue element (FQE)

- Global data area (GDA)
- Local data area (LDA)

The end of the VSMDATA LOG SUMMARY display has this interesting summary that can be very helpful for assisting with S878/80A abends. Figure 6-56 on page 191, and Figure 6-60 on page 193 show a sample of the data displayed for the Virtual Storage Manager.

```
 L O C A L   S T O R A G E   D A T A   S U M M A R Y


    LOCAL STORAGE MAP
 ___________________________
!                           !80000000  <- Top of Ext. Private
! Extended                  !
! LSQA/SWA/229/230          !80000000  <- Max Ext. User Region Address
!___________________________!7F25B000  <- ELSQA Bottom
!                           !
! (Free Extended Storage)   !
!___________________________!2511A000  <- Ext. User Region Top
!                           !
! Extended User Region      !
!___________________________!24B00000  <- Ext. User Region Start
:                           :
: Extended Global Storage   :
=======================================<- 16M Line
: Global Storage            :
:___________________________:  800000  <- Top of Private
!                           !
! LSQA/SWA/229/230          !  800000  <- Max User Region Address
!___________________________!  785000  <- LSQA Bottom
!                           !
! (Free Storage)            !
!___________________________!   CA000  <- User Region Top
!                           !
! User Region               !
!___________________________!    6000  <- User Region Start
: System Storage            :
:___________________________:       0

Input Specifications:

    Region Requested         =>        7FF00000
    IEFUSI/SMF Specification => SMFL : FFFFFFFF  SMFEL: FFFFFFFF
                                SMFR : FFFFFFFF  SMFER: FFFFFFFF
    Actual Limit             => LIMIT:   7FA000  ELIM : 5B500000
```

Figure 6-56 VERBX VSMDATA storage map output

```
Summary of Key Information from LDA (Local Data Area) :

STRTA  =     6000  (ADDRESS of start of private storage area)
SIZA   =   7FA000  (SIZE of private storage area)
CRGTP  =    CA000  (ADDRESS of current top of user region)
LIMIT  =   7FA000  (Maximum SIZE of user region)
LOAL   =    A0000  (TOTAL bytes allocated to user region)
HIAL   =    69000  (TOTAL bytes allocated to LSQA/SWA/229/230 region)
SMFL   = FFFFFFFF  (IEFUSI specification of LIMIT)
SMFR   = FFFFFFFF  (IEFUSI specification of VVRG)

ESTRA  = 24B00000  (ADDRESS of start of extended private storage area)
ESIZA  = 5B500000  (SIZE of extended private storage area)
ERGTP  = 2511A000  (ADDRESS of current top of extended user region)
ELIM   = 5B500000  (Maximum SIZE of extended user region)
ELOAL  =   340000  (TOTAL bytes allocated to extended user region)
EHIAL  =   C56000  (TOTAL bytes allocated to extended LSQA/SWA/229/230)
SMFEL  = FFFFFFFF  (IEFUSI specification of ELIM)
SMFER  = FFFFFFFF  (IEFUSI specification of EVVRG)
```

Figure 6-57 Summary of Key Information from LDA in VSMDATA output

Figure 6-58 shows that an IEFUSI exit, which is used to minimize storage, is active.

```
Input Specifications:
    Region Requested         =>              0
    IEFUSI/SMF Specification => SMFL :   980000  SMFEL: 79E00000
                                SMFR :   880000  SMFER: 79800000
    Actual Limit             => LIMIT:   980000  ELIM : 55100000
```

Figure 6-58 IEFUSI active

Figure 6-59 shows IEFUSI not active. This is shown by the FFFFFFFF character strings.

```
Input Specifications:
    Region Requested         =>        7FF00000
    IEFUSI/SMF Specification => SMFL : FFFFFFFF  SMFEL: FFFFFFFF
                                SMFR : FFFFFFFF  SMFER: FFFFFFFF
    Actual Limit             => LIMIT:   7FA000  ELIM : 5B500000
```

Figure 6-59 IEFUSI not active

Subpool usage summary

This SUMMARY report also generates the following information:

- Global storage map
- Global subpool usage summary
- Local storage map
- Local subpool usage summary

What are subpools

A subpool is a group of logically related storage blocks identified by a subpool number. In a request for virtual storage, a subpool number indicates the type of storage that is requested.

- VSM manages storage through the use of subpools. Each subpool has an associated set of predefined storage characteristics, for example user region, fetch-protected.
- Subpools are storage requested via GETMAIN or STORAGE OBTAIN services.
  - User input: subpool number and storage size
  - VSM output: storage of requested size and characteristics
- Subpools start off empty, then they grow, as follows:

  When a user requests a page of storage from a particular subpool, VSM maps a page of free storage to that subpool, then passes the storage address to the user. When a page is mapped to a subpool, it is said to be subpool-assigned or allocated.

> **Note:** The Global and Local subpool usage summaries reflect pages that have all or some of the page allocated. You can find information about the allocation of a particular page in the VSM control blocks representing the page.

Following is a subpool storage usage summary for each TCB.

```
LOCAL SUBPOOL USAGE SUMMARY

     TCB/OWNER   SP#   KEY      BELOW    ABOVE    TOTAL
     ---------   ---   ---      -----    -----    -----

       9FF410    129    0      340000  3100000  3440000
       9FF410    130    8      100000  1200000  1300000
       9FF410    130    9       80000   200000   280000
       9FF410    131    8        4000   62B000   62F000
       9FF410    132    4           0    1E000    1E000
       9FF410    132    8        C000    86000    92000
        LSQA     205    0           0    A3000    A3000
        LSQA     215    0           0    19000    19000
        LSQA     225    0           0    15000    15000
       9FFE88    229    0           0     D000     D000
       9FFBF8    229    0           0    1C000    1C000
       9FF5A8    229    0        1000     2000     3000
       9FF410    229    0           0     1000     1000
       9FF180    229    0           0     1000     1000
       9FB280    229    0           0     8000     8000
       9ECE88    229    0           0     1000     1000
       9ECAD8    229    0        3000     9000     C000
```

Figure 6-60 VERBX VSMDATA subpool usage summary

What is high virtual storage

The IARV64 macro allows a program to use the full range of virtual storage in an address space that is supported by 64-bit addresses. The macro creates and frees storage areas above the two gigabyte address and manages the physical frames behind the storage. Each storage area is a multiple of one megabyte in size and begins on a megabyte boundary. You can think of the IARV64 macro as the GETMAIN/FREEMAIN, PGSER or STORAGE macro for virtual storage above the 2-gigabyte address.

The 2-gigabyte address in the address space is marked by a virtual line called the bar. The bar separates storage below the 2-gigabyte address, called below the bar, from storage above the 2-igabyte address, called above the bar. The area above the bar is intended to be used for data only, not for executing programs. Programs use the IARV64 macro to obtain storage above the bar in “chunks” of virtual storage called memory objects. Your installation can set a limit on the use of the address space above the bar for a single address space. The limit is called the MEMLIMIT. Therefore, this virtual storage is:

- 64-bit addressable storage located above the 2-GB bar
- Managed by RSM, not VSM
- Managed via the IARV64 macro rather than GETMAIN/FREEMAIN or STORAGE
- Storage always obtained in 1-Meg multiples
- Allocated areas are called Memory Objects
  - Private memory objects are owned by TCBs.
  - Shared memory objects are owned by the system.

Use the IPCS RSMDATA HIGHVIRT command to view memory object status. You can use the IPCS RSMDATA HIGHVIRT ASID(X’5B') command to list storage above the BAR for asid x’5B’. Figure 6-61 shows the storage layout, including the 64-bit addressing area.

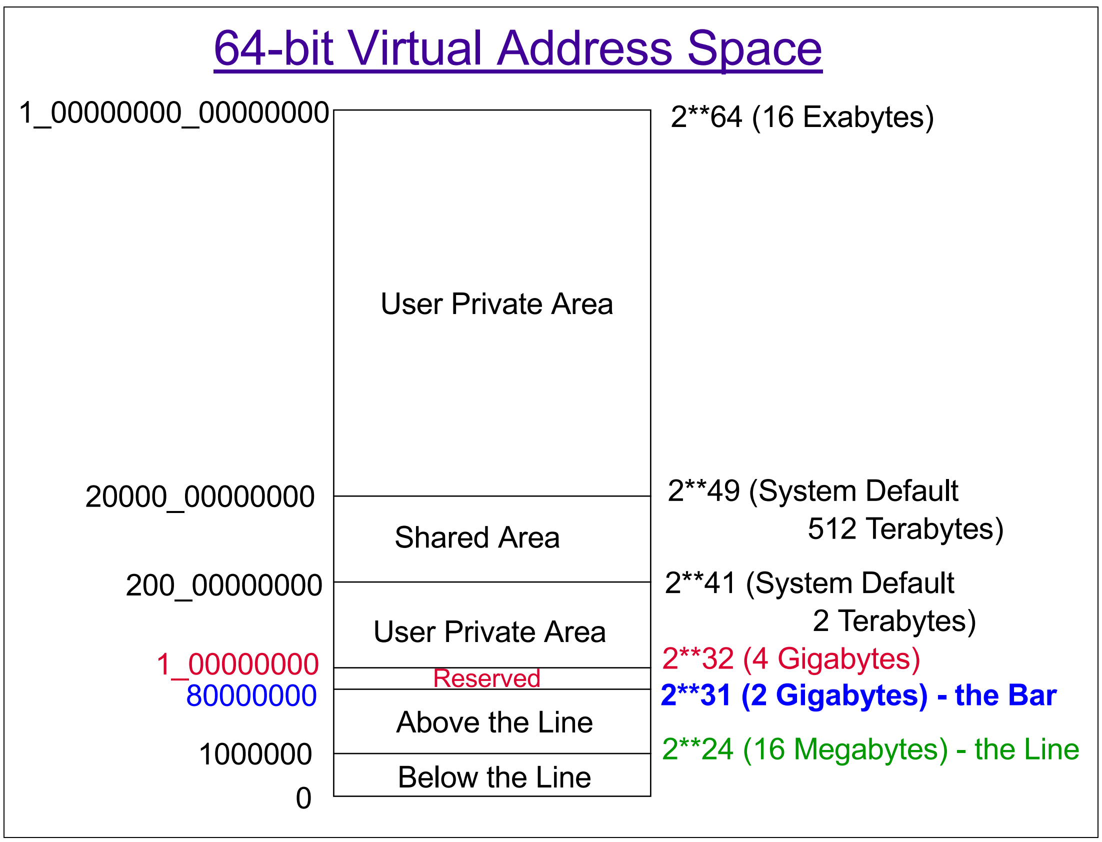

Figure 6-61 Storage layout

6.20 Using IPCS to browse storage

- Browse storage in a dump using IPCS
  - Select address to display

```
BLSPOPT ----------------- IPCS - ENTRY PANEL  --------------------------------
Command ==>

 CURRENT DEFAULTS:
  Source ==> DSNAME('DUMP.D100626.H20.SC75.JES3.S00001')
  Address space ==> ASID(X'001E')

 OVERRIDE DEFAULTS:                              (defaults used for blank fields)
  Source ==> DSNAME('DUMP.D100626.H20.SC75.JES3.S00001')
  Address space ==>
  Password      ==>

 POINTER:
  Address       ==>                             (blank to display pointer stack)
  Remark        ==>                                              (optional text)
```

- Place an address in the field, press Enter, and the storage is displayed

Figure 6-62 Browsing storage with IPCS

Browse storage in a dump using IPCS

Another function of IPCS is the ability to browse storage locations with the dump. There will be many times when you will need to look at storage locations in a dump using IPCS. Normally you browse storage locations once you have been viewing other options in the dump. Select the BROWSE (Option 1) from the IPCS primary option menu, shown in Figure 6-15 on page 157. The next panel will identify the current dump data set, as shown in Figure 6-63 on page 196.

Select address to display

Once you place an address in the Address (Pointer: field) in Figure 6-63 on page 196, the address appears in Figure 6-64 on page 196.

```
------------------------ IPCS - ENTRY PANEL  --------------------------------
Command ==>

 CURRENT DEFAULTS:
  Source ==> DSNAME('DUMP.D0506.H15.SC65.GABERT1.S00011')
  Address space ==> ASID(X'001E')

 OVERRIDE DEFAULTS:                            (defaults used for blank fields)
  Source ==> DSNAME('DUMP.D100626.H20.SC75.JES3.S00001')
  Address space ==>
  Password      ==>

 POINTER:
  Address       ==>                            (blank to display pointer stack)
  Remark        ==>                                             (optional text)
```

Figure 6-63 IPCS BROWSE storage panel

From this panel you can do a select (S) on the address, as shown in Figure 6-64.

```
DSNAME('DUMP.D0506.H15.SC65.GABERT1.S00011') POINTERS  ------------------------
Command ===>                                                     SCROLL ===> CSR
ASID(X'001E') is the default address space
PTR   Address           Address space                               Data type
S0003 01329D48.         ASID(X'001E')                               AREA
      Remarks:
```

Figure 6-64 IPCS BROWSE storage **S**elect option

Storage address displayed

Figure 6-65 shows the storage at location 01329D48—storage starting at that address.

```
ASID(X'001E') ADDRESS(01329D48.) STORAGE -------------------------------------
Command ===>                                                     SCROLL ===> CSR
01329D48                        50E0D004   91802021   |         &\}.j... |
01329D50   47806124   45E0631A   47F0629E   BF8F208C   | ../..\...0...... |
01329D60   47806184   58B08008   9501B018   47706162   | ../d....n...../. |
01329D70   1F11BF17   B0014100   00484130   00FA45E0   | ...............\ |
```

Figure 6-65 IPCS BROWSE selected storage

Browsing dataspace storage

Dataspaces are used to have quick access to data stored in the 2-Gig storage area. To list data space storage you need to have the dataspaces you would like to look at in the dump. If you would like to dump all dataspaces for omvs, you have to use the following option in your dump command or slip: DSPNAME=(‘OMVS’.*)

Figure 6-66 on page 197 shows how to access dataspace storage.

```
DSNAME('DUMP.D111114.H18.SC64.HILGER.S00025') POINTERS  -----------------------
Command ===>                                                        SCROLL ===> CSR
ASID(X'0010') is the default address space
PTR   Address             Address space                              Data type
s0001 00.                 ASID(X'0010') DSPNAME(SYSZBPX2)            AREA
      Remarks:
```

Figure 6-66 Browse dataspace storage

6.21 Using IPCS to find the failing instruction

- ❑ Find failing instruction in a dump
  - ➢ Use STATUS FAILDATA subcommand - gets report
  - ➢ Report shows the following:

```
PSW: 070C1000 81329D48   Instruction length: 02   Interrupt code: 000D
Failing instruction text: 00181610 0A0D50E0 D0049180
```

- ❑ Failing instruction text
- ❑ Detail edit report for a software record
  - ➢ Report is produced by EREP and, through the VERBEXIT LOGDATA subcommand, under IPCS
  - ➢ Use detail edit report for a software record to determine the cause of an abend, and the recovery action that the system or application needs to take

Figure 6-67 Finding the failing instruction in a dump

Find failing instruction in a dump

Normally when analyzing certain dumps, one of the first things to determine is to find the failing instruction. The STATUS FAILDATA report also helps you find the exact instruction that failed. This report—an example is shown in Figure C-6 on page 367 and Figure C-7 on page 368—provides the PSW address at the time of the error and the failing instruction text. Note that the text on this screen is not always the failing instruction text. Sometimes the PSW points to the place where the dump was taken and not the place where the error occurred. See Figure 6-20 on page 163, for the STATUS subcommand. On that display you issue the STATUS FAILDATA subcommand.

From the report, the PSW and failing instruction text are as follows:

```
PSW: 070C1000 81329D48   Instruction length: 02   Interrupt code: 000D
Failing instruction text: 00181610 0A0D50E0 D0049180
```

Failing instruction text

This contains 12 bytes of the instruction stream at the time of the error, including the actual instruction that caused the abend. Starting at the end of the sixth byte, subtract the instruction length to indicate the failing instruction. In the preceding example, the failing instruction is X'0A0D'.

Detail edit report for a software record

The detail edit report for a software record shows the complete contents of an error record for an abnormal end, including the system diagnostic work area (SDWA). The report is produced by EREP and, through the VERBEXIT LOGDATA subcommand, under IPCS.

Use the VERBEXIT subcommand to format the logrec buffer records that were in storage when the dump was generated. LOGDATA locates the logrec records in the logrec recording buffer and invokes the EREP program to format and print the logrec records. The records are formatted as an EREP detail edit report.

Use the LOGDATA report to examine the system errors that occurred just before the error that caused the dump to be requested.

EREP detail edit report

Use this report to determine the cause of an abend, and the recovery action that the system or application has either taken or not taken. This report enables you to locate where an error occurred, similar to the analysis of an SVC dump. Once you locate the error, you can develop a search argument to obtain a fix for the problem.

See *Environmental Record Editing and Printing Program (EREP) User's Guide*, GC35-01511, for information about producing a detail edit report for an SDWA-type record. See *z/OS MVS Interactive Problem Control System (IPCS) Commands*, SA22-7594, for information about the VERBEXIT LOGDATA subcommand.

6.22 Analyzing for resource contention

- Resource contention analysis in dumps
  - Use the IPCS subcommand ANALYZE
    - Command is used to detect resource contention
- ANALYZE RESOURCE subcommand
  - Report lists the jobs that hold the device group and the jobs requiring, or waiting for, the device group
- ANALYZE RESOURCE XREF subcommand
  - For each job that holds a device group, the report lists all other device groups that job holds
  - For each job waiting for a device group, the report lists all other device groups that job holds

Figure 6-68 Subcommands to analyze resource contention

Resource contention analysis in dumps

You can obtain information related to resource contention by using the IPCS subcommand ANALYZE. Use the ANALYZE subcommand to gather contention information from component analysis exits and format the data to show where contention exists in the dump. ANALYZE obtains contention information for I/O, ENQs, suspend locks, allocatable devices, real frames, global resource serialization latches, and other resources.

This command is used to detect resource contention. Specifying GRSQ in the SDATA options makes the information more reliable. Generally the most useful information is found at the bottom of this example report, shown in Figure 6-69. The top is generally I/O device contention and is not usually relevant.

```
RESOURCE #0011:
NAME=MAJOR=IGDCDSXS MINOR=SYSD.DFSMS.COMMDS SCOPE=SYSTEMS
RESOURCE #0011 IS HELD BY:
JOBNAME=SMS ASID=0025 TCB=009EB0F0 SYSNAME=CM01
RESOURCE #0011 IS REQUIRED BY:
JOBNAME=SMS ASID=0026 TCB=009EB0F0 SYSNAME=PR02
JOBNAME=SMS ASID=0026 TCB=009EB0F0 SYSNAME=PR03
JOBNAME=SMS ASID=0028 TCB=009EC660 SYSNAME=SP02
JOBNAME=SMS ASID=0027 TCB=009EB0F0 SYSNAME=TS01
```

Figure 6-69 Resource contention data from the IPCS ANALYZE command

Note: Holders of and waiters on resources are identified in the output. ASIDs and TCBs (where appropriate) are provided and if the scope is SYSTEMS, the resource is the holding system name.

ANALYZE RESOURCE subcommand

The ANALYZE RESOURCE subcommand produces a report that identifies each resource, or device group, that is experiencing contention. Under each resource, it lists the jobs that hold the device group and the jobs requiring, or waiting for, the device group. For example, the resource name in contention in Figure 6-69 on page 200 is:

```
MAJOR=IGDCDSXS MINOR=SYSD.DFSMS.COMMDS SCOPE=SYSTEMS
```

Note: Scope=SYSTEMS means multisystem, and scope=SYSTEM means single system.

ANALYZE RESOURCE XREF subcommand

If you add the XREF keyword to the ANALYZE RESOURCE subcommand, IPCS would add the following information to the previous report:

- For each job that holds a device group, the report lists all other device groups that job holds.
- For each job waiting for a device group, the report lists all other device groups that job holds.

Report using XREF keyword

An example of the output from a report generated using the XREF keyword is shown in Figure 6-70.

```
              CONTENTION REPORT BY RESOURCE NAME

RESOURCE #0001:
   NAME=GROUP record, group = SYSMCS   , member = all members

RESOURCE #0001 IS HELD BY:

  JOBNAME=XCFAS     ASID=0006  UNKNOWN#00000001=00000000
   DATA=Local lock owner
        Request id = 000131B8
        Request code = 00000002
```

Figure 6-70 ANALYZE RESOURCE XREF report

6.23 Searching IBM problem databases

- IBM database searches
  - Evaluate available diagnostic data - use abend code
  - Look in z/OS MVS Systems Codes, SA22-7626
- Use search arguments
  - Abend codes - Messages IDs - Return and reason codes (RCxx) - Reason codes (RSNxxxx)
- Partial dump checks
  - Possibly key areas of storage is missing
    - Commmands to determine this

Figure 6-71 Providing database search information

IBM database searches

At this point in time we have evaluated some of the available diagnostic data from the dumps. Look in *z/OS MVS Systems Codes*, SA22-7626 to find the meaning of an 0F4 abend. Figure 6-72 shows the explanation from this manual for a 0F4 abend.

```
Explanation:  An error occurred in DFSMSdfp support.
Source: DFSMSdfp
System Action:  Prior to the ABEND error occurring, a return code was placed in
the general register 15 and a reason code in general register 0. An SVC dump
has been taken unless the failure is in IGWSPZAP where register 15 contains 10.
The DFSMSdfp recovery routines retry to allow the failing module to return to
its caller. See DFSMS/MVS DFSMSdfp Diagnosis Guide for return code information.
Programmer Response:  System error. Rerun the job.
System Programmer Response:  If the error recurs and the program is not in
error, search problem reporting data bases for a fix for the problem. If no fix
exists, contact the IBM Support Center. Provide the JCL, the SYSOUT output for
the job, and the logrec data set error record.
```

Figure 6-72 Documented abend S0F4 Information

Note: The 9 volumes of the *z/OS MVS System Messages and Systems Codes*, SA22-763x manuals should always be your first reference point for possible causes.

Build search arguments for IBM databases

These are recommended formats to be used when querying the problem database or reporting problems. These are not the only formats that are used, and some creativity and imagination can assist with expanding your search. These search arguments are also called a symptom string. If the problem being diagnosed was already reported and the symptoms entered in the database, the search will produce a match. Figure 6-73 displays what we know of the abend details.

```
LOAD MODULE NAME: IGWLHHLS   - Maintenance level UW04733
    CSECT NAME:       IGWLGMOT   - Maintenance level UW03389
    SYSTEM ABEND CODE: 00F4
    ABEND REASON CODE: 00000024
    RSN=12088C01
```

Figure 6-73 Abend details

This information can be used to build the IBM problem database search arguments. The search arguments should use the following formats:

Abend: The format should be ABEND*xxx* or ABENDS*xxx,* where *xxx* is the abend code.

Messages The format should be MSG*xxxxxxx*, where *xxxxxxx* is the message code.

Return and Reason Codes
The format should be RC*xx,* where *xx* is the reason or return code. A reason code alternative is:

Reason Codes The format can be RSN*xxxxx*, where *xxxxx* is the reason code.

Partial dump check

A partial or incomplete dump will be missing some key areas of storage that in most cases will make the dump useless when it comes to efficient problem diagnosis. We should first check whether the dump is ok. The command shown in Figure 6-74 can provide this information, but there could be another problem which will not be shown by this command. If the dump has been transferred via FTP, it could be that not all data has been sent correctly.

```
Command ===> l e0. block(0) l(16)
```

Figure 6-74 Partial dump check command

The dump will not be a partial dump if you receive the following information:

```
LIST E0. BLOCK(0) LENGTH(X'10') AREA
E0. LENGTH(X'10')==>All bytes contain X'00'
```

If you get a bad return like the one shown below, you need to refer to the z/OS data areas manual. These codes are mapped by the SDRSN control block.

```
LIST E0. BLOCK(0) LENGTH(X'10') AREA
BLOCK(0) ADDRESS(E0)
000000E0. 00000000 30000000 00000000 00000000
```

For this example, you will find:

```
20000000 - The system detected an error in the SVC dump task and gave recovery
control
10000000 - The SVC dump task failed
```

Partial standalone dumps

While it is always best to get a complete standalone dump, sometimes time constraints will not allow this. There is no guarantee that it will be possible to diagnose a failure from a partial standalone dump; however, if the choice is between no dump at all or a partial dump, then the partial dump is the best choice.

When taking a partial standalone dump:

- Let the standalone dump run for as long as you can. If you run out of time, you can stop the dump cleanly.
- A standalone dump tries to write out the most important information first:
  - Status information (PSW, registers, and so forth) for all CPUs
  - Critical real storage, including common storage and trace information
  - Real storage for address spaces executing at the time of the dump
  - Any remaining real storage
  - Paged out storage for swapped in address spaces
  - Paged out storage for swapped out address spaces
- Use the EXTERNAL INTERRUPT key to terminate the dumping process. This causes a clean stop, closing the output data set properly.

7

z/OS Language Environment

Language Environment provides a common run-time environment across multiple high-level languages (HLLs). These languages include:

- COBOL
- C/C++
- PL/I
- FORTRAN
- Assembler (not HLL)

Language Environment (LE) establishes a common run-time environment for all participating HLLs. It combines essential run-time services, such as routines for run-time message handling, condition handling, and storage management. All of these services are available through a set of interfaces that are consistent across programming languages. You may either call these interfaces yourself, or use language-specific services that call the interfaces. With Language Environment, you can use one run-time environment for your applications, regardless of the application's programming language or system resource needs.

Language Environment consists of:

- Basic routines that support starting and stopping programs, allocating storage, communicating with programs written in different languages, and indicating and handling conditions.
- Common library services, such as math services and date and time services, that are commonly needed by programs running on the system. These functions are supported through a library of callable services.
- Language-specific portions of the run-time library. Because many language-specific routines call Language Environment services, behavior is consistent across languages.

7.1 Language Environment ABEND and CEEDUMP handling

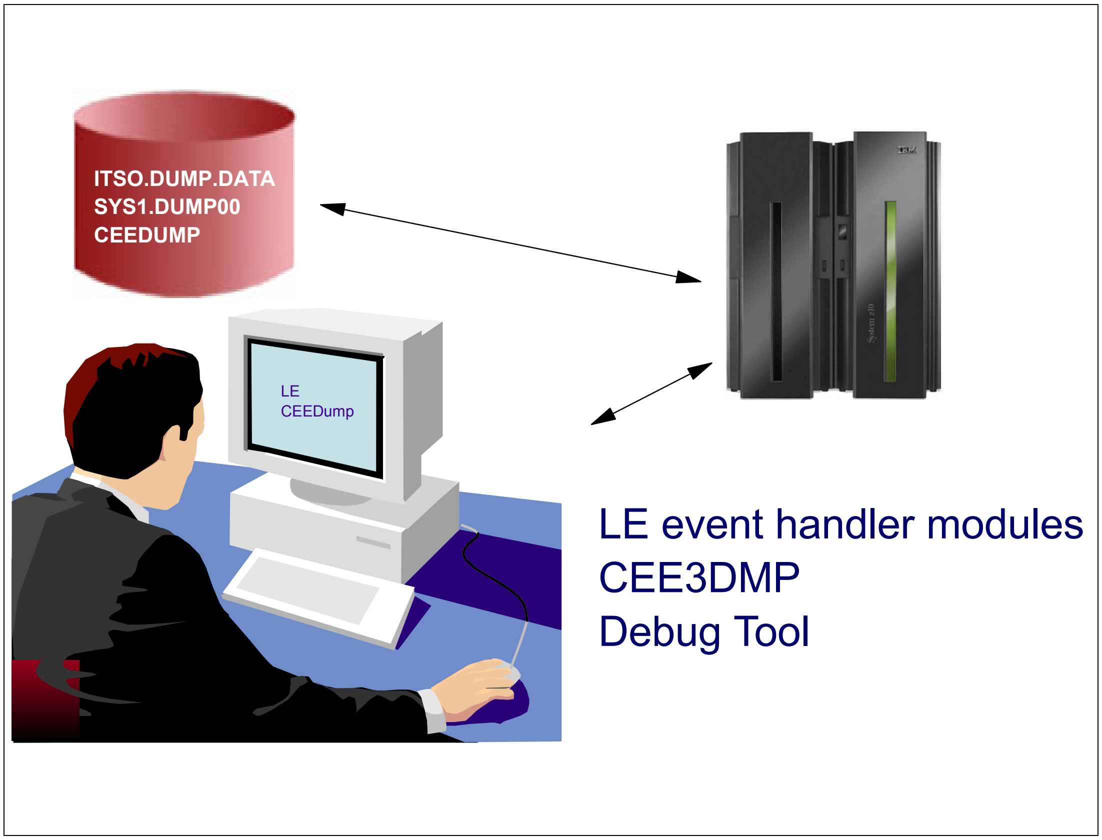

Figure 7-1 Language Environment ABEND and CEEDUMP handling

Run-time environment

A run-time environment provides facilities, such as storage control, system time and date functions, error processing, message processing and other system functions to the high-level languages. The run-time library is "called" by the user program to perform these functions. Before Language Environment, each high-level language had its own run-time library, but Language Environment has combined the functionality required by each language into a single run-time environment. Currently, most problems in Language Environment and member language routines can be determined with the use of a debugging tool or through information provided in the Language Environment dump.

Language Environment event handler modules

There are two common execution library (CEL) modules that will indicate a failure, but the cause will be elsewhere. The first is CEEHDSP, which schedules the Language Environment CEEDUMP to be taken. The second module is CEEPLPKA, which will always indicate an ABENDU4039 or ABENDU4038 no matter what the original error. Your diagnostic methodology should exclude failures in these two modules.

- The Language Environment event handler modules are identified as CEEExxx where *xxx* represents the language, as follows:

  003 C/C++ Run-time (that is, CEEEV003)
  005 COBOL
  007 FORTRAN
  008 DCE

010 PL/I
012 Debug Tool

CEE3DMP

For non-64-bit, the CEE3DMP callable service generates a dump of the run-time environment for Language Environment and the member language libraries at the point of the CEE3DMP call. You can call CEE3DMP directly from an application routine.

Depending on the CEE3DMP options you specify, the dump can contain information about conditions, tracebacks, variables, control blocks, stack and heap storage, file status and attributes, and language-specific information.

All output from CEE3DMP is written to the default ddname CEEDUMP. CEEDUMP, by default, sends the output to the SDSF output queue. You can direct the output from the CEEDUMP to a specific SYSOUT class by using the environment variable, _CEE_DMPTARG=SYSOUT(x), where x is the output class.

Debug Tool

Debug tools are designed to help you detect errors early in your routine. IBM offers Debug Tool, a comprehensive compile, edit, and debug product that is provided with the C/C++, Enterprise COBOL for z/OS, COBOL for OS/390 and VM, COBOL for MVS and VM, PL/I for MVS and VM, IBM VisualAge® PL/I, and VisualAge for Java compiler products.

You can use the IBM Debug Tool to examine, monitor, and control how your routines run, and debug your routines interactively or in batch mode. Debug Tool also provides facilities for setting breakpoints and altering the contents and values of variables. Language Environment run-time options can be used with Debug Tool to debug or analyze your routine. Refer to the Debug Tool publications for a detailed explanation of how to invoke and run Debug Tool.

Fault Analyzer

If you are not familiar with IPCS, Fault Analyzer is a very helpful tool to debug dumps. It will provide LE information. The address for the main LE control block, Common Anchor Area (CAA), will be provided. With this address you can get most of the storage information you would like to look at. Using the CAA you can look for LE runopts, TraceBack and ZMCH in the dump.

Condition handling

To get useful LE dumps, the LE runopts TRAP and TERMTHDACT should be set properly. You can activate LE runopts to use the LE parmlib members or in your application. Figure 7-2 shows information about TRAP options.

- ESPIE – one or no routines that get control in the event of a program check
  - With TRAP(ON,SPIE) – LE is the ESPIE
  - With TRAP(ON,NOSPIE) or TRAP(OFF) – application supplied or no ESPIE
- ESTAE – routines that get control in LIFO order when software detected or percolated abends occurs
  - LE is registered (first to get control) when LE initializes
  - If application registers it gets control before LE

Figure 7-2 TRAP options

LE Logic flow in an error case

Consider the following conditions in case of an error:

- Condition handling only happens when the TRAP Runtime Option is set to ON.
- If an exception is encountered, LE converts it into an LE condition and collects time of error information.
- If a condition of severity 2 or greater (Severe, Critical, or Error message suffix) is encountered, then LE will take the dump logic path.
- Only collect a DUMP if TERMTHDACT is set to take a dump.
- Only issue an ABEND if ABTERM is set to generate an abend.

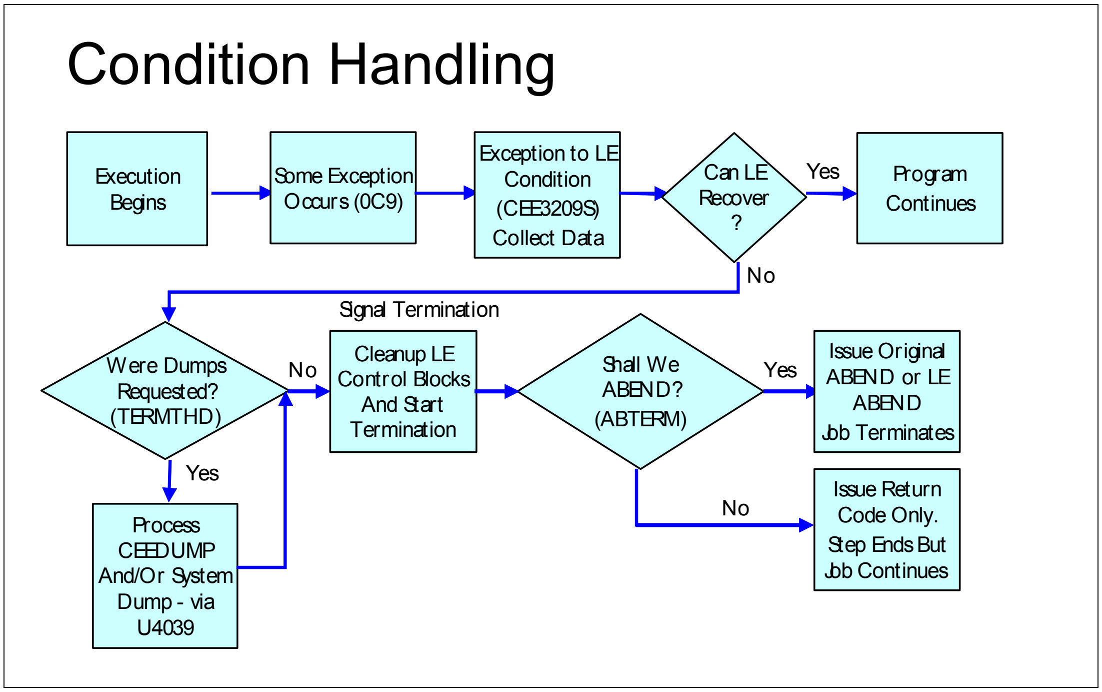

Figure 7-3 Error handling logic flow

7.2 Common Language Environment messages

- Run-time messages provide users with:
  - Information about a condition
  - Possible solutions for any errors that occurred
- Issued by Language Environment:
  - Common routines
  - Language-specific run-time routines
- Message content:
  - Message prefix
  - Message number
  - Severity code
  - Descriptive text

Figure 7-4 Debugging with run-time messages

Debugging with run-time messages

Run-time messages provide users with additional information about a condition, and possible solutions for any errors that occurred. They can be issued by Language Environment common routines or language-specific run-time routines and contain a message prefix, message number, severity code, and descriptive text.

The first step in debugging your routine is to look up any run-time messages. To find run-time messages, check the message file:

- On z/OS, run-time messages are written by default to ddname SYSOUT. If SYSOUT is not specified, then the messages are written to SYSOUT=*.
- On CICS, the run-time messages are written to the CESE transient data QUEUE.

> **Note:** The default message file ddname can be changed by using the MSGFILE run-time option. For information about displaying run-time messages for C/C++, COBOL, Fortran, or PL/I routines, see *z/OS Language Environment Programming Guide*, SA22-7561.

Message content

Run-time messages provide users with additional information about a condition, and possible solutions for any errors that occurred. They can be issued by Language Environment common routines or language-specific run-time routines and contain a message prefix, message number, severity code, and descriptive text.

In the following sample Language Environment message, the content is as follows:

```
CEE3206S The system detected a specification exception.
```

- The message prefix is CEE.
- The message number is 3206.
- The severity code is S.
- The message text is “The system detected a specification exception.”

Note: Language Environment messages can appear even though you made no explicit calls to Language Environment services. C/C++, COBOL, and PL/I run-time library routines commonly use the Language Environment services. This is why you can see LE messages even when the application routine does not directly call common run-time services.

Getting LE message from LE token

Language Environment uses the 12-byte condition token data type to perform a variety of communication functions. You can use the condition token to react to conditions and communicate conditions with other routines.

A condition token will be delivered by LE that can be used to get the original message information, and it shows how to do it; see Figure 7-5.

- 0003 | 0C84 | 59 | C3C5C5 | xxxxxxxx
  - 0003 Severity
    - 0000 Informational (I)
    - 0001 Warning (W)
    - 0002 Error (E)
    - 0003 Severe (S)
    - 0004 Critical (C)
  - 0C84 Hex message number (3204)
  - 59 Flags (ignore)
  - C3C5C5 Facility ID (message prefix)
  - xxxxxxxx Instance specific information (internal use)

Figure 7-5 Condition token

Note: If you provide an fc parameter in a call to a Language Environment callable service, the service sets fc to a specific value called a condition token and returns it to your application.

If you do not specify the fc parameter in a call to a Language Environment service, Language Environment generates a condition token for any nonzero condition and signals it using the CEESGL callable service. Signaling the condition token causes it to be passed to Language Environment condition handling.

7.3 Language Environment message abend prefixes

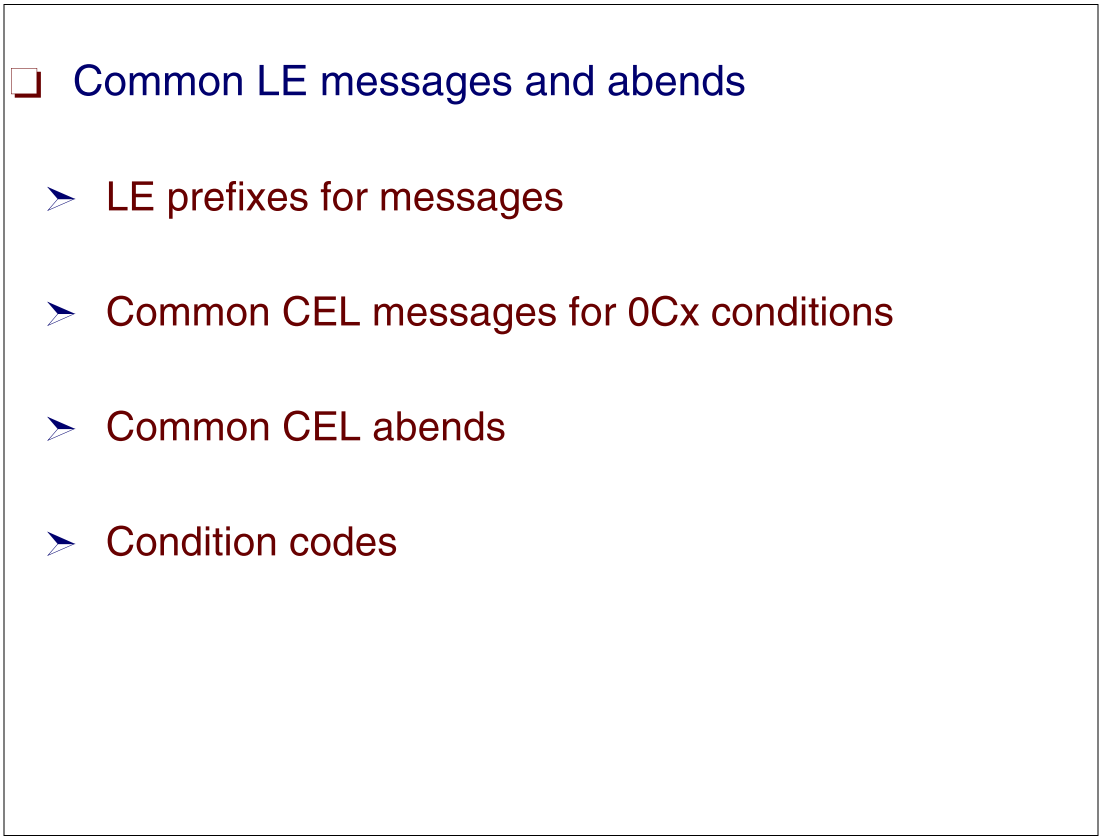

Figure 7-6 Understanding message prefixes and condition codes

Language Environment message abend prefixes

The message prefix indicates the Language Environment component that generated the message. The message prefix is the first three characters of the message number and is also the facility ID in the condition token.

> **Note:** You can identify Language Environment-supplied module elements by any of the following three-character prefixes:
>
> - CEE (Language Environment)
> - CEL (Language Environment)
> - EDC (C/C++)

The following messages and abend prefixes can assist with problem diagnosis:

CEE Is output by common execution library (CEL) modules, but may be reporting a problem elsewhere

IGZ Is output by COBOL

IBM Is output by PL/I

AFH Is output by FORTRAN

EDC Is output by C/C++

Some common CEL messages that indicate exception (0Cx) conditions are:

- CEE3201 = ABEND0C1
- CEE3204 = ABEND0C4
- CEE32xx = ABEND0Cy, where y is the hex equivalent of decimal xx

Message CEE3250 indicates a non-exception (0Cx) abend has occurred.

Common CEL abends

U4038 Some “severe” error occurred but no dump was requested.

U4039 Some “severe” error occurred and a dump was requested.

U4083* Backchain in error - only occurs after some other error.

U4087* Error during error processing.

U4093* Error during initialization.

U4094* Error during termination.

The * indicates that a reason code is required for this message to be meaningful.

Condition code token example

The following condition code example should show how to get the meaning of this information:

```
00030C84 59C3C5C5 xxxxxxxx
```

The condition code breaks down in the following way:

```
0003 | 0C84 | 59 | C3C5C5 | xxxxxxxx
```

0003 indicates severity and the other possibilities are:

0000 Informational (I)

0001 Warning (W)

0002 Error (E)

0003 Severe (S)

0004 Critical (C)

The other fields are as follows:

0C84 Hex message number (3204)

59 Flags (ignore)

C3C5C5 Facility ID (message prefix)

xxxxxxxx Instance specific information (internal use)

This token represents message CEE3204S.

7.4 Collecting debug documentation

- Specify run-time options
  - ABTERMENC(ABEND) TERMTHDACT(UADUMP) TRAP(ON)
- Include a SYSMDUMP DD statement in the JCL
  - SPACE=(CYL,(100,100),RLSE),DISP=(NEW,DELETE,CATLG), DSN=dump_dataset_name,LRECL=4160,RECFM=FBS
- SDATA statement in the IEADMR00 parmlib member

Figure 7-7 Specifying information for debugging

Specifications to obtain debug documentation

There are several run-time options that affect debugging in Language Environment. The TEST run-time option, for example, can be used with a debugging tool to specify the level of control the debugging tool has when the routine being initialized is started, as follows:

- The ABPERC, CHECK, DEPTHCONDLMT, DYNDUMP, ERRCOUNT, HEAPCHK, INTERRUPT, TERMTHDACT, TRACE, TRAP, and USRHDLR options affect condition handling.
- The ABTERMENC option affects how an application ends (that is, with an abend or with a return code and reason code) when an unhandled condition of severity 2 or greater occurs.

> **Note:** For more detailed information on the run-time options, see Table 9. Language Environment run-time options for debugging in *z/OS Language Environment Debugging Guide*, GA22-7560.

Language Environment and batch methods for collecting dumps

Using the following methods, are ways to specify how to collect dumps in the event of an error or ABEND condition:

- Specify the following run-time options:

```
ABTERMENC(ABEND)  TERMTHDACT(UAIMM) TRAP(ON,NOSPIE)
```

For information about how to specify run-time options, refer to the section “Specifying Runtime Options under z/OS Batch” in *z/OS XL C/C++ User's Guide*, SC09-4767.

- Include a SYSMDUMP DD card in the JCL by specifying the following parameters:

```
SPACE=(CYL,(100,100),RLSE),DISP=(NEW,DELETE,CATLG),
DSN=dump_dataset_name,LRECL=4160,RECFM=FBS
```

- IEADMR00 parmlib member

  IEADMR00 contains IBM defaults or installation parameters for ABDUMP, for use when an ABEND dump is written to a SYSMDUMP data set.

  The system writes a SYSMDUMP as the core dump of a forked address space that runs a z/OS UNIX process. A core dump is written to a file system file on behalf of the user experiencing the error. To obtain sufficient diagnostic data without consuming excessive storage in the file system, request the following options in IEADMR00:

```
SDATA=(RGN,TRT,SUM)
```

> **Note:** Ensure that your IEADMR00 parmlib member reflects the following SDATA defaults:
>
> ```
> SDATA=(NUC,SQA,LSQA,RGN,TRT,LPA,CSA,GRSQ,SUM)
> ```

See *z/OS MVS Initialization and Tuning Reference*, SA22-7592 for information about the IEADMR00 parmlib member and the SDATA parameter.

Activating runtime options

There are different possibilities to activate LE runtime options:

- CEEPRMxx parmlib member
  - CEEDOPT
  - CEECOPT
  - CELQDOPT

  > **Note:** To display active CEE members in the system, use the D CEE command. To display the members itself, use the D CEE,CEECOPT command.

- SETCEE command
  - SETCEE [CEEDOPT,opt,opt,...]
- #pragma runopts for C/C++
  - #pragma runopts(termthdact(uadump),ABTERMENC(ABEND),TRAP(ON))
- PLIXOPT for PL/I

  DCL PLIXOPT CHAR(140) VAR
- export _CEE_RUNOPTS=“run-time options” in USS
  - export _CEE_RUNOPTS='STORAGE(NONE,NONE,NONE,00000000)'
  - export _CEE_RUNOPTS='ALL31(ON)'
  - export _BPXK_MDUMP=HILG.MCETA1.USS
- In batch, on EXEC card
  - PARM='TODAY/TERM(UADUMP
- DD:CEEOPTS overrides
  - Optional data set including run options

Collecting error documentation

To get useful documentation you need to specify runtime options as shown in Figure 7-8.

- To request LE automatically take dump
  - Use LE run-time option TERMTHDACT()
    - UADUMP >> CEEDUMP, system dump
    - UAONLY >> System dump only, no CEEDUMP
    - UATRACE >> System dump and traceback
    - UAIMM >> System dump of original error. Use with TRAP(ON,NOSPIE)

Figure 7-8 LE dump runtime options

To catch an LE error using a slip, Figure 7-9 shows how to pull the trigger. This slip will force a dump when an abend U40xx is recognized by the slip processor. It will dump OMVS address spaces and the OMVS data spaces in addition to the address space where the abend takes place. U40xx should be changed to the abend code, which should be checked. U4038 abends are useless because they are far away from the original abend. If we do not get an U4039 instead, we may slip the U4038 to check whether we can find a ZMCH control block in the dump or using the DSA (LE save area) to find any hints about the original abend.

```
SLIP SET,A=SVCD,C=U40xx,ID=40xx,JL=(OMVS), DSPNAME=('OMVS'.*),
SDATA=(CSA,GRSQ,LPA,NUC,PSA,RGN,SQA,TRT,SUM),END
```

Figure 7-9 SLIP processing

7.5 Language Environment and CICS debugging

- CESE transient data queue
  - Messages are written to this data queue
- CICS system dump
  - Dump is useful for diagnosing problems
  - Generate a U4039 ABEND by either:
    - CEMT SET TRD(4039) SYS ADD - (command)
    - TERMTHDACT(UADUMP) ABTERMENC(ABEND) TRAP(ON) - (Run-time options)
- Procedure for 40xx dumps with CICS

Figure 7-10 Debugging with Language Environment and CICS

Debugging under CICS

The MSGFILE run-time option is ignored under CICS, because messages for a run unit are directed instead to the CICS transient data queue named CESE. Messages are prefixed by a terminal ID, a transaction ID, a date, and a timestamp before their transmission.

Under CICS, the Language Environment run-time messages, Language Environment traceback, and Language Environment dump output are written to the CESE transient data queue. The transaction identifier, terminal identifier, date, and time precede the data in the queue. The CESE transient data queue is defined in the CICS destination control table (DCT). The CICS macro DFHDCT is used to define entries in the DCT.

A sample Language Environment message that appears when an application abends due to an unhandled condition from an EXEC CICS command is as follows:

```
P039UTV9 19910916145313 CEE3250C The System or User ABEND AEI0 was issued.
P039UTV9 19910916145313          From program unit UT9CVERI at entry point
                                   +0000011E at P039UTV9 19910916145313
                                   at offset address 0006051E.
```

CICS system dump

Under CICS, a system dump provides the most useful information for diagnosing problems. However, if you have a Language Environment U4038 abend, CICS will not generate a system dump. In order to generate diagnostic information for a CICS run-time environment with a language Environment U4038 abend, you must create a Language Environment U4039 abend.

Perform the following steps to generate a system dump in a CICS run-time environment:

- Specify run-time options TERMTHDACT(UAONLY, UADUMP, or UATRACE), ABTERM(ABEND), and TRAP(ON,NOSPIE). The TERMTHDACT suboption determines the level of detail of the Language Environment formatted dump.

  TERMTHDACT(UAIMM) ABTERMENC(ABEND) TRAP(ON,NOSPIE) produces a CICS transaction dump. It will never produce a SYSUDUMP/SYSABEND/SYSMDUMP since Language Environment's ESTAE routine does not get driven. Information APAR II13228 explains how to find the PSW and GPRs at the time of failure.

- In a CICS environment, you automatically receive the default transaction dump unless you disable it by using the CEMT transaction, and by specifying the dump code '4039'. Update the transaction dump table with the CICS supplied CEMT command:

  ```
  CEMT SET TRD(4039) SYS ADD
  ```

  A transaction dump should be produced for all Language Environment ABENDU40xx series abends, except ABENDU4038. If a transaction dump is not enough, request a CICS system dump.

  > **Note:** A CICS system dump of an ABENDU4038 is not helpful because it is taken at the time of the last termination, not at the point of detection. Instead, specify the following:
  >
  > ```
  > TERMTHDACT(UADUMP) ABTERMENC(ABEND) TRAP(ON)
  > ```

  This produces a CICS transaction dump with an ABENDU4039.

  > **Note:** SLIP commands on C=U40xx will not work in CICS. SLIP commands on C=0Cx will work in a CICS environment but not in batch.

Procedure for an SVC dump for 40xx abends under CICS

Here are the steps to get an SDUMP for a specific 40xx transaction abend under CICS:

1. Make sure the CICS region is started with the DUMP=YES SYSIN input (SIP) parameter.
2. Make sure the SYS1.DUMP- data sets are available. Most customers should have all this already set up.

   As an alternative, the dynamic allocation facility may be used, as follows:

   ```
   DUMPDS ALLOC ADD,VOL=xxxxxx
   DUMPDS ALLOC=ACTIVE
   ```

   After these commands, MVS dynamically allocates data sets on the xxxxxx volume containing the dump with the following type of name:

   ```
   SYS1.DUMP.D970910.T191701.SY1.S00001
   ```

3. Once the CICS region is up, log on and issue the following:

   ```
   CEMT SET TRD(40xx) ADD SYS
   ```

   Substituting the real dump code, for example: 4088 for 40xx. Following is a sample of what CICS sends back for this:

   ```
   SET TRD(4088) ADD SYS
   STATUS:  RESULTS - OVERTYPE TO MODIFY
   Trd(4088) Tra Sys     Loc Max( 999 ) Cur(0000)
   ```

4. Now run the transaction that creates the U40xx abend. A system, or SVC dump, should be produced at the point of the abend. This procedure will work for any transaction dump under CICS, not just U40xx abends.
5. If you do not have Fault Analyzer installed, you can use the CICS IPCS command shown in Figure 7-11. DFHPDxxx is related to the CICS release level.

```
IP VERBX DFHPD640 'KE'

IP VERBX DFHPD650 'KE'

IP VERBX DFHPD660 'KE'
```

Figure 7-11 CICS IPCS commands

Note: The following options can be used to get CICS-related information from the dump:

- KE - Kernel Domain
- AP - Application Domain
- CSA - Common System Area

7.6 Language Environment and z/OS UNIX dumps

- SYSMDUMP for z/OS UNIX processes
  - Set environment variable for where dump is written
    - _BPXK_MDUMP=filename
- LE run-time options for z/OS UNIX
  - export _CEE_RUNOPTS="termthdact(suboption)"
- Steps to take system dumps
  - Specify where to write the dump
  - Specify the run-time options
  - Rerun the failing program to take the dump

Figure 7-12 Taking dumps for z/OS UNIX processes

Dumps with z/OS UNIX

You can dynamically request a SYSMDUMP by using the SIGDUMP signal. Use the _BPXK_MDUMP environment variable to specify where the SYSMDUMP is to be written to. You can also use F BPXOINIT,DUMP=pid command to request a SYSMDUMP. A SIGDUMP signal is then sent to the specified process. For both the SIGDUMP signal and the F BPXOINIT,DUMP command, the _BPXK_MDUMP environment variable must be set to an MVS data set name, as follows:

```
export _BPXK_MDUMP=filename
```

filename Is a fully qualified data set name with DCB information: LRECL=4160, BLKSIZE=4160, and RECFM=FBS.

If it is set to a z/OS UNIX file name or defaulted to OFF, then both the SIGDUMP signal and the F BPXOINIT,DUMP command may be ignored. To write the system dump to a file name, issue the following command, where filename is a fully qualified filename:

For example:

```
export _BPXK_MDUMP=/tmp/mydump.dmp
```

Handling dumps written to the z/OS UNIX file system

If the program terminates abnormally while running in the z/OS UNIX kernel address space, the kernel causes an unformatted storage dump to be written to an HFS file in the user's working directory. The file is placed in the current working directory or into `/tmp` if the current working directory is not defined. The file name has the following format: directory is the current working directory or tmp, and pid is the hexadecimal process ID (PID) for the process that terminated.

If you have a loop, hang, or wait condition in a z/OS UNIX process and need a dump or diagnosis, you need to dump several types of data:

- The kernel address space
- Any kernel dataspaces that may be associated with the problem
- Any process address spaces that may be associated with the problem
- Appropriate storage areas containing system control blocks (for example, SQA, CSA, RGN, TRT)

Language Environment run-time options

Using z/OS UNIX System Services and the Language Environment run-time options. Consider the following steps to take system dumps:

1. To write the system dump to a data set, issue the command:

   ```
   export _BPXK_MDUMP=filename
   ```

   Where `filename` is a fully qualified data set name with LRECL=4160 and RECFM=FBS, or Where `filename` is a fully qualified HFS filename.

2. Specify Language Environment run-time options:

   ```
   export _CEE_RUNOPTS="termthdact(suboption)"
   ```

   Where suboption = UAONLY, UADUMP, UATRACE, or UAIMM. If UAIMM is set, TRAP(ON,NOSPIE) must also be set. The TERMTHDACT suboption determines the level of detail of the Language Environment formatted dump. For

3. Rerun the program and the dump will be written to the specified data set.

LE IPCS commands

To get at least LE run options information and a search argument, you can use the following commands:

- IP VERBX LEDATA
- IP VERBX LEDATA ‘CEEDUMP’

If you do not get useful information or the output shows the following:

```
No Language Environment control blocks were found. Use one or more of the
parameters: ASID(), TCB(), CAA() or LAA() to identify the control blocks to
format.
```

Then you need to look for our CAA control block, which is pointed to by register 12. CAA shows right at the beginning 0800 for bytes 2 and 3. If you cannot get it from registers at the time of error, you may follow the save area chain pointed to by reg 13.

If the CAA pointer is available, you can use the following IPCS command:

```
IP VERBX LEDATA ‘CAA(xxxxxxxx) CEEDUMP’
```

If you have more than one address space in the dump,r you need to provide the address space number in the command, as follows:

```
IP VERBX LEDATA ‘CAA(xxxxxxxx) CEEDUMP ASID(5B)’
```

Note: Do not specify ASID(X’5B’) in the IPCS command. For IP VERBX you can use either LEDATA or CEEERRIP

7.7 Understanding CEEDUMP

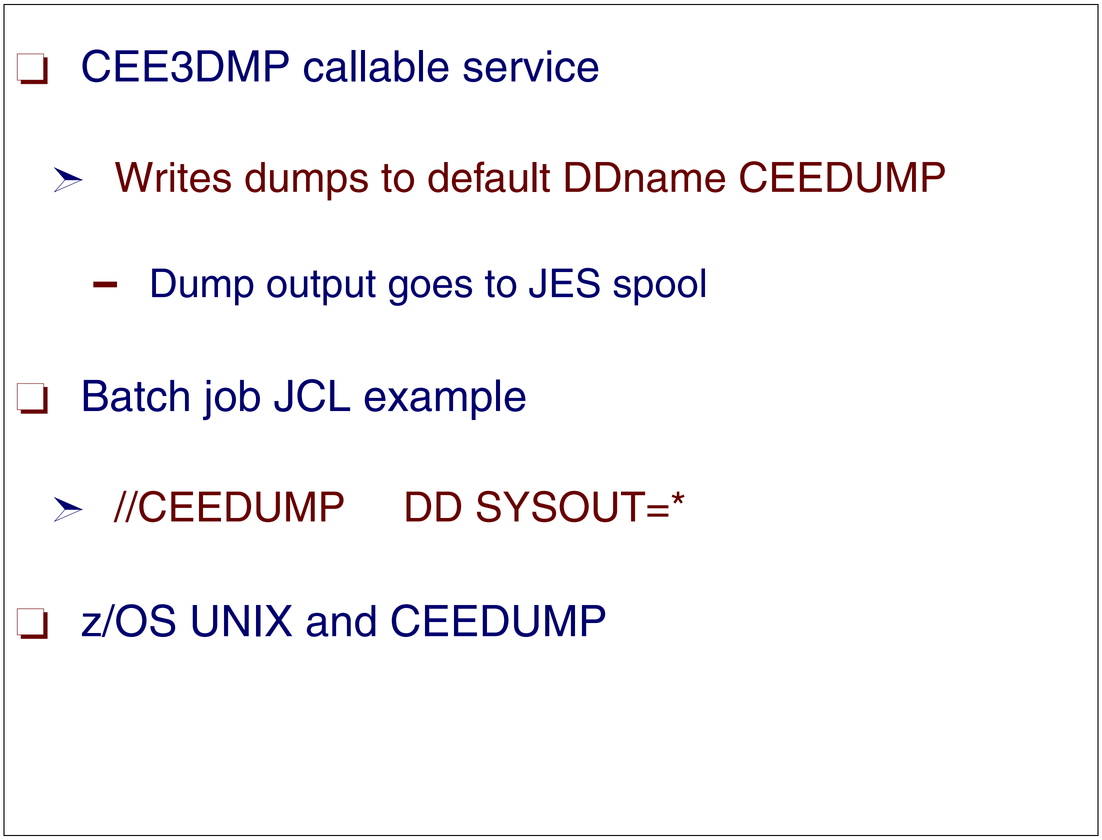

Figure 7-13 Using CEEDUMP

Locating the trace dump

If your application calls CEE3DMP, the Language Environment dump is written to the file specified in the FNAME parameter of CEE3DMP (the default is CEEDUMP).

If your application is running under TSO or batch, and a CEEDUMP DD is not specified, Language Environment writes the CEEDUMP to the batch log (SYSOUT=* by default). You can change the SYSOUT class by specifying a CEEDUMP DD, or by setting the environment variable, _CEE_DMPTARG=SYSOUT(x), where x is the preferred SYSOUT class.

If your application is running under z/OS UNIX and is either running in an address space you issued a fork() to, or it is invoked by one of the exec family of functions, the dump is written to the hierarchical file system. Language Environment writes the CEEDUMP to one of the following directories in the specified order:

1. The directory found in environment variable _CEE_DMPTARG, if found
2. The current working directory, if the directory is not the root directory (/), the directory is writable, and the CEEDUMP path name does not exceed 1024 characters
3. The directory found in environment variable TMPDIR (an environment variable that indicates the location of a temporary directory if it is not `/tmp`)
4. The `/tmp` directory

Additional hints to collect error information

All output from CEE3DMP, the callable service that generates a dump of the run-time environment for Language Environment, is written to the default ddname CEEDUMP. CEEDUMP, by default, sends the output to the JES output queue.

The IBM-supplied default settings for CEE3DMP are:

```
ENCLAVE(ALL) TRACEBACK
THREAD(CURRENT) FI S VARIABLES NOBLOCKS NOSTORAGE
STACKFRAME(ALL) PAGESIZE(60) FNAME(CEEDUMP)
CONDITION ENTRY NOGENOPTS REGSTOR(96)
```

Batch JCL example

For batch, use a CEEDUMP DD card to route the dump to a specific SYSOUT or data set. If not specified, it will be dynamically allocated to SYSOUT=* by default.

In the following JCL example, The ddname of the dump output file can be CEEDUMP. If you do not define this ddname, Language Environment creates a default CEEDUMP file to contain the dump output. The LRECL of the dump output file must be at least 133 bytes to prevent dump records from wrapping. If you write the dump output to the SYSOUT file, make sure you change the default LRECL size of 121 to 133 to prevent from wrapping.

```
//SYSLOGD  PROC
//SYSLOGD  EXEC PGM=SYSLOGD,REGION=30M,TIME=NOLIMIT
//       PARM='POSIX(ON) ALL31(ON)/ -f /etc/syslogd.conf'
//SYSPRINT    DD SYSOUT=*
//SYSIN       DD DUMMY
//SYSOUT      DD SYSOUT=*
//SYSERR      DD SYSOUT=*
//CEEDUMP     DD SYSOUT=*
```

Note: You can change the default SYSOUT class by specifying a CEEDUMP DD, or by setting the environment variable, _CEE_DMPTARG=SYSOUT(x), where x is the preferred SYSOUT class.

z/OS UNIX and CEEDUMP

If your application is running under z/OS UNIX and is either running in an address space you issued a fork() to, or is invoked by one of the exec family of functions, the dump is written to the hierarchical file system. Language Environment writes the CEEDUMP to one of the following directories in the specified order:

1. The directory found in environment variable _CEE_DMPTARG, if found
2. The current working directory, if the directory is not the root directory (/), and the directory is writable
3. The directory found in environment variable TMPDIR (an environment variable that indicates the location of a temporary directory if it is not `/tmp`)
4. The `/tmp` directory

Examining dumps

In most cases Language Environment condition handling will trap original program checks (like ABEND0C4) and turn them into corresponding Language Environment conditions (such as CEE3204S). After storing information about the original program check, Language

Environment will terminate with an ABENDU40xx. When examining a dump of a U40xx the PSW and registers can be found in a control block called the ZMCH. APAR II11016 is specifically written for those running Language Environment in a non-CICS environment, as the control block structure and condition handling changes when running under CICS. Depending on how the dump was produced it might be a formatted or unformatted one. The formatted one can be browsed. The unformatted one needs to be accessed by IPCS.

Figure 7-14 shows an ABEND0C9 problem. The dump is a formatted one. These dumps are mostly useful for the program owner. Let us start with the joblog information:

```
IEA995I SYMPTOM DUMP OUTPUT
  USER COMPLETION CODE=4039 REASON CODE=00000000   TIME=21.45.36  SEQ=03447
CPU=0000  ASID=0153
 PSW AT TIME OF ERROR  078D1000   A3E207B0  ILC 2  INTC 0D
    ACTIVE LOAD MODULE     ADDRESS=23E19D30 OFFSET=00006A80
   NAME=CEEPLPKA
   DATA AT PSW  23E207AA - 00181610  0A0D58D0  D00498EC
   GPR  0-3  84000000  84000FC7  00024478  23E207B0
   GPR  4-7  23E178A0  00000000  00024478  00025017
   GPR  8-11 23E238A5  23E228A6  000243D0  A3E206E0
   GPR 12-15 00015910  00026180  A3E22F1E  00000000
 END OF SYMPTOM DUMP
IEA993I SYSMDUMP TAKEN TO JMONTI.LECOBED1.SYSMDUMP
IEF450I JMONTI@B GO - ABEND=S0C9 U0000 REASON=00000009
```

Figure 7-14 Joblog information

You should also get a program-related output message, as shown in Figure 7-15.

```
CEE3209S The system detected a fixed-point divide exception.
From compile unit COBOLED2 at entry point COBOLED2 at statement 13
at compile unit offset +00000308 at address 23E029E0.
```

Figure 7-15 Program output

7.8 ZMCH control block

```
Machine State
+000348  MCH_EYE:ZMCH
+000350  MCH_GPR00:00026180      MCH_GPR01:00000000
+000358  MCH_GPR02:00000000      MCH_GPR03:0000000A
+000360  MCH_GPR04:00000000      MCH_GPR05:00046038
+000368  MCH_GPR06:00000000      MCH_GPR07:00FCCBF0
+000370  MCH_GPR08:23F1B100      MCH_GPR09:23F17700
+000378  MCH_GPR10:23E027E0      MCH_GPR11:23E028B0
+000380  MCH_GPR12:23E027D4      MCH_GPR13:000260C8
+000388  MCH_GPR14:A3E029D4      MCH_GPR15:A3E02916
+000390  MCH_PSW:078D2000 A3E029E2     MCH_ILC:0002      MCH_IC1:00
+00039B  MCH_IC2:09  MCH_PFT:00000000  MCH_FLT_0:00000000 00000000
+0003A8  MCH_FLT_2:00000000 00000000   MCH_FLT_4:00000000 00000000
+0003B8  MCH_FLT_6:00000000 00000000   MCH_EXT:00000000
+000418  MCH_FLT_1:00000000 00000000   MCH_FLT_3:00000000 00000000
+000428  MCH_FLT_5:00000000 00000000   MCH_FLT_7:00000000 00000000
+000438  MCH_FLT_8:00000000 00000000   MCH_FLT_9:00000000 00000000
```

Figure 7-16 Display of the ZMCH control block

IPCS VERBEXIT LEDATA

The Language Environment IPCS VERBEXIT LEDATA generates formatted output of the Language Environment run-time environment control blocks from a system dump. The LEDATA VERBEXIT is invoked with the ALL parameter. The system dump being formatted was obtained by specifying the TERMTHDACT(UADUMP) run-time option.

ZMCH (machine state information at the time of exception)

The eye catcher in the Machine State control block is ZMCH, as shown in Figure 7-16,and this control block shows the information at the time of the error. It includes the PSW and the registers at the beginning.

The GPRs 0-15 start at x'8' into the ZMCH. The Program Status Word (PSW) at the time of the abend is at offset x'4C' in the ZMCH. The Extended PSW interrupt code is at offset x'52' in the ZMCH. For more information about the ZMCH, see *z/OS Language Environment Vendor Interfaces*, SA22-7568.

Traceback information

The Traceback information shown in Figure 7-17 on page 225 provides a module flow from involved modules. The traceback output is read from bottom to top. This information is from the following dump:

```
DSNAME('DUMP.SC74CIC1.CN11SERV.D110902.T142637.X001')
```

The VERBX CEEERRIP 'CEEDUMP' command produces the output shown in Figure 7-17.

```
CEEDUMP
******************************************************************************
                   64 BIT LANGUAGE ENVIRONMENT DATA
******************************************************************************

 Language Environment Product 04 V01 R0D.00

 Information for enclave CELQPIPI

   Information for thread 13A146000000000E
   TCB Address: 007BBCF0
   CAA Address: 00000048_721FEC60
   PCB Address: 00000048_40903DB0

   Registers and PSW:
   GPR0..... 0000000000000000  GPR1..... 00000000362DA1C0  GPR2..... 000000003
   GPR4..... 0000004871FF9660  GPR5..... 0000000000000000  GPR6..... 000000007
   GPR8..... 00000000792000F2  GPR9..... 0000004871FFBB60  GPR10.... 000000484
   GPR12.... 00000048449D2210  GPR13.... 00000000362DA1C0  GPR14.... 000000007
   PSW..... 078D1400 80000000 00000000 792001A2

   Traceback:
     DSA      Entry       E  Offset  Statement   Load Mod             Program

     1        _TDUMP      +000000C2              *PATHNAM             _TDUMP
     2        tdump_wrapper
                          +00000530              *PATHNAM
     3        j9dump_create
                          +0000004A              *PATHNAM
     4        doSystemDump+00000392              *PATHNAM
----------------------more information left out------------------------
```

Figure 7-17 Traceback information

Condition information

The condition information is provided by the condition information block (CIB) address. Register 13 points to the save area (DSA) and register 12 points to the common anchor area (CAA). The CIB also provides the storage area where we can see the instruction flow getting the error.

The Language Environment condition manager creates a condition information block (CIB) for each condition encountered in the Language Environment environment. The CIB holds data required by the condition handling facilities and pointers to locations of other data. The address of the current CIB is located in the CAA.

Each thread is represented by a common anchor area CAA, which is the central communication area for Language Environment. All thread- and enclave-related resources are anchored, provided for, or can be obtained through the CAA. The CAA is generated during thread initialization and deleted during thread termination. When calling Language Environment-conforming routines, register 12 points to the address of the CAA.

```
Condition Information for Active Routines
Condition Information for COBOLED2 (DSA address 000260C8)
CIB Address: 00024478
Current Condition:
CEE0198S The termination of a thread was signaled due to an unhandled
condition.
Original Condition:
CEE3209S The system detected a fixed-point divide exception.
Location:
Program Unit: COBOLED2 Entry: COBOLED2 Statement: 13 Offset: +00000308
Machine State:
 ILC..... 0002    Interruption Code..... 0009
 PSW..... 078D2000 A3E029E2
 GPR0..... 00026180  GPR1..... 00000000  GPR2..... 00000000  GPR3..... 0000000A
 GPR4..... 00000000  GPR5..... 00046038  GPR6..... 00000000  GPR7..... 00FCCBF0
 GPR8..... 23F1B100  GPR9..... 23F17700  GPR10.... 23E027E0  GPR11.... 23E028B0
 GPR12.... 23E027D4  GPR13.... 000260C8  GPR14.... A3E029D4  GPR15.... A3E02916
Storage dump near condition, beginning at location: 23E029D0
+000000 23E029D0  45E0913A 48208000 8E200020 48408002  1D244030 800445E0
913A9140
```

Figure 7-18 Condition information

The PSW at the time of the error points to instruction 1D24, which is a divide register (DR). Looking at the register value you see that GPR4 is 00000000. This leads to our ABEND0C9.

The dump will show the CAA control block pointed to by register 12 (GPR12) followed by the process control block (PCB), the region control block (RCB), and the enclaved data block (EDB). It shows that you can find the run-time options (runopts) in the formatted dump.

7.9 IPCS and Language Environment

- IPCS LE problem diagnosis
  - Display LE run-time options
    - VERBX CEERRIP - format the dump data
    - VERBX LEDATA - search for error TCB
  - If no error TCB found
    - Load SYSMDUMP into IPCS
    - Issue IP SUMM FORMAT command
    - Issue BOTTOM or MAX (PF8) command
    - Find the TCB
    - Issue IP VERBX LEDATA 'CM TCB(xxxxxxxx)'
  - Should now see ZMCH

Figure 7-19 IPCS commands to diagnose a Language Environment dump

IPCS Language Environment problem diagnosis

All the information you can find in a formatted Language Environment dump can also be found in the SVC dump. IPCS provides some facilities to assist with Language Environment problem diagnosis. The IPCS commands VERBX LEDATA and VERBX CEEERRIP show the Language Environment run-time options and general information about your Language Environment environment at the time of the failure. For more information about using IPCS, see *z/OS MVS Interactive Problem Control System (IPCS) User's Guide*, SA22-7596.

VERBX CEEERRIP

CEEERRIP is the Language Environment diagnostic module that is used to format the dump data. Figure 7-17 on page 225 shows the result of the VERBX CEEERRIP 'CEEDUMP' command and related traceback information. To review a SYSMDUMP, use VERBEXIT CEEERRIP (alias LEDATA) from within IPCS.

VERBX LEDATA

You can use the interactive problem control system (IPCS) to format and analyze system dumps. Use the LEDATA verb exit to format data for Language Environment. This VERBEXIT provides information about the following topics:

- A summary of Language Environment at the time of the dump
- Run-time options
- Storage Management Control Blocks
- Condition Management Control Blocks

- Message Handler Control Blocks
- C/C++ Control Blocks
- COBOL Control Blocks

LEDATA searches for an error TCB and formats the control blocks for that TCB. If there is no error TCB (shown in a console dump) the TCB or CAA keywords will need to be specified as follows:

1. Load SYSMDUMP into IPCS (instructions on how to get a SYSMDUMP with Language Environment can be found in info APAR II10573).
2. Issue the command:

   ```
   IP SUMM FORMAT
   ```

3. Issue the command:

   ```
   BOTTOM or MAX (PF8)
   ```

4. Find the TCB with a non-zero completion code. Now issue the command:

   ```
   IP VERBX LEDATA 'CM TCB(xxxxxxxx)'
   ```

Continue dump analysis if no ZMCH

If this does not format the ZMCH, locate the CAA with the following steps:

1. Issue the following command, where xxxxxxxx represents the address of the failing TCB:

   ```
   F 'TCB: xxxxxxxx' PREV
   ```

2. Issue the command:

   ```
   F RTM2WA
   ```

3. Press PF5 to search again. If there is a second RTM2WA for the failing TCB, then use the data contained in the RTM2WA.
4. Find the address in Register 12.
5. Issue the command “=1” to go into browse mode. Or select Option 1 from the IPCS Primary Option menu.
6. Issue the command L yyyyyyyy, where yyyyyyyy represents the address obtained from Register 12.
7. Now verify whether this is a valid CAA with the following:
   a. At the address in R12 verify that the value is “xxxx0800”.
   b. Issue L X-18 and the eyecatcher should be CEECAA.

   This indicates we have found a valid CAA and can now issue the command:

   ```
   IP VERBX LEDATA 'CM CAA(yyyyyyyy)'
   ```

You have now formatted the ZMCH, so you can begin locating the values you were looking for.

Note: The above steps do *not* pertain to an ABENDU4036 dump.

Commands for additional dump information

The following IPCS VERBX commands can provide useful information from the dump:

```
VERBX CEEERRIP 'SUMMARY'        Like formatted dump
VERBX CEEERRIP 'CEEDUMP'        Traceback
VERBX CEEERRIP 'CM'             Condition Information
VERBX CEEERRIP 'NTHREADS(*)'    Traceback each Language Environment-enabled TCB
```

8

Debug and maintenance tools

Debugging a dump does not always provide all necessary information. Sometimes you can locate a module name but cannot determine its maintenance level.

This chapter describes System Modification Program Extended (SMP/E) as the basic tool for installing and maintaining software in OS/390 or z/OS systems and subsystems. It controls the changes at the element level by:

- Selecting the proper levels of elements to be installed from a large number of potential changes
- Calling system utility programs to install the changes
- Keeping records of the installed changes

In other cases you may find a load module name (LMOD) but cannot find the CSECT or member name. AMBLIST is a utility that provides the internal CSECTs of a load module. In addition you can list the object code.

This chapter describes some of the diagnostic aids that can be used via members in SYS1.PARMLIB. These facilities enable you to simplify the diagnostic data collection process by enabling you to prepare data collection parameters in advance to ensure that complex dump procedures do not have to be typed in when a problem arises and prompt, error free action is required. The SYS1.PARMLIB members that can simplify the diagnostic data collection process include:

- IEAABD00
- IEADMP00
- IEADMR00
- IEADMCxx
- IEASLPxx

8.1 Using SMP/E

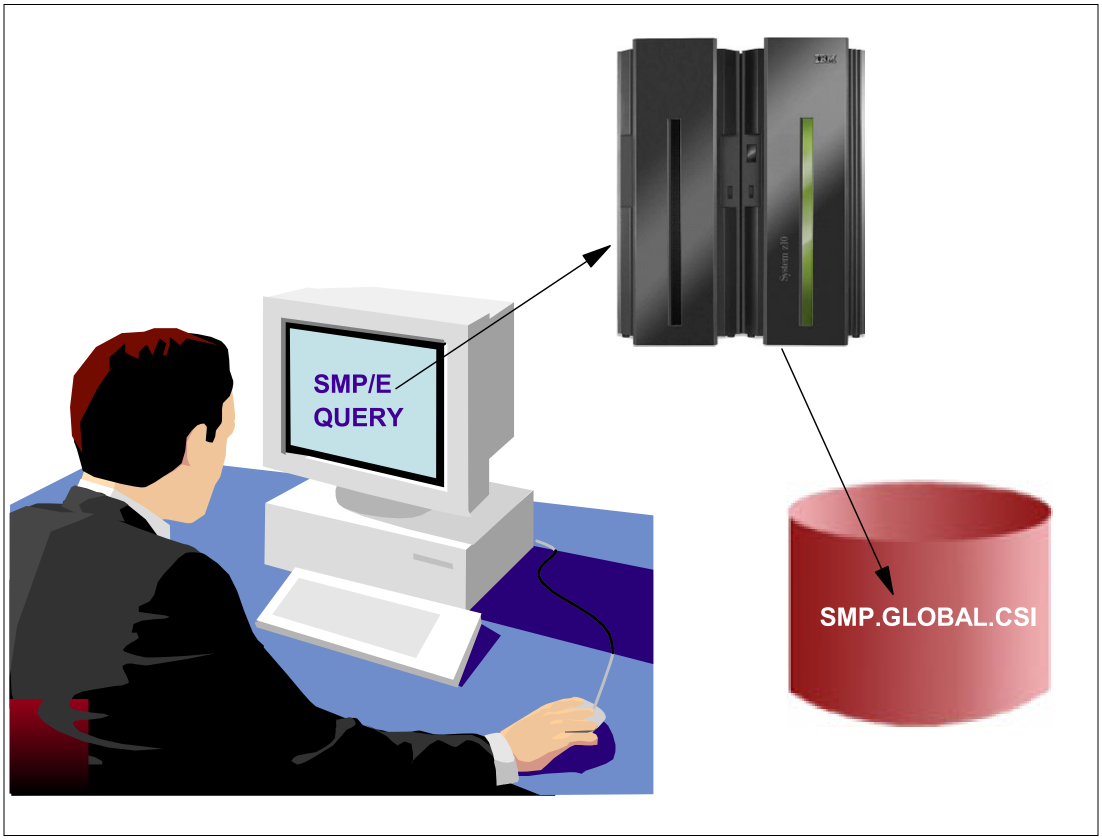

Figure 8-1 Using SMP/E

Using SMP/E

SMP/E is a tool designed to manage the installation of software products on your z/OS system and to track the modifications you make to those products. Usually, it is the system programmer's responsibility to ensure that all software products and their modifications are properly installed on the system. The system programmer also has to ensure that all products are installed at the proper level so all elements of the system can work together. At first, that might not sound too difficult, but as the complexity of the software configuration increases, so does the task of monitoring all the elements of the system.

The GIMSAMPU member in SYS1.SAMPLIB is a sample job to allocate the prime CSI and SMP/E operational data sets. The following sample job step, which is taken from the sample job in GIMSAMPU, allocates a CSI data set with enough space to have multiple target or distribution zones and then initializes the CSI with the zpool record.

To get a module level using SMP/E, you should select the SMP/E PRIMARY OPTION MENU. as shown in Figure 8-2 on page 231.

```
---------------------- SMP/E PRIMARY OPTION MENU ---------------- SMP/E 34.10
===> 3

    0  SETTINGS           - Configure settings for the SMP/E dialogs
    1  ADMINISTRATION     - Administer the SMPCSI contents
    2  SYSMOD MANAGEMENT  - Receive SYSMODs and HOLDDATA
                            and install SYSMODs
    3  QUERY              - Display SMPCSI information
    4  COMMAND GENERATION - Generate SMP/E commands
    5  RECEIVE            - Receive SYSMODs, HOLDDATA and
                            support information
    6  MIGRATION ASSISTANT- Generate Planning and Migration Reports
    7  ORDER MANAGEMENT   - Manage ORDER entries in the global zone

    D  DESCRIBE           - An overview of the dialogs
    T  TUTORIAL           - Details on using the dialogs
    W  WHAT IS NEW        - What is New in SMP/E

Specify the name of the CSI that contains the global zone:
   SMPCSI DATA SET   ===> 'ZOSR17.GLOBAL.CSI'
(Leave blank for a list of SMPCSI data set names.)

Specify YES to have DD statements for SYSOUT and temporary
data sets generated. Specify NO, to use DDDEFs.
   Generate DD statements   ===> NO

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(C) Copyright IBM Corp. 1982, 2005
```

Figure 8-2 Get the module level and load module information

Enter the SMPCSI data set name in Figure 8-2 and select Option 3 Query as shown in Figure 8-3.

```
                            QUERY SELECTION MENU
===> 2

    1  CSI QUERY           - Display SMPCSI entries
    2  CROSS-ZONE QUERY    - Display status of an entry in
                             all zones
    3  SOURCEID QUERY      - Display SOURCEIDs for specified zone

    D  DESCRIBE            - Overview of using QUERY

    T  TUTORIAL            - Information on using QUERY

To return to the SMP/E primary option menu, enter  END .
```

Figure 8-3 Get the module level and load module information

Now select 2 Cross-Zone Query as shown in Figure 8-3 and Figure 8-5 on page 233.

8.2 Find a load module

- Select the CROSS-ZONE QUERY
  - Enter the module name
    - Entry type is MOD
- From the ENTRY Selection panel
  - Place an S next to the target zone module
- From the CSI QUERY - MOD ENTRY panel
  - Load module information

Figure 8-4 Steps to find a load module

Find a load module

The SMP/E dialogs provide you with an online method of system management, software inventory, data base inquiries, and guidance. For example, with the Query dialogs, you can look up information in the CSI data set. The Query dialogs are one of the easiest and most direct methods you can use to obtain the content and status of any SYSMOD that has been processed by SMP/E. You can use the Query dialogs to display an entry in either a specific zone (CSI query) or in all zones (cross-zone query).

From the QUERY SELECTION MENU shown in Figure 8-3 on page 231, Select Option 2, which then displays the panel shown in Figure 8-5 on page 233.

```
 CSI CROSS-ZONE QUERY - ENTRY SELECTION          Row 1 to 5 of 5

  Entry Type:  MOD
  Entry Name:  ATRFMQUR

  To return to the previous panel, enter END .

  To select an entry from a zone, enter S next to the zone.

       * - Entry not found in zone.
      ** - Zone could not be allocated or is not initialized.

            -------------------- Status -----------------------------------
    ZONE     FMID     RMID     LASTUPD  DISTLIB  UMID(S)
    -------- -------- -------- -------- -------- -------- -------- --------
    GLOBAL   *
    MVSDWAS  *
 s  MVSDZN   HBB7770  HBB7770  HBB7770  AOSC5
    MVSTWAS  *
    MVSTZN   HBB7770  HBB7770  HBB7770  AOSC5
 ******************************* Bottom of data********************************
```

Figure 8-5 Get the module level and load module information

Enter the entry type you would like to get information from. In our case, MOD (module), and then add the module name, ATRFMQUR, as shown in Figure 8-5. To get load module-related information, select the target zone, in our case MVSD700, place an S as shown in Figure 8-5, and press Enter.

```
 CSI QUERY - MOD ENTRY               Row 1 to 2 of 2

 To return to the previous panel, enter END .

 Primary Command: FIND

 Entry Type:  MOD                                 Zone Name: MVSDZN
 Entry Name:  ATRFMQUR                            Zone Type: DLIB

   FMID:    HBB7770                     LASTUPD: HBB7770  TYPE=ADD
   RMID:    HBB7770     DISTLIB: AOSC5

 Link-edit Parameters:
 STD




         -------- -------- -------- -------- -------- -------- --------
LMOD     ATRAMPVX
CSECTS   ATRFMQUR
******************************* Bottom of data *******************************
```

Figure 8-6 Get module level and load module information

8.3 AMBLIST job to get LMOD and source information

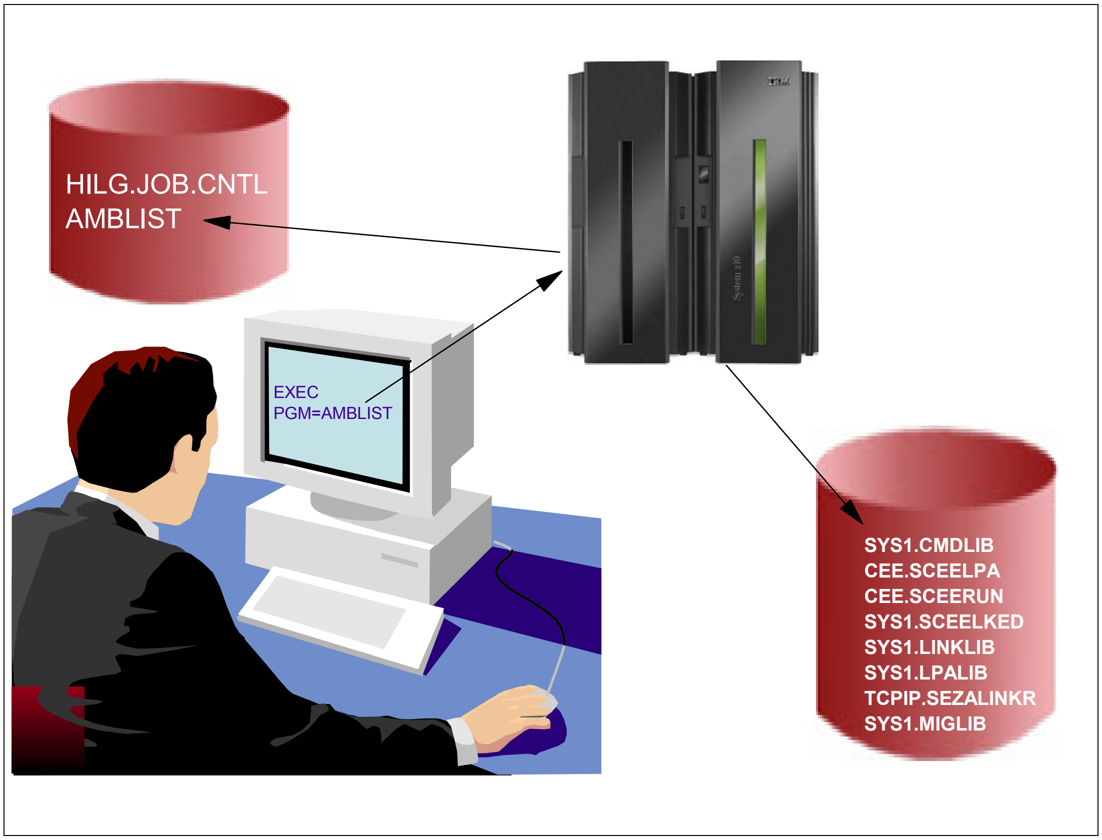


Figure 8-7 AMBLIST to get load module CSECTs and source listed

Using AMBLIST

AMBLIST is a very powerful utility that is easy to handle. It provides useful debug and diagnosis information. Use AMBLIST when you need information about the content of load modules and program objects or when you have a problem related to the modules on your system. AMBLIST is a program that provides lots of data about modules in the system, such as a listing of the load modules, map of the CSECTs in a load module or program object, list of modifications in a CSECT, map of modules in the LPA, and a map of the contents of the DAT-on (dynamic address translation) nucleus.

These formatted listings can help you diagnose problems related to modules as they currently exist on your system. AMBLIST is a batch job that runs in problem state. AMBLIST provides the following problem data:

- Formatted listing of an object module
- Map of the control sections (CSECTs) in a load module or program object
- List of modifications to the code in a CSECT
- Map of all modules in the link pack areas (LPA)
- Map of the contents of the DAT-on nucleus

  The map no longer represents the IPL version and message AMB129I will be issued.

If you are analyzing a dump, for example, and can only get the load module name and not any CSECT name, you can use the AMBLIST JCL to get CSECT and, if necessary, source information. You need to know in which SYSLIB data set the load module resides. The following JCL shows an AMBLIST request for load Unix System Service module BPXINPVT, which should be in the SYS1.LINKLIB data set.

Obtaining AMBLIST output

To obtain AMBLIST output, you must code JCL, providing control statements as input to the job. These control statements dictate what type of information AMBLIST produces, as shown in Figure 8-8. A snapshot of the output is shown in Figure 8-9.

```
//HILGAA   JOB 7904,HILGER,MSGLEVEL=(1,1),MSGCLASS=K,CLASS=A,
//    NOTIFY=HILG3
//AMBLIST  EXEC  PGM=AMBLIST,REGION=0M
//*YSLIB   DD DSN=SYS1.CMDLIB,DISP=SHR
//*YSLIB   DD DSN=CEE.SCEELPA,DISP=SHR
//*YSLIB   DD DSN=CEE.SCEERUN,DISP=SHR
//*YSLIB   DD DSN=IOE.SIOELMOD,DISP=SHR
//*YSLIB   DD DSN=SYS1.SCEELKED,DISP=SHR
//SYSLIB   DD DSN=SYS1.LINKLIB,DISP=SHR
//*YSLIB   DD DSN=SYS1.LOTUS.LPALIB,DISP=SHR
//*YSLIB   DD DSN=SYS1.LPALIB,DISP=SHR
//*YSLIB   DD DSN=TCPIP.SEZALINK,DISP=SHR
//*YSLIB   DD DSN=SYS1.MIGLIB,DISP=SHR
//*YSLIB   DD DSN=ISP.V4R4M0.SISPLPA,DISP=SHR
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
  LISTLOAD MEMBER=(BPXINPVT),OUTPUT=XREF
```

Figure 8-8 AMBLIST JCL job

```
MEMBER NAME:  BPXINPVT
LIBRARY:      SYSLIB
    ** ALIASES **      ENTRY POINT    AMODE
      BPXBDMI           001E80F8        31
      BPXBDSI           001F1EF0        31
      BPXFCSIN          002110E8        31
      BPXFDNIN          002128F0        31
      BPXFPINT          00214BE8        31
      BPXFSLIT          00172228        31
      BPXFSLM           00153E90        31
      BPXFTCLN          00016858        31

CONTROL SECTION
 LMOD LOC     NAME      LENGTH  TYPE
      00    BPXINPVT      3728   SD
    3728    BPXTAVNO      4BD8   SD
    8300    BPXPTCRE      25C8   SD
    A8C8    P8CRECPY        6E   SD
    A938    P8CRERET        52   SD
    A990    BPXNXFST      4460   SD
```

Figure 8-9 AMBLIST output

LISTLOAD control statement

Use the LISTLOAD control statement to obtain a listing of load module or program objects; see Figure 8-10 on page 236. The listed data can help you verify why certain link-edit errors might have occurred.

```
LISTLOAD
  [OUTPUT={MODLIST|XREF|BOTH}]
  [,TITLE=('title',position)]
  [,DDN=ddname]
  [,MEMBER={member|(member1,membern...)}]
  [,RELOC=hhhhhhhh]
  [,ADATA={YES|NO}]
```

Figure 8-10 LISTLOAD control statement to obtain a listing of load module or program objects

Obtaining AMBLIST output for modules located in HFS and zFS

If an AMBLIST is required from a module that is located in an HFS or ZFS date set, we need to provide the data set name and the directory string where the file, including the module, is located; see Figure 8-11 and Figure 8-12.

```
//PHILGER JOB (999,POK),'JOB',CLASS=A,REGION=0M,
//     MSGCLASS=T,TIME=NOLIMIT,MSGLEVEL=(1,1),NOTIFY=&SYSUID
//AMBLIST  EXEC  PGM=AMBLIST,REGION=6000K
//SYSLIB   DD DSN=HFS.ZOSR1D.Z1DRB1.ROOT,DISP=SHR
//HFS1 DD PATH='/Z1DRB1/bin/IBM/FOMFTSO'
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
   LISTLOAD DDN=HFS1,OUTPUT=XREF
//*LISTLOAD DDN=HFS1,OUTPUT=MODLIST
```

Figure 8-11 AMBLIST JCL to get listing from an LMOD located in a file

```
 ** SEGMENT MAP TABLE **

CLASS            SEGMENT    OFFSET   LENGTH       LOAD      TYPE    ALIGNMENT
B_TEXT                 1         0     658A       INITIAL   CAT      DOUBLE
WORD
                             ** NUMERICAL MAP OF PROGRAM OBJECT **UNIX**

--------------------------------------------------------------------------------
-
RESIDENT CLASS:           B_TEXT
      CLAS LOC   ELEM LOC    LENGTH  TYPE    ALIGNMENT             NAME
       0                        7C   ED     DOUBLE WORD            CEESTART
      80                         C   ED     DOUBLE WORD            §§PPA2
      90                         C   ED     DOUBLE WORD            EDCOEXTS
      A0                      46E0   ED     DOUBLE WORD            FOMFTSOC
```

Figure 8-12 AMBLIST output

8.4 IEAABD00, IEADMP00 and IEADMR00 members

- ❑ IEAABD00 parmlib member
  - ➢ Contains ABDUMP parameters for a SYSABEND dump data set
- ❑ IEADMP00 parmlib member
  - ➢ Contains ABDUMP parameters for a SYSUDUMP dump data set
- ❑ IEASMR00 parmlib member
  - ➢ Contains ABDUMP parameters for a SYSMDUMP dump data set
- ❑ SDATA options for members

Figure 8-13 SYS1.PARMLIB members for abend dumps

Parmlib members for abend dumps

IEAABD00 contains IBM defaults and/or installation-assigned parameters for ABDUMP, for use when an abend dump is written to a SYSABEND data set.

IEADMP00 contains IBM defaults and installation parameters for ABDUMP for use when an abend dump is written to a SYSUDUMP data set.

IEADMR00 contains IBM defaults and installation parameters for ABDUMP for use when an abend dump is written to a SYSMDUMP data set.

These members contain the SDATA and PDATA options that will be used when an abend dump is triggered.

Note: The ABDUMP initialization routine reads IEAABD00 to get ABDUMP parameters. If during initialization, IEAABD00 is invalid or cannot be located, the operator is notified. No prompting occurs. If both valid and invalid options are included in the member, or a syntax error is encountered, a message lists the valid options that were accepted before the error occurred.

SDATA options

Following are the SDATA options:

ALLSDATA All the following options are automatically specified (except ALLVNUC and NOSYM).

The following parameters request a dump of specific SDATA areas, as indicated:

ALLVNUC Entire virtual nucleus. SQA, LSQA, and the PSA are included.

NOSYM No symptom dump is to be produced.

SUM Requests that the dump contain summary data, which includes the following:

–Dump title.

–Abend code and PSW at the time of the error.

–If the PSW at the time of the error points to an active load module: (1) the name and address of the load module, (2) the offset into the load module indicating where the error occurred, and (3) the contents of the load module.

–Control blocks related to the failing task.

–Recovery termination control blocks.

–Save areas.

–Registers at the time of the error.

–Storage summary consisting of 1K (1024) bytes of storage before and 1K bytes of storage after the addresses pointed to by the registers and the PSW. The storage will be printed only if the user is authorized to obtain it, and, when printed, duplicate addresses will be removed.

–System trace table entries for the dumped address space.

NUC Read/write portion of the control program nucleus. SQA, LSQA, and the PSA are included.

PCDATA Program call information for the task being dumped.

SQA The system queue area.

LSQA Local system queue area for the address space. If storage is allocated for subpools 229, 230 and 249, they will be dumped for the current task.

SWA Scheduler work area used for the failing task.

CB Control blocks related to the failing task.

ENQ Global resource serialization control blocks for the task.

TRT System trace table and GTF trace, as available.

DM Data management control blocks (DEB, DCB, IOB) for the task.

IO IOS control blocks (UCB, EXCPD) for the task.

ERR Recovery termination control blocks (RTM2WA, registers from the SDWA, SCB, EED) for the task.

8.5 PDATA options (only valid for IEADMP00)

- ALLPDATA - Specifies all PDATA options
  - PSW
  - REGS
  - SA
  - SAH
  - JPA
  - LPA
  - ALLPA
  - SPLS
  - SUBTASKS

Figure 8-14 The PDATA options for ABEND dumps

PDATA options for abend dumps

Following are the PDATA options:

ALLPDATA All the following options are automatically specified.
The following parameters request dump of specific PDATA areas, as indicated:

PSW Program status word at entry to abend.

REGS Contents of general registers at entry to abend.

SA or SAH SA requests save area linkage information and a backward trace of save areas. This option is automatically selected if ALLPDATA is specified.

SAH Requests only save area linkage information.

JPA Contents of the job pack area that relate to the failing task. These include module names and contents.

LPA Contents of the LPA related to the failing task. These include module names and contents. Also includes active SVCs related to the failing task.

ALLPA Contents of both the job pack area and the LPA, as they relate to the failing task, plus SVCs related to the failing task.

SPLS User storage subpools (0-127, 129-132, 244, 251, and 252) related to the failing task.

SUBTASKS Problem data (PDATA) options requested for the designated task will also be in effect for its subtasks.

8.6 SDATA and PDATA recommendations

- SDATA and PDATA parameters that solve most problems
  - SDATA=(CSA,RGN,PSA,SQA,LSQA,TRT,SUM),
  - PDATA=(PSW,REGS,SPLS,ALLPA,SA)
- IEADMCxx parmlib member for dump commands
  - DUMP TITLE=(CICS Looping),PARMLIB=CI
  - DUMP COMM=(..........),PARMLIB=(xx)
- Setting SLIP traps
  - SYS1.PARMLIB(IEASLPxx)
    - SET SLIP=xx

Figure 8-15 SDATA and PDATA options for dumps and SLIP traps

SDATA and PDATA options

The following SDATA and PDATA parameters will provide you and IBM with sufficient data to solve most problems.

```
SDATA=(CSA,RGN,PSA,SQA,LSQA,TRT,SUM),
PDATA=(PSW,REGS,SPLS,ALLPA,SA)
```

IEADMCxx (dump command parameter library)

IEADMCxx enables you to supply DUMP command parameters through a parmlib member. It enables the operator to specify the collection of dump data without having to remember and identify all the systems, address spaces, and data spaces involved.

This parmlib enables you to specify lengthy DUMP commands without having to reply to multiple writes to operator with reply (WTORs). Any errors in an original specification may be corrected and the DUMP command respecified.

IEADMCxx is an installation-supplied member of SYS1.PARMLIB that can contain any valid DUMP command. A dump command may span multiple lines and contain system static and (DUMP command SYMDEF defined) symbols and comments.

Figure 8-16 on page 241 shows a sample of what might be included in a SYS1.PARMLIB(IEADMCxx) member. As you can see, to key in this data when we need to capture a dump would be time-consuming and prone to errors. This simplifies the process and when you need to capture a dump you can refer to the IEADMCxx parmlib member with the dump command. For example:

```
DUMP TITLE=(CICS Looping), PARMLIB=CI
```

where CI is the IEADMCxx parmlib member using the suffix, SYS1.PARMLIB(IEADMCCI).

The title is the name (1 to 100 characters) you want the dump to have. This title becomes the first record in the dump data set. COMM= and TITLE= are synonyms.

You can also use the parmlib parameter as follows:

```
DUMP COMM=(..........),PARMLIB=(xx)
```

```
TITLE=(DYNDUMP FOR IMS810I,IVP8IRC1,IVP8IDL1,IVP8IM11,
IVP8IM12,IVP8IM13,RRS,APPC)
JOBNAME=(IMS810I,IVP8IRC1,IVP8IDL1,IVP8IM11,IVP8IM12,IVP8IM13,
RRS,APPC)
DSPNAME=('APPC'.*,'RRS'.*)
SDATA=(PSA,SQA,LSQA,RGN,LPA,TRT,CSA,SWA,SUM,ALLNUC,GRSQ)
```

Figure 8-16 IEADMCxx example

IEASLPxx (SLIP commands)

Use the IEASLPxx parmlib member to contain SLIP commands. The commands can span multiple lines; the system processes the commands in order.

We recommend that you move any SLIP commands in the COMMNDxx and IEACMDxx parmlib members into a IEASLPxx parmlib member. By using IEASLPxx to contain your SLIP commands, you avoid restrictions found in other parmlib members.

Figure 8-17 shows a sample of what may be contained in SYS1.PARMLIB(IEASLPxx). In this example we are actually suppressing dumps.

```
SLIP SET,C=013,ID=X013,A=NOSVCD,J=JES2,END
SLIP SET,C=213,ID=X213,A=NOSVCD,END
SLIP SET,C=028,ID=X028,A=NOSVCD,END
SLIP SET,C=058,ID=X058,A=NODUMP,DATA=(15R,EQ,4,OR,15R,EQ,8,OR,
     15R,EQ,C,OR,15R,EQ,10,OR,15R,EQ,2C,OR,15R,EQ,30,OR,
     15R,EQ,3C),END
SLIP SET,C=0E7,ID=X0E7,A=NOSVCD,END
SLIP SET,C=0F3,ID=X0F3,A=NODUMP,END
SLIP SET,C=13E,ID=X13E,A=NODUMP,END
SLIP SET,C=1C5,RE=00090004,ID=X1C5,A=NODUMP,END
SLIP SET,C=222,ID=X222,A=NODUMP,END
SLIP SET,C=322,ID=X322,A=NODUMP,END
SLIP SET,C=33E,ID=X33E,A=NODUMP,END
SLIP SET,C=422,ID=X422,A=NODUMP,END
SLIP SET,C=47B,DATA=(15R,EQ,0,OR,15R,EQ,8),ID=X47B,A=NODUMP,END
SLIP SET,C=622,ID=X622,A=NODUMP,END
```

Figure 8-17 SYS1.PARMLIB(IEASLPxx)

Figure 8-18 on page 242 shows a much more complex SLIP that will capture dumps in multiple MVS images, when a certain message, IXC521I, is generated and Register 5 contains some specific data. It will dump the Console address space, the MSOPS address space, and also the XCFAS address space.

```
SLIP SET,MSGID=IXC521I,
DATA=(5R?+0,EQ,C8C1E240,+4,EQ,D9C5C1C3),
ACTION=SVCD,JOBLIST=(CONSOLE,XCFAS),
DSPNAME=('XCFAS'.IXCDSL01),
REMOTE=(SYSLIST=(SC55,SC66),
JOBLIST=(CONSOLE,MSOPS,XCFAS),DSPNAME=('XCFAS'.IXCDSL01)),
SDATA=(NUC,CSA,GRSQ,LPA,LSQA,PSA,RGN,SQA,SWA,TRT),
MATCHLIM=3,ID=RON1,END
```

Figure 8-18 SLIP example with increased complexity

The DATA option specified in the SLIP means the following:

- Take the address from register 5 and jump to this area. Check at offset 0 whether it shows C8C1E240, and in addition offset 4 should show the value D9C5C1C3. If this is true, take a dump.
- The SLIP is activated by issuing the SET SLIP=xxxx command, where xxxx is the IEASLPxx parmlib member you want to activate.
- SLIP can be disabled by issuing the SLIP MOD,ID=xxxx,DISABLE command.
- To enable a slip, issue the following command:

  ```
  SLIP MOD,ID=xxxx,EN
  ```

9

SDSF and RMF

SDSF System Display and Search Facility (SDSF)

SDSF provides you with information to monitor, manage, and control your z/OS MVS/JES2 system. It can help you run your business and save you time and money.

SDSF panels provide current information about jobs, output, devices (including printers, punches, initiators, lines, spool offloaders, and spool volumes) and system resources, including nodes and WLM enclaves, anywhere in the JES2 Multi-Access Spool (MAS).

With SDSF panels, there is no need to learn or remember complex command syntax. SDSF's action characters, fields that can be overtyped, action bar, pull-downs, and pop-up windows allow you to select available functions.

IBM RMF Resource Measurement Facility (RMF)

RMF is designed to ease the management of single or multiple system workload and to enable faster reaction to system delays. Detecting a possible bottleneck early means that corrective actions can be taken earlier. System delays are avoided or at least remedied at an early stage.

System programmers are supported by several reports that ease their work, helping them to tune their system optimally. Consequently, this leads to fewer workload problems and, most important, increases system and operator productivity, a fact that makes the company as a whole more effective at less cost.

9.1 System Display and Search Facility (SDSF)

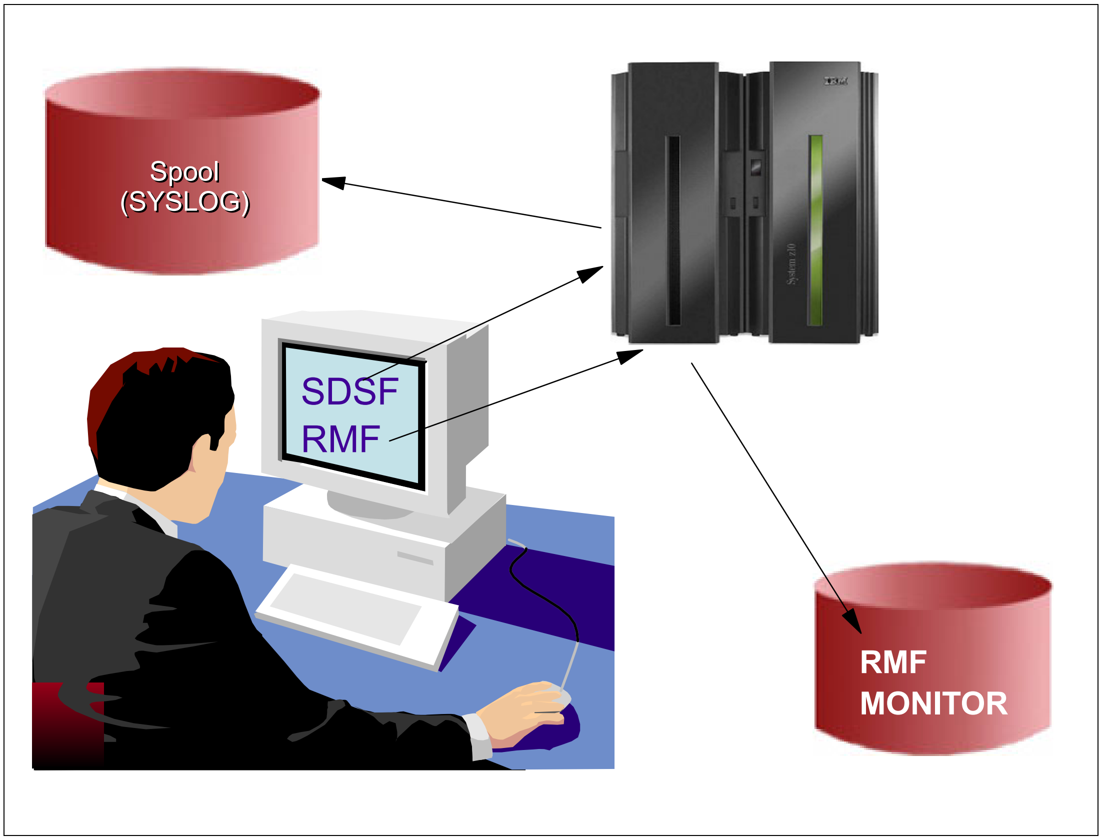


Figure 9-1 SDSF and RMF

System Display and Search Facility (SDSF)

SDSF gives you an easy and efficient way to monitor, manage, and control the key aspects of your MVS/JES2 system or MVS/JES3 system. Using SDSF, you can:

- Control job processing (hold, release, cancel, and purge jobs)
- Control output, and browse jobs without printing
- Control devices such as printers, lines, and initiators across the MAS
- Browse the syslog
- Manage system resources, such as members of the MAS, job classes, and WLM enclaves

With SDSF panels, there is no need to learn or remember complex command syntax. The SDSF action characters, overtypable fields, action bar, pull-downs, and pop-up windows allow you to select available functions. The SDSF primary option menu is shown in Figure 9-2 on page 245.

SDSF provides an easy way to manage work productively, as follows:

- Control jobs
- Control output
- Control devices
- Manage system resources

To become familiar with the panel handling and the output, select a function. If the RACF administration has been done correctly, you should not be able to delete or destroy processes.

```
  Display  Filter  View  Print  Options  Help
 -------------------------------------------------------------------------------
 HQX7720 -----------------  SDSF PRIMARY OPTION MENU --------------------------
 COMMAND INPUT ===>                                             SCROLL ===> PAGE

 DA    Active users                     INIT  Initiators
 I     Input queue                      PR    Printers
 O     Output queue                     PUN   Punches
 H     Held output queue                RDR   Readers
 ST    Status of jobs                   LINE  Lines
                                        NODE  Nodes
 LOG   System log                       SO    Spool offload
 SR    System requests                  SP    Spool volumes
 MAS   Members in the MAS
 JC    Job classes                      RM    Resource monitor
 SE    Scheduling environments          CK    Health checker
 RES   WLM resources
 ENC   Enclaves                         ULOG  User session log
 PS    Processes

 END   Exit SDSF
```

Figure 9-2 JES2 SDSF Primary Option Menu

Figure 9-4 on page 246 shows the active users on a system. To get this output, select **DA** on the command line in Figure 9-2 or on Figure 9-3.

```
 Display  Filter  View  Print  Options  Search  Help

-------------------------------------------------------------------------------
 HQX7780 -----------------  SDSF PRIMARY OPTION MENU
--------------------------
 COMMAND INPUT ===>                                             SCROLL ===> HALF

 DA    Active users                     INIT  Initiators
 I     Input queue                      PR    Printers
 O     Output queue                     PUN   Punches
 H     Held output queue                RDR   Readers
 ST    Status of jobs                   LINE  Lines
 J0    Job zero                         NODE  Nodes
                                        SP    Spool volumes
 LOG   System log                       NS    Network servers
 SR    System requests                  NC    Network connections
 JP    Members in the JESPlex
 JC    Job classes                      CK    Health checker
 SE    Scheduling environments
 RES   WLM resources                    ULOG  User session log
 ENC   Enclaves
 PS    Processes
```

Figure 9-3 JES3 SDSF Primary Option Menu

```
  Display  Filter  View  Print  Options  Help

-------------------------------------------------------------------------------
 SDSF DA SC69  SC69     PAG    0  CPU/L     4/  4       LINE 1-26 (70)
 COMMAND INPUT ===>                                            SCROLL ===> PAGE
 PREFIX=*  DEST=(ALL)  OWNER=*  SYSNAME=
 NP   JOBNAME  StepName ProcStep JobID    Owner    C Pos DP Real Paging    SIO
      *MASTER*                   STC14926 +MASTER+   NS  FF 6339   0.00   0.00
      PCAUTH   PCAUTH                                NS  FF  152   0.00   0.00
      RASP     RASP                                  NS  FF  531   0.00   0.00
      TRACE    TRACE                                 NS  FF  594   0.00   0.00
      DUMPSRV  DUMPSRV  DUMPSRV                      NS  FF  409   0.00   0.00
      XCFAS    XCFAS    IEFPROC                      NS  FF  21T   0.00   0.00
      GRS      GRS                                   NS  FF  13T   0.00   0.00
      SMSPDSE  SMSPDSE                               NS  FF  58T   0.00   0.00
      SMSVSAM  SMSVSAM  IEFPROC                      NS  FF  11T   0.00   0.00
      CONSOLE  CONSOLE                               NS  FF 7931   0.00   0.00
      WLM      WLM      IEFPROC                      NS  FF 4641   0.00   0.00
      ANTMAIN  ANTMAIN  IEFPROC                      NS  FF 1298   0.00   0.00
      ANTAS000 ANTAS000 IEFPROC                      NS  FE 1137   0.00   0.00
      DEVMAN   DEVMAN   IEFPROC                      NS  FF  150   0.00   0.00
      OMVS     OMVS     OMVS                         NS  FF 352T   0.00   0.00
```

Figure 9-4 Display active address spaces

9.2 Using the SYSLOG for debugging

- ❑ SYSLOG data set on JES spool
  - ➢ View SYSLOG using:
    - – SDSF with JES2
    - – SDSF with JES3
  - ➢ Can be queued for printing
- ❑ Viewing messages in a DUMP
  - ➢ Messages appear in the master trace
- ❑ Using SYSLOG for debugging
  - ➢ Check messages in the SYSLOG for ABENDs

Figure 9-5 Using the SYSLOG for problem analysis

SYSLOG data set

The SYSLOG is a SYSOUT data set provided by the job entry subsystem (JES2 or JES3). SYSOUT data sets are output spool data sets on direct access storage devices (DASD). Print the SYSLOG periodically to check for problems.

> **Note:** The IBM Support Center may ask for the SYSLOG or OPERLOG from the failing system and any dumps taken by the system.

The SYSLOG consists of the following:

- All messages issued through WTL macros
- All messages entered by LOG operator commands
- Usually, the hard-copy logs
- Any messages routed to the SYSLOG from any system component or program

It can be used by application and system programmers to record communications about problem programs and system functions. The operator can use the LOG command to add an entry to the system log.

SYSLOG processing

The SYSLOG is queued for printing when the number of messages recorded reaches a threshold specified at system initialization. The operator can force the system log data set to be queued for printing before the threshold is reached by issuing the WRITELOG command. The SYSLOG can be viewed using SDSF with JES2 and with (E)JES with JES3 systems.

The SYSLOG, often referred to as the hard-copy log, is a record of all system message traffic, as follows:

- Messages to and from all consoles
- Commands and replies that are entered by the operator

In a dump, these messages appear in the master trace. With JES3, the hard-copy log is always written to the SYSLOG. With JES2, the hard-copy log is usually written to the SYSLOG but can be written to a console printer, if the installation chooses.

SYSLOG for debugging

To check for messages and abend information, have a look at the SYSLOG. To view the system log, enter `log` on the command line. Figure 9-6 shows an example starting with the time stamp and followed by the messages. In the complete output you will get more information. Data that would normally be seen to the left of the time stamp has been removed for presentation.

```
D U,,ALLOC,8052,1
IEE106I 17.04.19 UNITS ALLOCATED 881
UNIT    JOBNAME  ASID   JOBNAME  ASID   JOBNAME  ASID   JOBNAME  ASID
8052    *MASTER* 0000   *MASTER* 0001   DUMPSRV  0005   XCFAS    0006
8052    LLA      0018   JES2     001A   VTAM44   001B   NFSCLNT7 001D
8052    RMF      0024   ZFS      0028   APPC     002A   DFRMM    002E
8052    OPTSO    0030   RACF     0031   OSASF    004D   HAIMO    0050
8052    RMFGAT   0055   NFSMVS7  0058
D GRS,C
ISG343I 17.04.38 GRS STATUS 883
NO ENQ RESOURCE CONTENTION EXISTS
NO REQUESTS PENDING FOR ISGLOCK STRUCTURE
NO LATCH CONTENTION EXISTS
IEF126I HAIMO - LOGGED OFF - TIME=17.13.48 - ASID=0050 - SC69
$HASP395 HAIMO    ENDED
$HASP100 HAIMO    ON TSOINRDR
$HASP373 HAIMO    STARTED
IEF125I HAIMO - LOGGED ON - TIME=17.13.51 - ASID=0050 - SC69
IEF126I HAIMO - LOGGED OFF - TIME=17.14.05 - ASID=0050 - SC69
$HASP395 HAIMO    ENDED
IEA631I  OPERATOR BOBH     NOW INACTIVE, SYSTEM=SC69    , LU=SC38TCC6
```

Figure 9-6 Sample SYSLOG output

9.3 RMF Resource Measurement Facility

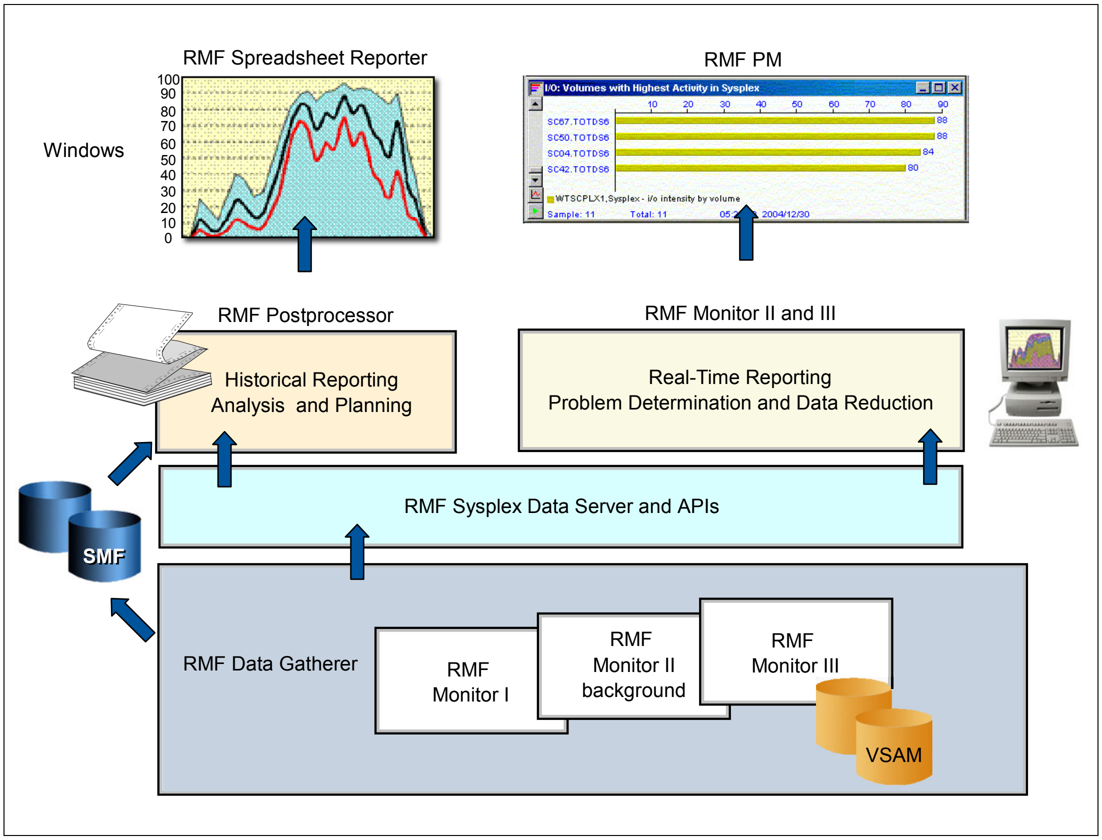


Figure 9-7 RMF data gatherer

RMF

IBM Resource Measurement Facility™ (RMF) is shipped with every release of z/OS at the current level of support. It is integration tested with z/OS and includes the enhancements available with every new release. It's easier than ever to install RMF. RMF is an optional feature of z/OS.

RMF is designed to ease the management of single or multiple system workloads and to enable faster reaction to system delays. Detecting a possible bottleneck early means that corrective actions can be taken earlier. System delays are avoided or at least remedied at an early stage.

System programmers are supported by several reports that ease their work, helping them to tune their system optimally. Consequently, this leads to fewer workload problems and, most important, increases system and operator productivity, a fact that makes the company as a whole more effective at less cost.

RMF issues reports about performance problems as they occur, so that your installation can take action before the problems become critical. Your installation can use RMF to:

- Determine that your system is running smoothly
- Detect system bottlenecks caused by contention for resources
- Evaluate the service your installation provides to different groups of users
- Identify the workload delayed and the reason for the delay

- Monitor system failures, system stalls, and failures of selected applications

RMF monitors

RMF comes with three monitors, Monitor I, II and III. Monitor III with its ability to determine the "cause of delay" is where we start:

- Monitor III provides short-term data collection and online reports for continuous monitoring of system status and solving performance problems. Monitor III is a good place to begin system tuning. It allows the system tuner to distinguish between delays for important jobs and delays for jobs that are not as important to overall system performance.
- Monitor I provides long-term data collection for system workload and resource utilization. The Monitor I session is continuous, and measures various areas of system activity over a long period of time. You can get Monitor I reports directly as real-time reports for each completed interval (single-system reports only), or you run the postprocessor to create the reports, either as single-system or as sysplex reports. Many installations produce daily reports of RMF data for ongoing performance management.
- Monitor II provides online measurements on demand for use in solving immediate problems. A Monitor II session can be regarded as a snapshot session. Unlike the continuous Monitor I session, a Monitor II session generates a requested report from a single data sample. Since Monitor II is an ISPF application, you might use Monitor II and Monitor III simultaneously in split-screen mode to get different views of the performance of your system. In addition, you can use the Spreadsheet Reporter for further processing the measurement data on a workstation by help of spreadsheet applications. The following sections provide sample reports including the name of the corresponding macro.

Find a detailed description of how to create the reports and records and how to use the macros in *z/OS Resource Measurement Facility User's Guide*, SC33-7990.

Note: If an error occurs in the Monitor II or Monitor III reporter session, RMF prompts you whether you want to write a dump. Follow the steps of the diagnostic procedure to obtain a dump:

1. Enter into the command line:
   ```
   TSO FREE FI(SYSUDUMP SYSABEND)
   ```
   You can ignore messages, for example: IKJ56247I FILE xxxxxxxx NOT FREED, IS NOT ALLOCATED
2. Enter into the command line:
   ```
   TSO ALLOC FI(SYSMDUMP) DA(dsname) NEW SP(200 200) CYL REUSE REL
   ```
   If the command does not fit into the command line, start the split-screen mode to enter the command.
3. Answer Y in the dump request panel:
   ```
   Would you like a dump?  Enter Y or N.  ===> Y
   ```
4. The system now writes an unformatted dump to the data set just allocated. This may take some time. When it is finished, the system issues the message:
   ```
   IEA993I SYSMDUMP TAKEN TO dsname
   ```
5. You can now process the dump with IPCS.

9.4 RMF Monitor I data gathering

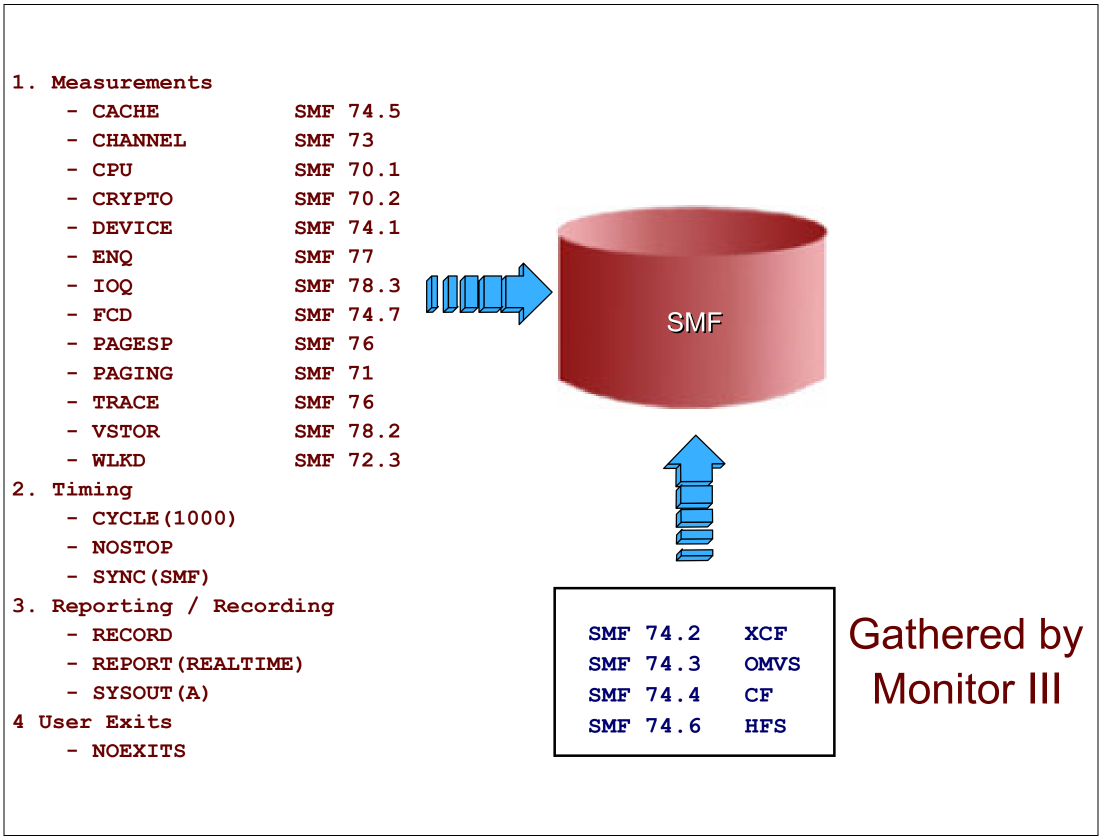


Figure 9-8 RMF Monitor output

Monitor I

Monitor I measures and reports the use of system resources (that is, the processor, I/O devices, storage, and data sets on which a job can enqueue during its execution). It runs in the background and measures data over a time period. Reports can be printed immediately after the end of the measurement interval, or the data can be stored in SMF records and printed later with the RMF postprocessor, which can be used to generate reports for exceptions, that is, conditions where user-specified values are exceeded. SMF data is kept in VSAM data sets as the postprocessor requires a sequential format. Use the SMF dump utility, IFASMFDP, to unload the data. Usually Generation Data Groups (GDGs) are the preferred target:

```
RMF.SMFDATA.SYSNAME(0)
```

IFASMFDP to unload JCL

Figure 9-9 on page 252 shows the JCL to unload the SMF data.

```
//SMFDUMP EXEC PGM=IFASMFDP
//IDD1 DD DISP=SHR,DSN=<input_smfdata_system1>
//IDD2 DD DISP=SHR,DSN=<input_smfdata_system2>
//SMFDATA DD DISP=(NEW,PASS),SPACE=(CYL,(10,10),RLSE),
// UNIT=SYSDA,DCB=(RECFM=VBS,LRECL=32760,BLKSIZE=0)
//SYSIN DD *
INDD(IDD1,OPTIONS(DUMP))
INDD(IDD2,OPTIONS(DUMP))
OUTDD(SMFDATA,TYPE(70:78))
```

Figure 9-9 IFASMFDP to unload JCL

Sort JCL job

To get an output sorted by date and time, the following sort job is required for sysplex-wide reporting.

```
//RMFSORT EXEC PGM=SORT
//SORTIN DD DISP=SHR,DSN=<input_smfdata_system1>
// DD DISP=SHR,DSN=<input_smfdata_system2>
//SYSIN DD *
SORT FIELDS=(11,4,CH,A,7,4,CH,A),EQUALS
MODS E15=(ERBPPE15,36000,,N),E35=(ERBPPE35,3000,,N)
```

Figure 9-10 Sort JCL

9.5 Monitor II data gathering

- Monitor II is a snapshot reporter
  - Collects the status of system resources (CPU, devices,..)
  - Collects the status of address spaces (resource usage,..)
- Use Monitor II to:
  - Coninuously monitor resource usage
  - Determine the state of any address space in the system
  - Track CPU usage of problem address spaces
  - Collect supplemental information when analyzing performance problems with Monitor III
- Choose background session to:
  - Collect SMFA records for archiving and later processing
  - Automate snapshot reporting
- Choose display session for:
  - Immediate feedback
  - Online analysis

Figure 9-11 RMF Monitor II data gathering

Monitor II

Monitor II tells you what is happening right now on your system, how system resources are used, and how your address spaces are doing. Several standard reports are provided, and you can add your own reports. You cannot see older or historical data. You can only see what is happening right now on your system, or current data.

You can collect data to SMF data sets continuously for Monitor II reports. In this case, you decide beforehand which reports you will produce by specifying them to the Monitor II data gatherer. Later, you can write the reports using the postprocessor for the period you want to see. This is a useful method, for example, if you want to get information every third second about certain address spaces for one day or perhaps every day.

Starting Monitor II

To become familiar with RMF, start RMF Monitor II by issuing the TSO RMFMON command. Figure 9-12 shows the RMF display menu. Monitor II is a snapshot reporting tool for very fast information about how specific address spaces or system resources (processor, DASD volumes, storage) are performing. Monitor II has two modes for reporting on the performance of your system.

```
                          RMF DISPLAY MENU
     NAME       PFK#   DESCRIPTION

     ARD         1     ADDRESS SPACE RESOURCE DATA
     ASD         2     ADDRESS SPACE STATE DATA
     ASRM        3     ADDRESS SPACE SRM DATA
     CHANNEL     4     CHANNEL PATH ACTIVITY
     DDMN        5     -----NOT APPLICABLE IN GOAL MODE-----
     DEV         6     DEVICE ACTIVITY
     PGSP        7     PAGE/SWAP DATA SET ACTIVITY
     SENQ        8     SYSTEM ENQUEUE CONTENTION
     SENQR       9     SYSTEM ENQUEUE RESERVE
     SPAG        10    PAGING ACTIVITY
     SRCS        11    CENTRAL STORAGE / PROCESSOR / SRM
     TRX         12    -----NOT APPLICABLE IN GOAL MODE-----
     ARDJ              ADDRESS SPACE RESOURCE DATA
     ASDJ              ADDRESS SPACE STATE DATA
     ASRMJ             ADDRESS SPACE SRM DATA
     DEVV              DEVICE ACTIVITY
     IOQUEUE           I/O QUEUING ACTIVITY
     SDS               RMF SYSPLEX DATA SERVER
     LLI               PROGRAM LIBRARY INFORMATION
     ILOCK             IRLM LONG LOCK DETECTION
```

Figure 9-12 RMF display menu

ARD report

In the ARD report, the number of data lines in the report depends on the number of address space identifiers in the system that meet your selection criteria. The shown report is a sample for a system running in IBM z/Architecture®. Figure 9-13 shows the result of issuing the ARD command, showing data for each ASID. The key information we are looking for is who is consuming the CPU and/or EXCP cycles.

```
                                CPU=  2/  2 UIC=2540 PR=   0  ESA2 ASD
17:42:30          S C  R  DP   CS   ESF   CS   TAR  X  PIN   ES  TX  SWAP
JOBNAME  SRVCLASS P L  LS PR    F         TAR  WSS  M   RT   RT  SC    RV
*MASTER* SYSTEM   1 NS    FF 4104              0      ----        0     0
PCAUTH   SYSSTC   1 NS    FE  103              0   X  ----        0     0
RASP     SYSTEM   1 NS    FF  348              0   X  ----        0     0
TRACE    SYSSTC   1 NS    FE  985              0   X  ----        0     0
DUMPSRV  SYSTEM   1 NS    FF  182              0      ----        0     0
XCFAS    SYSTEM   1 NS    FF 1703              0   X  ----        0     0
GRS      SYSTEM   1 NS    FF  942            691   X  ----        0     0
SMSPDSE  SYSTEM   1 NS    FF 21.4K          9860   X  ----        0     0
CONSOLE  SYSTEM   1 NS    FF 1277              0   X  ----        0     0
WLM      SYSTEM   1 NS    FF 1092              0   X  ----        0     0
ANTMAIN  SYSTEM   1 NS    FF 2203              0   X  ----        1   998
ANTAS000 STC      1 NS    FB  203              0   X  ----        1   998
OMVS     SYSTEM   1 NS    FF 25.3K         19.8K   X  ----        0     0
JESXCF   SYSTEM   1 NS    FF   92              0   X  ----        0   998
ALLOCAS  SYSTEM   1 NS    FF 2195              0   X  ----        1     0
IOSAS    SYSTEM   1 NS    FF 1173              0   X  ----        0     0
IXGLOGR  SYSTEM   1 NS    FF  752              0   X  ----        0     0
SMS      SYSSTC   1 NS    FE 1150              0   X  ----        0   998
SMF      SYSTEM   1 NS    FF  285              0   X  ----        0     0
LLA      SYSSTC   1 NS    FE 1688              0   X  ----        0   998
JES2AUX  STC      1 NS    FB  118              0      ----        1     0
```

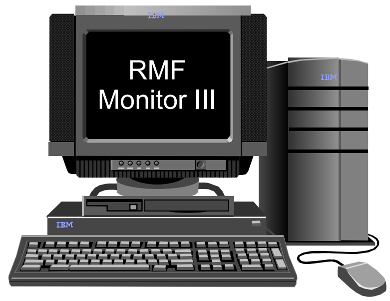
Figure 9-13 Output of the ARD command

To leave the RMF panel, enter `end`.

9.6 RMF Monitor III data gathering

Monitor III Delay Monitoring
- Processor
- Storage
- Device
- Enqueue
- Operaotr
  - Message
  - Tape mount
- Subsystem
  - HSM - JES- XCF

Monitor III Activity Monitoring
- Common storage
- Page/Swap data sets
- Storage frames
- Device
- Data set level by job and volume
- Cache
- Coupling Facility
- Goal attainment
- VSAM RLS
- UNIX System Services
- Enclaves



Monitor III Advanced Features
- Cursor sensitive navigation
- Workflow exceptions monitoring
- Automatic customization
- Continue monitoring
- Hardcopy reports
- Online tutorial
- Online help
- Adaptive reports
- User reports
- GDDM graphics
- Sysplex-wide reports
- Remote reporting

Figure 9-14 RMF Monitor III data gathering

Monitor III

Monitor III tells you how well your single system or sysplex is performing, and what is going on. This is presented at different levels:

- Sysplex-wide reports about the workloads, Coupling Facilities, and caching
- System-wide reports about the resources and address spaces

You can see what is happening right now, typically during the last 60 seconds. You can also see what happened recently or you might be able to see what happened the day before yesterday depending on your installation setup. Additionally, you can dynamically change the time frame you want to observe. For example, your actions might be:

- Using 10-minute time frames on one day, travelling backward and forward, to find the most interesting 10-minute period.
- Using one-minute time frames, travelling backward and forward, to find the most interesting one-minute period.

At that point, it should be easy to locate the system, partition, address space, device, or whatever it is that you want to examine.

10

z/Architecture and addressing

z/Architecture is the next step in the evolution from System/360 to System/370, System/370 Extended Architecture (370-XA), Enterprise Systems Architecture/370* (ESA/370),and Enterprise Systems Architecture/390 (ESA/390). In order to understand z/Architecture you have to be familiar also with the basics of ESA/390 and its predecessors.

An address space maps all of the available addresses, and includes system code and data as well as user code and data. Thus, not all of the mapped addresses are available for user code and data. This limit on user applications was a major reason for System/370 Extended Architecture (370-XA) and MVS/XA. Because the effective length of an address field expanded from 24 bits to 31 bits, the size of an address space expanded from 16 megabytes to 2 gigabytes. An MVS/XA address space is 128 times as big as an MVS/370 address space.

This chapter describes:

- Program status word (PSW)
- Address space addressability
- Dumps in 31-bit and 64-bit modes

10.1 Program status word (PSW)

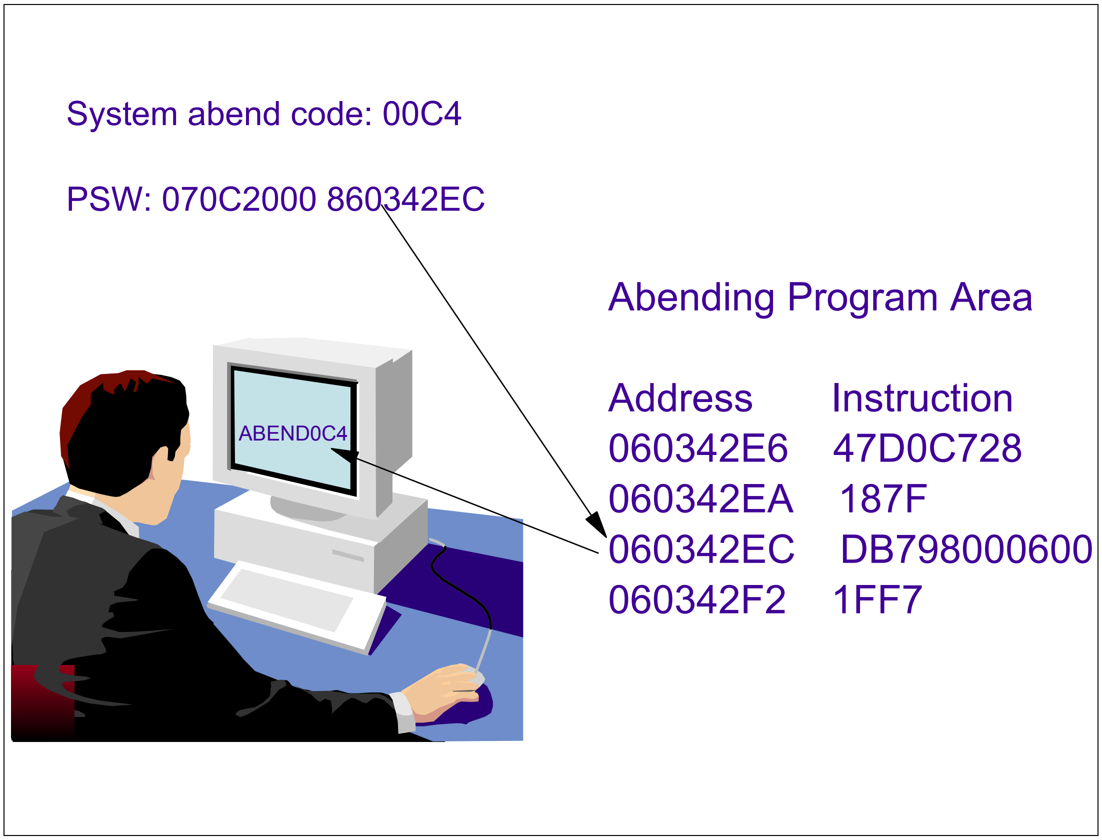


Figure 10-1 Program status word (PSW)

Program status word

One very important piece of information that will be crucial to your ability to diagnose a problem on z/OS is the program status word, more commonly referred to as the PSW. The PSW includes the instruction address, condition code, and other information to control instruction sequencing and to determine the state of the CPU. The active or controlling PSW is called the current PSW.

The PSW is so important because it keeps track of the progress of the system and the executing program. The current PSW usually points to the address of the next instruction to be executed. In some specific cases the PSW will point to the address of the failing instruction and this occurs when the interrupt code is 0010, which is a segment translation exception, or interrupt code 0011, which is a page translation exception.

What this means is that when a task abends and a dump is taken, the PSW is pointing to the next instruction that will be executed in the failing program. By subtracting the instruction-length code (ILC) from the PSW address, we will be looking at the failing instruction for which the abend was triggered.

Note: For page translation and segment translation errors, the PSW points to the failing instruction.

10.2 Program-status word (PSW)

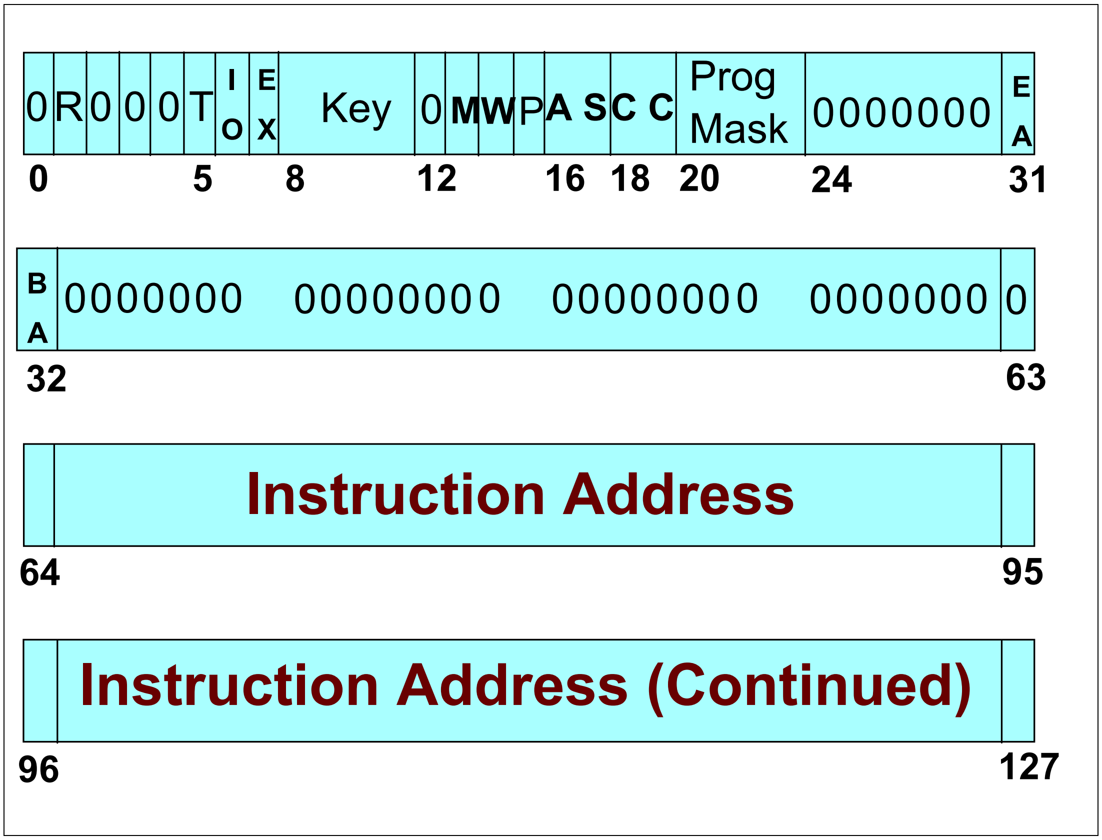


Figure 10-2 Program Status Word (PSW)

Current PSW

The current PSW is a storage circuit located within the CP. It contains information required for the execution of the currently active program, or, in other words, it contains the current state of a CP. It has 16 bytes (128 bits). The PSW includes the instruction address, condition code, and other information used to control instruction sequencing and to determine the state of the CP. The active or controlling PSW is called the current PSW. It governs the program currently being executed. Figure 10-2 describes the PSW from bits 0 to 127.

PER mask - R (bit 1)

Bit 1 controls whether the CP is enabled for interrupts associated with program-event recording (PER). When the bit is zero, no PER event can cause an interruption. When the bit is one, interruptions are permitted, subject to the PER-event-mask bits in control register 9.

DAT mode - T (bit 5)

Bit 5 controls whether implicit dynamic address translation of logical and instruction addresses used to access storage takes place. When the bit is zero, DAT is off, and logical and instruction addresses are treated as real addresses. When the bit is one, DAT is on, and the dynamic-address-translation mechanism is invoked.

I/O mask - IO (bit 6)

Bit 6 controls whether the CP is enabled for I/O interruptions. When the bit is zero, an I/O interruption cannot occur. When the bit is one, I/O interruptions are subject to the

I/O-interruption subclass-mask bits in control register 6. When an I/O-interruption subclass-mask bit is zero, an I/O interruption for that I/O-interruption subclass cannot occur; when the I/O-interruption subclass-mask bit is one, an I/O interruption for that I/O-interruption subclass can occur.

External mask - EX (bit 7)

Bit 7 controls whether the CP is enabled for interruption by conditions included in the external class. When the bit is zero, an external interruption cannot occur. When the bit is one, an external interruption is subject to the corresponding external subclass-mask bits in control register 0; when the subclass-mask bit is zero, conditions associated with the subclass cannot cause an interruption; when the subclass-mask bit is one, an interruption in that subclass can occur.

PSW key (bits 8-11)

Bits 8-11 form the access key for storage references by the CP. If the reference is subject to key-controlled protection, the PSW key is matched with a storage key when information is stored or when information is fetched from a location that is protected against fetching. However, for one of the operands of each of MOVE TO PRIMARY, MOVE TO SECONDARY, MOVE WITH KEY, MOVE WITH SOURCE KEY, and MOVE WITH DESTINATION KEY, an access key specified as an operand is used instead of the PSW key.

Machine-check mask - M (bit 13)

Bit 13 controls whether the CP is enabled for interruption by machine-check conditions. When the bit is zero, a machine-check interruption cannot occur. When the bit is one, machine-check interruptions due to system damage and instruction-processing damage are permitted, but interruptions due to other machine-check-subclass conditions are subject to the subclass-mask bits in control register 14.

Wait state - W (bit 14)

When bit 14 is one, the CP is waiting; that is, no instructions are processed by the CP, but interruptions may take place. When bit 14 is zero, instruction fetching and execution occur in the normal manner. The wait indicator is on when the bit is one. When in a wait state, the only way of getting out of that state is through an interruption, or IPL (a z/OS boot). Certain bits in the current PSW, when off, place the CP in a disabled state, that is, it does not accept interrupts. So, when z/OS because of any error reason (software or hardware) decides to stop a CP, it sets the PSW in a disabled and wait state, forcing an IPL as the way to get the CP back in a running state.

Problem state - P (bit 15)

When bit 15 is one, the CP is in the problem state. When bit 15 is zero, the CP is in the supervisor state. In the supervisor state, all instructions are valid. In the problem state, only those instructions are valid that provide meaningful information to the problem program and that cannot affect system integrity; such instructions are called unprivileged instructions. The instructions that are never valid in the problem state are called privileged instructions. When a CP in the problem state attempts to execute a privileged instruction, a privileged-operation exception is recognized. Another group of instructions, called semiprivileged instructions, are executed by a CP in the problem state only if specific authority tests are met; otherwise, a privileged-operation exception or a special-operation exception is recognized.

Address-space control -AS (bits 16-17)

Bits 16 and 17, in conjunction with PSW bit 5, control the translation mode.

Condition code - CC (bits 18-19)

Bits 18 and 19 are the two bits of the condition code. The condition code is set to 0, 1, 2, or 3, depending on the result obtained in executing certain instructions. Most arithmetic and logical operations, as well as some other operations, set the condition code. The instruction BRANCH ON CONDITION can specify any selection of the condition code values as a criterion for branching.

The part of the CP that executes instructions is called the arithmetic logic unit (ALU). The ALU has four internal bits that are set by certain instructions. At the end of such instructions this 4-bit configuration is mapped into bits 18 and 19 of the current PSW.

As an example, the instruction COMPARE establishes a comparison between two operands. The result of the comparison is placed in the CC of the current PSW, as follows:

- CC=00, the operands are equal
- CC=01, the first operand is lower
- CC=10, the first operand is greater

To test the contents of a CC (set by a previous instruction), use the BRANCH ON CONDITION (BC) instruction. It has an address of another instruction (branch address) to be executed depending on the comparison of the CC and a mask M. The instruction address in the current PSW is replaced by the branch address, if the condition code has one of the values specified by M; otherwise a normal instruction sequencing proceeds with the normal updated instruction address. Here are the types of codes:

- Condition code - bits 18 and 19 of the PSW
- Return code - a code associated with how a program ended
- Completion code - a code associated with how a task ended
- Reason code - a code passed in GPR 15, giving more details about how a task ended

Program Mask (bits 20-23)

During the execution of an arithmetic instruction, the CP may find some unusual (or error) condition, such as: overflows, loss of significance, underflow. In these cases, the CP generates a program interrupt. When this interrupt is treated by z/OS, usually the current task is abnormally ended (abend). However, in certain situations the programmer does not want an abend, so through the instruction SET PROGRAM MASK (SPM), he or she can mask such interrupts by setting to `off` some of the program mask bits. Each bit is associated with one type of condition:

- Fixed point overflow (bit 20)
- Decimal overflow (bit 21)
- Exponent underflow (bit 22)
- Significance (bit 23)

Observe that the active program is informed about the above events through the condition code posted by the instruction where the events described happened.

The contents of the CP can be totally changed by two events:

- Loading a new PSW from storage along an interruption
- Executing the instruction LPSW, which copies 128 bits from memory to the current PSW.

Extended addressing mode - EA, BA (bits 31-32)

The combination of bits 31 and 32 specify the addressing mode (24, 31, or 64) of the running program. Bit 31 controls the size of effective addresses and effective address generation in conjunction with bit 32, the basic addressing mode bit. When bit 31 is zero, the addressing mode is controlled by bit 32. When bits 31 and 32 are both one, 64-bit addressing is specified.

10.3 64-bit addressing

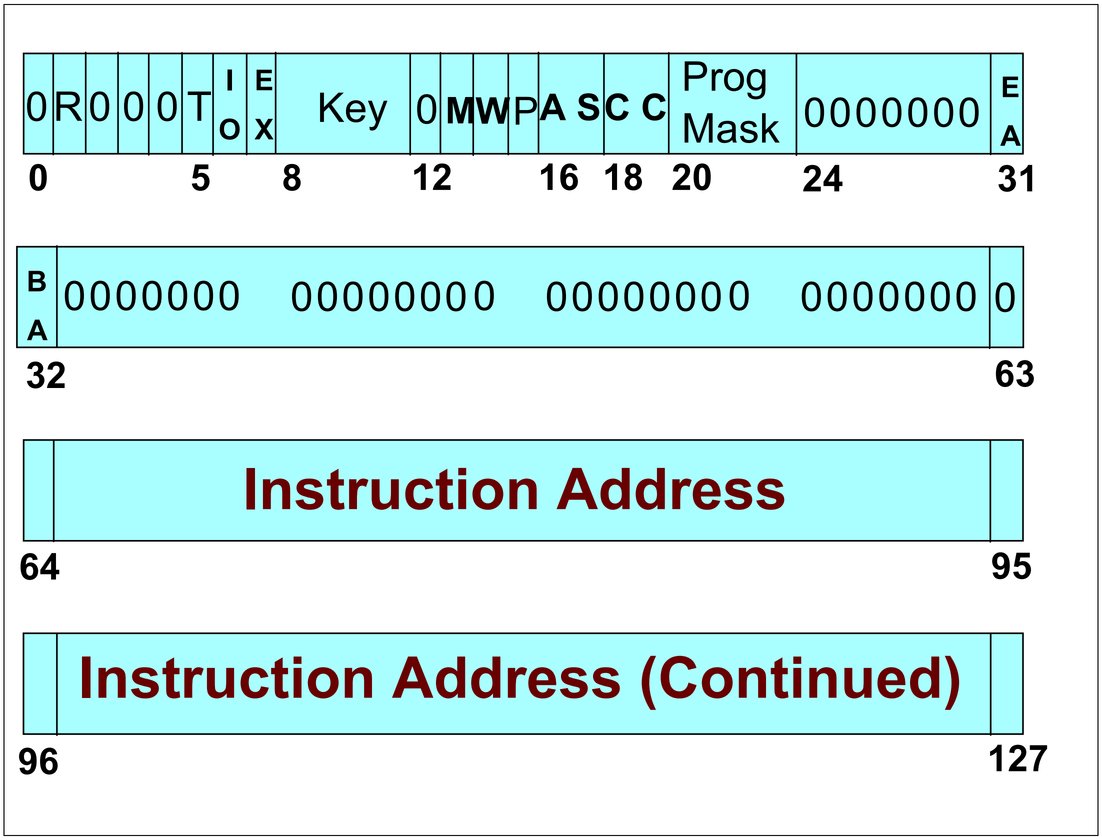


Figure 10-3 64-bit addressing

What is addressability

One of the major developments of the MVS operating system was the implementation of 31-bit addressing. Prior to MVS/XA the highest virtual storage location that could be addressed was 16 megabytes, or hexadecimal FFFFFF. Actually, it was one byte less that 16 megabytes, because we start at zero. As applications grew larger the 24-bit architecture limitations were recognized, and 31-bit addressability was introduced. The 31-bit standard increased the amount of addressable virtual storage to 2 gigabytes. The addressing mode of a program is determined by the high order bit (bit 32 of the PSW) of the instruction address. If this bit is set to 1 the processor is running in 31-bit mode. If it is 0 then the processor is running in 24-bit mode.

We have now taken the next step in storage addressability with z/OS, implementing 64-bit addressing. This means that the maximum storage that can be addressed is 2 ** 64, or 16 exabytes. The highest address when running in 64-bit mode is X'FFFFFFFF_FFFFFFFF' as opposed to the previous 31-bit high address of X'7FFFFFFF'.

Format of the PSW

Prior to z/OS and 64-bit mode operations, the PSW was 64 bits in length and comprised of two 32-bit words. The first 32 bits (identified as bits 0 through 31) related to system state and mode status, but the second 32 bits (identified as bits 32 through 63 as shown in Figure 10-4 on page 264) indicated the addressing mode in the first bit and the address of the next instruction in bits 33 through 63. The second word is what will interest us in most cases, as shown in Figure 10-3.

For example,

`PSW: 075C2000 82CC5BCC` Instruction length: 02

Instruction address (bits 64 to 127)

Bits 64 to 127, shown in Figure 10-3 on page 262, point to the storage address of the next instruction to be executed by this CP. When an instruction is fetched from main storage, its length is automatically added to this field. It then points to the next instruction address. However, there are instructions such as a BRANCH that may replace the contents of this field, pointing to the branched instruction. The address contained in this PSW field may have 24, 31, or 64 bits, depending on the addressing mode attribute of the executing program. For compatibility reasons, old programs that use small addresses are still allowed to execute. When in 24- or 31-bit addressing mode, the leftmost bits of this field are filled with zeroes.

CP interrupts

The CP has an interrupt capability, which permits it to switch rapidly to another program in response to exceptional conditions and external stimuli. When an interrupt occurs, the CP places the current PSW in an assigned storage location, called the old-PSW location, for the particular class of interrupt. The CP fetches a new PSW from a second assigned storage location. This new PSW determines the next program to be executed. When it has finished processing the interrupt, the program handling the interrupt may reload the old PSW, making it again the current PSW, so that the interrupted program can continue.

There are six classes of interrupt: external, I/O, machine check, program, restart, and supervisor call. Each class has a distinct pair of old-PSW and new-PSW locations permanently assigned in real storage.

10.4 Next sequential instruction

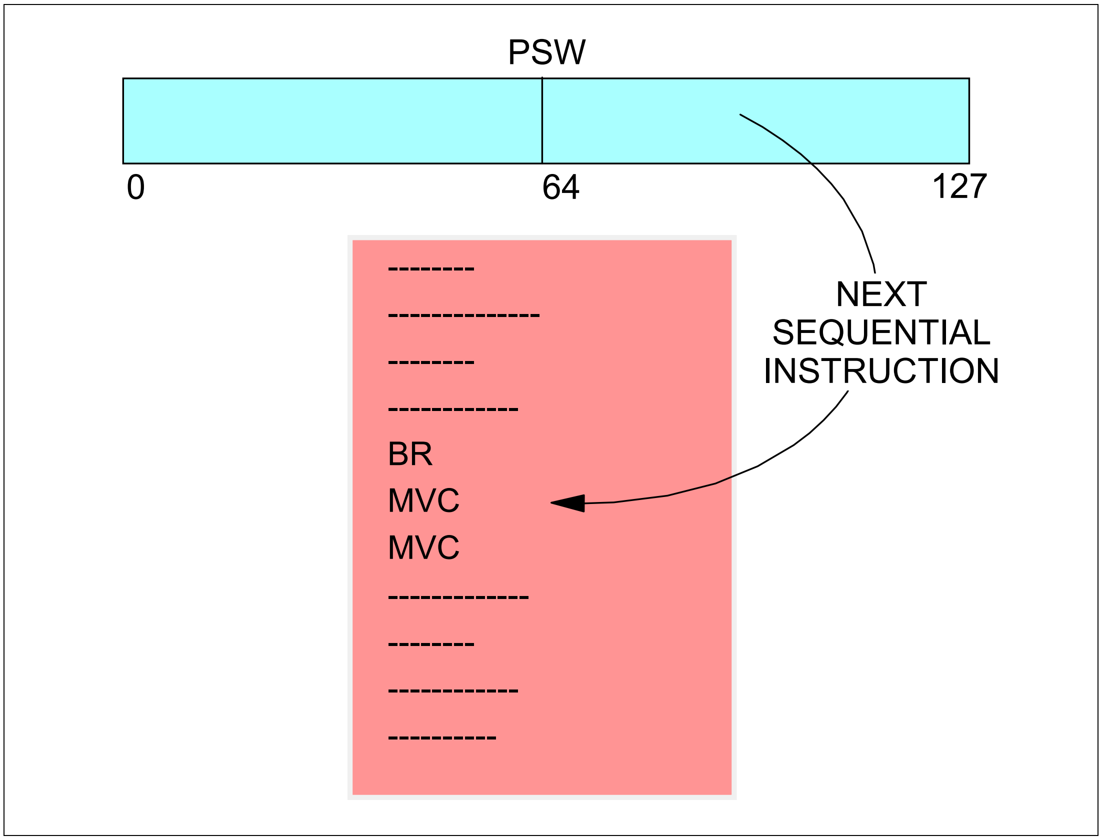


Figure 10-4 Next sequential instruction address

PSW second word

Using the PSW, example:

`PSW: 075C2000 82CC5BCC` Instruction length: 02

The second word of the PSW is `82CC5BCC`. The first number, `8`, indicates that this program is executing in 31-bit mode. In other words, this program runs above the 16-megabyte line. The number `8` in binary is 1000, which indicates the addressing mode bit 32 is ON. A value of zero decimal would be binary zero, 0000, indicating that the addressing mode bit 32 is OFF, which identifies that this location was below the 16-bit line, or in 24-bit mode.

The remaining data points to the next instruction to be executed. In this case, `2CC5BCC`. For the sake of correctness the full address would be `02CC5BCC`.

Subtracting the instruction length value, in this case, 2, from the PSW address, would result in `02CC5BCA`, which would point to the failing instruction.

The PSW has now changed and the z/OS 128-bit PSW is converted by MVS to a 64-bit double word and the z/OS-formatted PSW is stored in control blocks. The PSW is represented as follows:

```
AMODE 24
07850000 00000000 00000000 00065788 078D0000 00065788
AMODE 31
04041000 80000000 00000000 00FE5768 040C1000 80FE5768
```

```
AMODE 64
04045001 80000000 00000000 01685B28 040C5001_81685B28
```

The bold form of the PSW indicates the “converted” z/OS PSW. The underscore between the two words of the converted PSW indicates that this is a 64-bit (above the bar) address.

As you can see, it looks similar to the 31-bit PSW except for the non-zero value of bit 31 in the 1st word of the PSW, 040C500**1,** as well as the non-zero value in bit 32 of the PSW, which is the 1st bit of the second word, **8**1685B28. It is the use of bits 31 and 32 that indicates this is a 64-bit address. The address to interrogate in this case would be `1_81685B28`**.**

In many cases, for most current applications, you will still be interrogating 31-bit storage addresses, but in the future, as more applications make use of the extended addressability, you will reference storage pointed to by the Addressing Mode (AMODE) 64-bit PSW.

10.5 64-bit address space

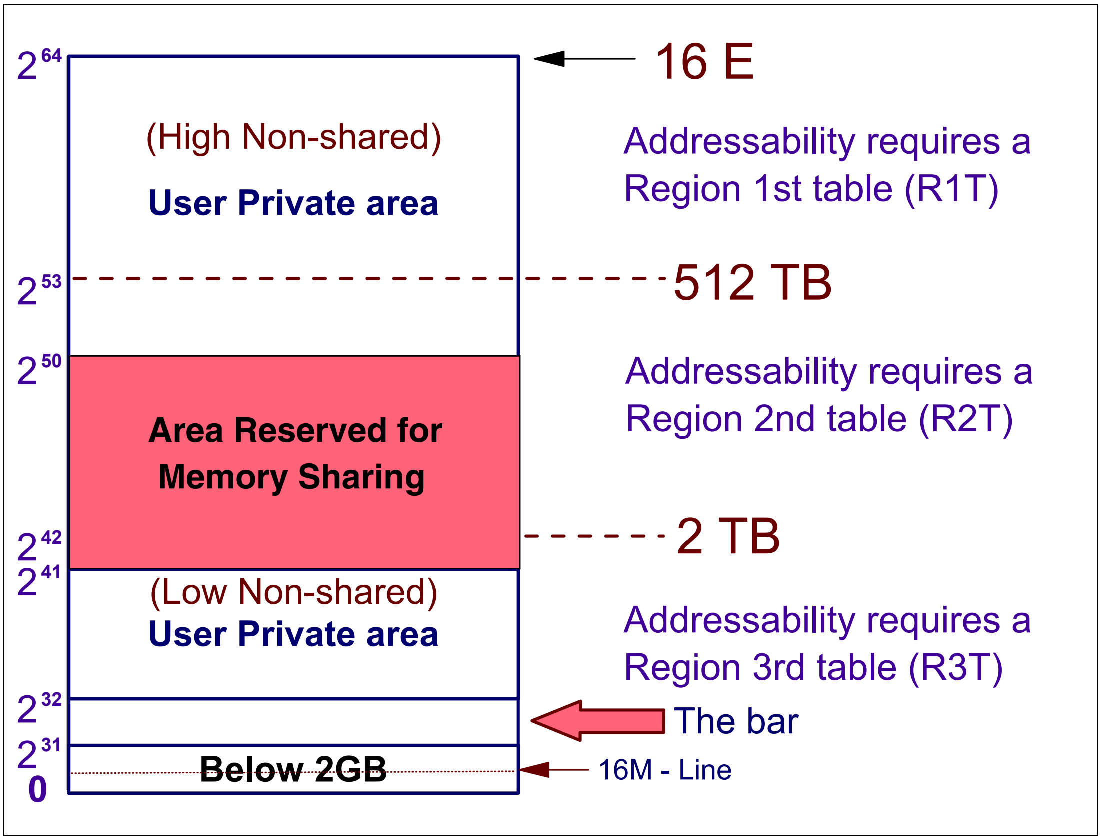


Figure 10-5 64-bit address space map

64-bit address space

With z/OS, the MVS address space expands to a size so vast that we need new terms to describe it. Each address space, called a 64-bit address space, is 16 exabytes in size; an exabyte is slightly more than one billion gigabytes. The new address space has logically 2^{64} addresses. It is 8 billion times the size of the former 2-gigabyte address space that logically has 2^{31} addresses. The number is 16 with 18 zeros after it:

```
16,000,000,000,000,000,000 bytes, or 16 exabytes
```

If you are coding a new program that needs to store large amounts of data, a 64-bit address space might work for you.

Introduction of 64-bit address space

As of z/OS V1R2, the address space begins at address 0 and ends at 16 exabytes, an incomprehensibly high address. The architecture that creates this address space provides 64-bit addresses. The address space structure below the 2-gigabyte address has not changed; all programs in AMODE 24 and AMODE 31 continue to run without change. In some fundamental ways, the address space is much the same as the XA address space.

In the previous 31-bit address space, a virtual line marks the 16-megabyte address. The 64-bit address space also includes the virtual line at the 16-megabyte address; additionally, it includes a second virtual line called the bar that marks the 2-gigabyte address.

The bar

The bar separates storage below the 2-gigabyte address, called *below the bar*, from storage above the 2-gigabyte address, called *above the bar*. The area above the bar is intended for data; no programs run above the bar. There is no area above the bar that is common to all address spaces, and no system control blocks exist above the bar. IBM reserves an area of storage above the bar for special uses to be developed in the future.

Memory sharing

Before z/OS V1R3, all programs in AMODE 31 or AMODE 24 were unable to work with data above the bar. To use virtual storage above the bar, a program must request storage above the bar, be in AMODE 64, and use the new z/Architecture assembler instructions.

As of z/OS V1R5, the following enhancements for 64-bit virtual storage have been added:

- 64-bit shared memory support
- Default shared memory addressing area between 2 terabytes and 512 terabytes

  This shared memory is used by z/OS UNIX applications.

Using memory above the bar

The reason why someone designing an application would want to use the area above the bar is simple: the program needs more virtual storage than the first 2-gigabyte address space provides. Before z/OS V1R2, a program's need for storage beyond what the former 2-gigabyte address space provided was sometimes met by creating one or more data spaces or hiperspaces and then designing a memory management schema to keep track of the data in those spaces. Sometimes programs written before z/OS V1R2 used complex algorithms to manage storage, reallocate and reuse areas, and check storage availability. With the 16-exabyte address space, these kinds of programming complexities are unnecessary. A program can potentially have as much virtual storage as it needs, while containing the data within the program's primary or home address space.

Virtual memory above 2 GB is organized as memory objects that a program creates. A memory object is a contiguous range of virtual addresses that are allocated by programs as a number of application pages which are 1 MB multiples on a 1 MB boundary. Programs continue to run and execute in the first 2 GB of the address space.

Dynamic address translation

Dynamic address translation is the process of translating a virtual address during a storage reference into the corresponding real address. The virtual address may be a primary virtual address, secondary virtual address, AR-specified virtual address, or home virtual address. These addresses are translated by means of the primary, the secondary, an AR-specified, or the home address-space-control element, respectively.

After selection of the appropriate address-space-control element, the translation process is the same for all of the four types of virtual address. An address-space-control element may be a segment-table designation specifying a 2-GB address space, a region-table designation specifying a 4-TB, 8-PB, or 16-EB space, or a real-space designation specifying a 16-EB space. The letters K, M, G, T, P, and E represent kilo, $2^{1}0$, mega, $2^{2}0$, giga, $2^{3}0$, tera, $2^{4}0$, peta, $2^{5}0$, and exa, $2^{6}0$, respectively. A segment-table designation or region-table designation causes translation to be performed by means of tables established by the operating system in real or absolute storage. A real-space designation causes the virtual address simply to be treated as a real address, without the use of tables in storage.

Is a dump 31-bit or 64-bit?

The easiest way to determine this is to use ISPF to browse the unformatted dump data set.

The header for each record in the dump will show DR1 for a system running in 31-bit mode and DR2 for a 64-bit system dump. Figure 10-6 shows an ISPF browse of the dump data set.

```
BROWSE    APSG.SC48TS.DUMP1
 Command ===>
****************************
DR2 H .....................
DR2 CV.....................
DR2 CV..................]°.
DR2 CV..................]µ.
DR2 CV..................]^.
DR2 CV..................]{.
```

Figure 10-6 64-bit architecture dump header record

A slightly more complex method for those familiar with IPCS is as follows:

- 31-bit (2 GB) MVS address spaces have architected Prefix Save Areas starting at x'0' in low core. These start with the restart new PSW (which begins “040C...”). This is what you would expect to see in low core of dumps from systems that are not running on the new HW, or which are using the new 64-bit support hardware, but are not running in 64-bit mode.
- If an MVS image has been IPLed to exploit 64-bit architecture, the low core will look completely different. The PSA is now 2 KB in size, rather than 1 KB and the format of the PSA starting from x'0' is completely different. Only a few of the fields are retained (for compatibility purposes), for example, the CVT address, the current TCB address and current ASCB address.
- To quickly identify whether a dump was taken from an image exploiting the 64-bit architecture you can look at offset x'A3'. If the value x'01' is set, this dump comes from an MVS image running in 64-bit mode. If x'00' is set, it is running in 31-bit mode. Currently no other bits are used in this byte.

It must be said that apart from the historical significance, you will not see many non-64 bit dumps in most current z/OS environments.

11

IBM Fault Analyzer for z/OS

Fault Analyzer for z/OS provides the information you require to determine the cause and assist with the resolution of application and system failures. Integrated support for Java and IBM WebSphere Application Server for z/OS gives Fault Analyzer expanded application coverage and related business value beyond traditional applications. You can use this one tool to assist in composite-application abend analysis, including 64-bit DB2 Universal Database support. It helps you repair failures quickly by gathering information about an application and its environment at the time of failure.

When an application abend occurs, Fault Analyzer captures and analyzes real-time information about the application and its environment, then generates an analysis report detailing the cause of the failure. The report describes the failure in terms of the application code, so you no longer lose time reviewing cumbersome, low-level system error messages. Fault Analyzer allows you to choose a report format to locate the information more easily.

Each application abend is recorded by Fault Analyzer in a fault-history file by job name, failure code and other details, along with the analysis report and storage pages referenced during the analysis. This information can later be retrieved to reanalyze the failure.

Through the inclusion of softcopy versions of selected manuals, Fault Analyzer can extract message and failure-code descriptions and insert them into the analysis report where applicable. You can also provide your own descriptions for messages.

You can write your own user exits. For example, you can write a user exit to access compiler listings that are compressed or available only through a proprietary access method.

Integration with IBM Rational® Developer for IBM System z® enables application developers to work with fault entries directly from their development environment, and also allows Debug Tool and Fault Analyzer to share common source files without redundancy.

IBM Application Performance Analyzer for z/OS, IBM Debug Tool Utilities and Advanced Functions for z/OS, IBM Fault Analyzer for z/OS and IBM File Manager for z/OS, along with Optim™ MOVE and Rational Developer for System z, provide a robust suite of problem determination tools that can help improve application delivery throughout the application life cycle.

11.1 Fault Analyzer

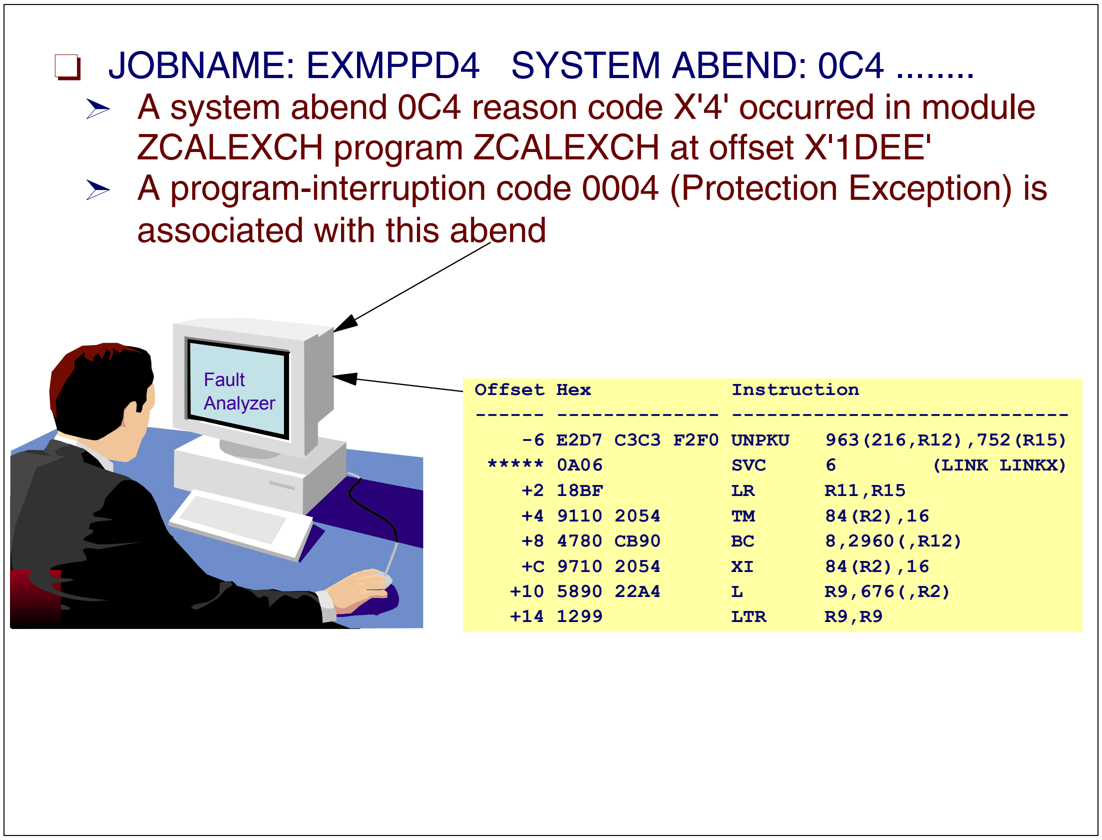


Figure 11-1 Fault Analyzer

Fault Analyzer highlights

A summary of the main features of Fault Analyzer for z/OS:

- Fault Analyzer provides a detailed report about program failures to help you resolve them quickly, which also includes a fault-history file that enables you to track and manage application failures and fault reports.
- Fault Analyzer offers a view of storage contents, trace tables, and terminal screen images at the time of failure to help speed corrective action.
- Fault Analyzer provides the ability to customize message descriptions to be used in application-failure reports.
- All z/OS subsystems and compilers are supported.
- Fault Analyzer provides integration with Rational Developer for System z.

System abend analysis

When an application abend occurs, such as an 0C4, Fault Analyzer captures and analyzes real-time information about the application and its environment, then generates an analysis report detailing the cause of the failure. The report describes the failure in terms of the application code, so you no longer lose time reviewing cumbersome, low-level system error messages. Fault Analyzer allows you to choose a report format to locate the information more easily.

Recording abend information

Each application abend is recorded by Fault Analyzer in a fault-history file by job name, failure code and other details, along with the analysis report and storage pages referenced during the analysis. This information can later be retrieved to reanalyze the failure.

Note: This chapter describes how to work with Fault Analyzer using the panels provided on z/OS. If you need information about Fault Analyzer Browser, see *IBM Application Development and Problem Determination*, SG24-7661.

11.2 Fault Analyzer analysis options

- Fault Analyzer analysis options
  - Real-time analysis
  - Batch reanalysis
  - Interactive reanalysis
- Recording abend information
- Fault Analyzer ISPF interface
  - At any time after an abend you can:
    - As a TSO user, start the Fault Analyzer ISPF interface to review the fault

Figure 11-2 Fault Analyzer analysis options

Using Fault Analyzer

Fault Analyzer provides three modes to help you better track and analyze application and system failure information:

- Real-time analysis

  When a program abends, the abend processing (MVS or subsystem) is intercepted and Fault Analyzer is automatically invoked via an appropriate exit for the processing environment. Fault Analyzer performs fault analysis processing, and then records details about the abend in a history file. Fault Analyzer writes the fault analysis report to the job, and a summary to the SYSLOG. It also saves the analysis report in the history file along with a minidump consisting of a copy of all virtual storage pages that were referenced during the analysis process.

  Note: If Fault Analyzer deems the analysis to be successful, and either a SYSMDUMP, SYSABEND, or SYSUDUMP was specified for the abending job step, then Fault Analyzer tells MVS to suppress the dump.

- Batch reanalysis

  Batch reanalysis generates a new analysis report. This report is based on the dump and information gathered in real time, but with potentially different options specified, or with compiler listings or side files made available. You can submit a Fault Analyzer batch-mode job using either the Fault Analyzer ISPF or RDz interface or your own job control language.

The format of the batch reanalysis report is the same as the real-time analysis report. The batch reanalysis report is written as a sequential file to a DD statement in the reanalysis job but it is not saved in the fault history file entry. As well as using the ISPF interface to initiate batch reanalysis, you can also submit a batch reanalysis job using your own JCL.

- Interactive reanalysis

  Interactive reanalysis runs under ISPF and enables you to navigate through a formatted, structured view of a fully detailed reanalysis. This Fault Analyzer mode enables you to view working storage and control blocks at the time the dump was written. The interface has many point-and-click fields for easy navigation through the interactive reports.

  The reanalysis process is essentially identical to the real-time analysis process, except for the following:

  – Fault Analyzer obtains the required information from the saved minidump (and/or SYSMDUMP) instead of the abending program's virtual storage.
  – The history file is not updated.
  – No summary is written to the SYSLOG.

Note: Interactive reanalysis can only be initiated using the Fault Analyzer ISPF interface.

The Fault Analyzer ISPF interface

At any time after an abend you can, as a TSO user, start the Fault Analyzer ISPF interface to review the fault. Using this interface you can:

- View the stored real-time analysis report.
- Start a batch reanalysis.
- Start an interactive reanalysis.
- View information about the fault.
- View details about any faults that might have occurred, that were deemed to be duplicates of the current fault.
- Delete the fault entry.

Attention: When analyzing dumps with Fault Analyzer, you can choose several ways to do the analysis, as follows:

1. Use a line command as shown in “IDI.SIDIEXEC(IDISFA) as a line command” on page 274.
2. “Analyze MVS dump data set selection” on page 276.
3. “Invoke Fault Analyzer from ISPF” on page 278.

11.3 IDI.SIDIEXEC(IDISFA) as a line command

- Sample exec to invoke Fault Analyzer using ISPF line command
  - Allocate ISPF data sets
  - Place IDI.SIDIEXEC(IDISFA) into SYSPROC data set
- IDISFA will work as a line command against ISPF 3.4 data sets
  - Optionally, copy the exec to another data set in the SYSEXEC concatenation
    - Use a shorter name, for example FA

Figure 11-3 IDI.SIDIEXEC(IDISFA)

IDI.SIDIEXEC(IDISFA)

To use this exec, it needs to be copied to a data set that is allocated to the SYSPROC concatenation of the ISPF user. Although the name of this sample is IDISFA, it may be more convenient to rename it to a shorter name, FA for example, once it has been copied to the SYSPROC data set.

Modifying your ISPF environment

To use Fault Analyzer with ISPF, you need to ensure that the appropriate data sets have been allocated and that one or more ways to invoke Fault Analyzer have been provided. This is now explained.

Allocating ISPF data sets

The following data sets must be allocated to the respective ISPF DDnames (either in the TSO logon procedure or using any other installation-specific method):

- DDname Data set name
- ISPPLIB IDI.SIDIPLIB
- ISPMLIB IDI.SIDIMLIB
- ISPSLIB IDI.SIDISLIB
- ISPTLIB IDI.SIDITLIB
- SYSEXEC IDI.SIDIEXEC

One of the data sets that should exist after you have completed the SMP/E APPLY of Fault Analyzer is:

IDI.SIDIEXEC

This data set contains the REXX execs that are needed and should be placed into SYSEXEC as shown above. While IDISFA will work as a line command against ISPF 3.4 data sets, as long as IDI.SIDIEXEC is included in the SYSEXEC concatenation, it might be more convenient to copy this exec to another data set in the SYSEXEC concatenation with a shorter name, for example FA.

Using Fault Analyzer with a line command

From ISPF Option 3.4, enter a HLQ, dump, on the command line; Figure 11-4 is displayed, showing the current dumps.

```
  Menu  Options  View  Utilities  Compilers  Help
  ------------------------------------------------------------------------------
  DSLIST - Data Sets Matching DUMP                                 Row 1 of 24
  Command ===>                                                Scroll ===> PAGE

  Command - Enter "/" to select action                  Message          Volume

-------------------------------------------------------------------------------
         DUMP                                                             *ALIAS
IDISFA   DUMP.D120204.H02.SC55.OMVS.S00001                                DUMPS8
         DUMP.D120204.H02.SC69.DUMPSRV.S00001                             DUMPS3
         DUMP.D120212.H15.SC67.MQG2MSTR.S00001                            DUMPS3
         DUMP.D120217.H01.SC55.DB9MMSTR.S00001                            DUMPS3
         DUMP.D120218.H18.SC69.WOMS001S.S00001                            DUMPS6
         DUMP.D120221.H16.SC69.#MASTER#.S00004                            DUMPS4
         DUMP.D120221.H18.SC47.#MASTER#.S00009                            DUMPS6
         DUMP.D120222.H00.SC55.WMSR01AS.S00002                            DUMPS2
         DUMP.D120222.H00.SC55.WMSR01AS.S00003                            DUMPS5
         DUMP.D120222.H00.SC55.WMSR01AS.S00004                            DUMPS4
         DUMP.D120222.H05.SC55.WKDMGR.S00005                              DUMPS3
         DUMP.D120223.H00.SC55.WKDMGR.S00001                              DUMPS2
         DUMP.D120224.H11.SC47.IM1BCQS.S00001                             DUMPS7
         DUMP.D120224.H11.SC47.IM1BRM.S00002                              DUMPS4
         DUMP.D120227.H03.SC55.WYSR01A.S00002                             DUMPS1
         DUMP.D120301.H05.SC55.WYSR01AA.S00003                            DUMPS6
```

Figure 11-4 Current dumps in the system

As shown in Figure 11-4, when you enter the command IDISFA next to a dump, this invokes Fault Analyzer.

11.4 Analyze MVS dump data set selection

```
 File  Options  View  Services  Help
 _5 1. Last Accessed Fault History Files or Views...        Line 1 Col 1 80
    2. Last Accessed Fault History File Entries...          Scroll ===> CSR
    3. Clear Last Accessed Information
    4. List Views...
    5. Analyze MVS Dump Data Set...
    6. Fault History File Properties...                    or S (View saved
    7. New Fault History File Allocation...               ), D (Delete), H
    8. Exit Fault Analyzer                                 entry), X (XMIT fault

  Fault_ID Job/Tran User_ID  Sys/Job  Abend  Date       Time
    F01230 RD803RD9 DAVIS    SC47     SE37   2011/12/14 04:37:00
    F01229 RD803RD7 DAVIS    SC47     SE37   2011/12/12 07:07:49
    F01228 RD803RD7 DAVIS    SC47     S002   2011/11/23 05:06:22
    F01227 PFA3     PFA      SC55     U4088  2011/11/04 10:43:26
    F01226 IMS11IF3 STC      SC47     U0458  2011/10/20 07:15:08
    F01225 IMS11IF2 STC      SC47     U0458  2011/10/20 07:15:03
    F01224 IMS11IF3 STC      SC47     U0458  2011/10/20 07:15:02
    F01223 IMS11IF2 STC      SC47     U0458  2011/10/20 07:15:02
    F01222 JOUKO5S2 JOUKO5   SC66     U3007  2011/10/20 05:02:35
```

Figure 11-5 Analyze MVS dump data set selection (Option 5)

MVS dump data set selection

If you know the dump data set name you want to analyze, you can use the options shown in Figure 11-5 and the Options described below.

Once the cursor is placed on an action-bar item, File, in Figure 11-5, press the Enter key and the associated pull-down menu is displayed, as shown in Figure 11-5.

Select Option 5

By selecting Option 5 in the pull-down shown in Figure 11-5, Figure 11-6 on page 277 is displayed.

Then Enter the dump data set name to initiate the analysis. This Option is mainly used to initiate an interactive analysis of a SYSMDUMP or SVC dump data set and is primarily intended for CICS system dump analysis or Java dump analysis.

> **Note:** The data set name specification follows the ISPF data set name rules, that is, a data set name that is not enclosed in single quotes is prefixed with the current TSO profile prefix.

The data set specified is checked for existence before being accepted. In Figure 11-6 on page 277, data set `CICS.GS075.P78308.C724.D111110.N4039.SYD` is being analyzed.

The last data set name specified is stored in the ISPF profile for your application ID and is used for initialization of the display.

```
 File  View  Services  Help
------------------------------------------------------------------------------
Analyze MVS Dump Data Set

Enter the name of a MVS SVC or SYSMDUMP data set and press Enter to initiate
analysis. To return from this display without performing analysis, issue the
Exit (PF3) or Cancel (PF12) command.

Dump Data Set Name. . . . . : 'CICS.GSO75.P78308.C724.D111110.N4039.SYD'

*** Bottom of data.
```

Figure 11-6 Enter dump data set name

11.5 Invoke Fault Analyzer from ISPF

```
  Menu  List  Mode  Functions  Utilities  Help
------------------------------------------------------------------
                              ISPF Command Shell
Enter TSO or Workstation commands below:

===> ex 'IDI.SIDISAM1(IDISISPF)'
_________________________________
__________________________________________________________________
__________________________________________________________________


Place cursor on choice and press enter to Retrieve command

=> ex 'IDI.SIDISAM1(IDISISPF)'
=> wlm
```

Figure 11-7 ISPF Option 6 panel to invoke Fault Analyzer

Invoke Fault Analyzer from ISPF

Note: A sample REXX EXEC that can be used to invoke Fault Analyzer from within ISPF is provided as member IDISISPF in data set IDI.SIDISAM1. The EXEC performs the necessary dynamic definition of the required data sets using the ISPF LIBDEF and TSO ALTLIB services.

To enable edit or browse of data sets using IBM File Manager for z/OS, all necessary ISPF libraries for File Manager must be made available also when Fault Analyzer is invoked. Refer to the File Manager documentation for information about the required data set names that should be added to your TSO logon procedure or invocation exec. The IDISISPF sample exec allows you to optionally include File Manager data sets.

To help with diagnosis of problems relating to the allocation of data sets for Fault Analyzer, the TSO/ISPF commands ISRDDN, ISRFIND, or ISPLIBD might be useful.

While IDISFA will work as a line command against ISPF 3.4 data sets, as long as IDI.SIDIEXEC is included in the SYSEXEC concatenation, it might be more convenient to copy this exec to another data set in the SYSEXEC concatenation with a shorter name, for example FA, or use the following command from the ISPF Option 6 command line:

```
ex 'IDI.SIDISAM1(IDISISPF)'
```

This command displays Figure 11-8 on page 279.

11.6 IBM Fault Analyzer history files

```
  File  Options  View  Services  Help
─────────────────────────────────────────────────────────────────────────────
IBM Fault Analyzer - Fault Entry List                          Line 1 Col 1 80
Command ===> ______________________________________________  Scroll ===> CSR

Fault History File or View  : 'WTSCPLX1.IDI.HIST'

{The following line commands are available: ? (Query), V or S (View saved
report), I (Interactive reanalysis), B (Batch reanalysis), D (Delete), H
(Duplicate history), C (Copy fault entry), M (Move fault entry), X (XMIT fault
entry).}

   Fault_ID Job/Tran User_ID  Sys/Job  Abend  Date       Time
I__  F01230 RD803RD9 DAVIS    SC47     SE37   2011/12/14 04:37:00
___  F01229 RD803RD7 DAVIS    SC47     SE37   2011/12/12 07:07:49
___  F01228 RD803RD7 DAVIS    SC47     S002   2011/11/23 05:06:22
___  F01227 PFA3     PFA      SC55     U4088  2011/11/04 10:43:26
___  F01226 IMS11IF3 STC      SC47     U0458  2011/10/20 07:15:08
___  F01225 IMS11IF2 STC      SC47     U0458  2011/10/20 07:15:03
___  F01224 IMS11IF3 STC      SC47     U0458  2011/10/20 07:15:02
___  F01223 IMS11IF2 STC      SC47     U0458  2011/10/20 07:15:02
___  F01222 JOUKO5S2 JOUKO5   SC66     U3007  2011/10/20 05:02:35
___  F01221 PFA7     PFA      SC55     U4088  2011/10/03 04:26:24
___  F01220 PFA2     PFA      SC55     U4088  2011/10/01 23:50:22
___  F01219 PFA1     PFA      SC55     U4088  2011/09/30 10:12:47
___  F01218 RD803RD7 DAVIS    SC47     SE37   2011/09/29 11:16:04
```

Figure 11-8 IBM Fault Analyzer history files

Fault history files

Fault Analyzer performs fault analysis processing, and then records details about the abend in a history file. It writes the fault analysis report to the job, and a summary to the SYSLOG. It also saves the analysis report in the history file along with a minidump consisting of a copy of all virtual storage pages that were referenced during the analysis process. This mode of operation is known as “real-time analysis”.

Fault history files are PDS(E) data sets that contain information about faults that have been analyzed by Fault Analyzer. Fault entries, which are stored as separate members in the history file, as shown in Figure 11-8, contain the following type of information:

- Real-time analysis key information, such as abend code and failing program name
- Execution environment details, such as job name, system ID, and date and time when the fault occurred
- Associated real-time analysis report (if applicable)
- Saved minidump (if applicable)
- Name of associated SYSMDUMP or SVC dump data set (if applicable)

Each new fault entry in a history file is given an identifier, which is unique to that history file. The ID consists of a 1-3 character prefix, and the default is F, followed by a 5-digit sequence number.

Note: Although a history file can be either a PDS or a PDSE data set, PDSE data sets are recommended because they provide concurrent member write capability, which is not possible with PDS data sets. This allows Fault Analyzer to provide better sharing and performance when using PDSE history files.

Select a dump to analyze

The options, as shown in Figure 11-8 on page 279, are the following line commands:

- ? (Query)
- V or S (View saved report)
- I (Interactive reanalysis)
- B (Batch reanalysis)
- D (Delete
- H (Duplicate history)
- C (Copy fault entry)
- M (Move fault entry)
- X (XMIT fault entry).}

Interactive reanalysis (I)

As shown in Figure 11-9 on page 281, when you enter an I next to a history file as shown in Figure 11-8 on page 279, when the specified MVS dump data set name has been validated, the Fault Analyzer CICS system abend analysis commences as indicated by the message being displayed in Figure 11-9 on page 281:

“`Analyzing MVS dump data set. Please wait...`”

11.7 Analyzing dumps with Fault Analyzer

```
  File  Options  View  Services  Help
──────────────────────────────────────────────────────────────────────────────
IBM Fault Analyzer - Fault Entry List                           Line 1 Col 1 80
Command ===> ______________________________________________   Scroll ===> CSR

Fault History File or View  : 'WTSCPLX1.IDI.HIST'

{The following line commands are available: ? (Query), V or S (View saved
report), I (Interactive reanalysis), B (Batch reanalysis), D (Delete), H
(Duplicate history), C (Copy fault entry), M (Move fault entry), X (XMIT fault
entry).}

   Fault_ID Job/Tran User_ID  Sys/Job  Abend  Date       Time
___  F01230 RD803RD9 DAVIS    SC47     SE37   2011/12/14 04:37:00
___  F01229 RD803RD7 DAVIS    SC47     SE37   2011/12/12 07:07:49
___  F01228 RD803RD7 DAVIS    SC47     S002   2011/11/23 05:06:22
___  F01227 PFA3     PFA      SC55     U4088  2011/11/04 10:43:26
___  F01226 IMS11IF3 STC      SC47     U0458  2011/10/20 07:15:08
___  F01225 IMS11IF2 STC      SC47     U0458  2011/10/20 07:15:03
___  F01224 IMS11IF3 STC      SC47     U0458  2011/10/20 07:15:02
___  F01223 IMS11IF2 STC      SC47     U0458  2011/10/20 07:15:02
___  F0122      Analyzing MVS dump data set. Please wait...        2:35
___  F0122                                                          6:24
___  F01220 PFA2     PFA      SC55     U4088  2011/10/01 23:50:22
___  F01219 PFA1     PFA      SC55     U4088  2011/09/30 10:12:47
___  F01218 RD803RD7 DAVIS    SC47     SE37   2011/09/29 11:16:04
```

Figure 11-9 Analyzing an MVS dump data set

Analyzing dumps with Fault Analyzer

The purpose of Fault Analyzer is to determine why an application abends. After analyzing information about the application and its environment, Fault Analyzer generates an analysis report. The report describes the problem in terms of application code, which means that application developers and system programmers are not forced to interpret a low-level system dump or system-level error messages. As a result, the reason for the abend is made available sooner and with less effort.

Figure 11-10 on page 282 is displayed when the analysis of the “SYSTEM ABEND: 0C4:” , is complete. This Interactive Reanalysis Report is the first display shown when interactive reanalysis has finished analyzing a fault. It includes a brief summary of the fault and provides access to key areas of the analysis.

```
   File  View  Services  Help
────────────────────────────────────────────────────────────────────────────────
Interactive Reanalysis Report                                Line 1 Col 1 80
Command ===>                                                 Scroll ===> CSR
JOBNAME: VALDEMO   SYSTEM ABEND: 0C4            SC52      2012/03/05  11:24:59

Fault Summary:
Module GO, CSECT VALDEMO, offset X'CD0': Abend S0C4-X'11' (Page-Translation
Exception).

Select one of the following options to access further fault information:
  1. Synopsis
  2. Event Summary
  3. Storage Areas
  4. Messages
  5. Abend Job Information
  6. Fault Analyzer Options

{Fault Analyzer maximum storage allocated: 0.80 megabytes.}

*** Bottom of data.
```

Figure 11-10 Sample Interactive Reanalysis Report display

Interactive Reanalysis Report panel

There are six options shown in Figure 11-10 for the Report, but there are many possible options that can be displayed depending on the abend type. For the particular abend, the options shown are:

1. Synopsis Selecting the Synopsis option shows a display that summarizes the analysis of the fault. The synopsis will normally contain all of the information that is required to diagnose and fix the problem that caused the fault.

2. Event Summary Selecting the Event Summary option displays a summary list of all the events associated with the fault. This display is particularly useful for getting an overview of complex faults involving numerous abends and other events.

3. Storage Areas Selecting the Storage Areas option provides access to information about storage areas for all events.

4. Messages Selecting the Messages option provides access to information about all messages issued, regardless of the event to which they might belong.

5. Abend Job Information Selecting the abend job information option provides information about the execution environment of the abending job.

6. Fault Analyzer Options Selecting Fault Analyzer options provides information about the Fault Analyzer options that were in effect during the fault analysis.

11.8 A CICS selected dump

```
   File  View  Services  Help
─────────────────────────────────────────────────────────────────────────────
Interactive Reanalysis Report                                 Line 1 Col 1 80
Command ===>                                                  Scroll ===> HALF
SYSTEM=SCSCPAZ2 CODE=PI0001   ID=1/0001         SC54      2012/01/19  10:53:31

Select one of the following options and press Enter to access further fault
info:

   1.  Synopsis
   2.  Abend Job Information
   3.  CICS System Information
   4.  Fault Analyzer Options


DFHPI0001 SCSCPAZ2 An abend (code 0C4/AKEA) has occurred at offset X'2B54' in
module DFHPIWR.


*** Bottom of data.
```

Figure 11-11 A CICS selected dump

CICS selected dump

When the analysis of the CICS system abend has completed, the CICS system abend interactive report is shown Figure 11-11. From this panel, you can display the following information:

- For Option 1 - Synopsis, see “1. Synopsis” on page 283.
- For Option 2 - Abend Job Information, see “2. Abend Job Information” on page 284.
- For Option 3 - CICS System Information, see “3. CICS System Information” on page 286.
- For Option 4 - Fault Analyzer Options, see “4. Fault Analyzer options” on page 291.

1. Synopsis

Selecting option 1 from the CICS System Abend Interactive Reanalysis Report display results in the presentation of the CICS System Abend Synopsis display, of which an example is shown in Figure 11-12 on page 284.

This display provides details about the analyzed dump.

```
Synopsis                                                        Line 1 Col 1 80
Command ===> ________________________________________________  Scroll ===>HALF
SYSTEM=SCSCPAZ2 CODE=PI0001   ID=1/0001        SC54      2012/01/19  10:53:31

Fault Information:

 CICS Product Level. . . . . : V6 R6 M0
 Dump Id . . . . . . . . . . : 1/0001
 Dump Code . . . . . . . . . : PI0001
 Date/Time . . . . . . . . . : 2012/01/19 10:53:31 (Local)
 Message . . . . . . . . . . : DFHPI0001 SCSCPAZ2 An abend (code 0C4/AKEA) has
                               occurred at offset X'2B54' in module DFHPIWR.
 Symptoms. . . . . . . . . . : PIDS/5655S9700 LVLS/660 MS/DFHPI0001
                               RIDS/DFHPIWR PTFS/UK57403 AB/S00C4 AB/UAKEA
                               ADRS/00002B54
 Title . . . . . . . . . . . : n/a
 Caller address. . . . . . . : n/a

*** Bottom of data.
```

Figure 11-12 A CICS System Abend Options display

2. Abend Job Information

Selecting option 2 from the CICS System Abend Interactive Reanalysis Report display results in the presentation of the Abend Job Information display, of which an example is shown in Figure 11-13 on page 285.

```
SYSTEM=SCSCPAZ2 CODE=PI0001   ID=1/0001        SC54      2012/01/19  10:53:31

Job information:

 Abend Date. . . . . . . . . : 2012/01/19
 Abend Time. . . . . . . . . : 10:53:31
 System Name . . . . . . . . : SC54
 Subsystem Info. . . . . . . : CICS V6 R6 M0  (TS 4.1)
 Job Name. . . . . . . . . . : CICSPAZ2
 Job Step Name . . . . . . . : CICSPAZ2
 Exec Program Name . . . . . : DFHSIP
 Requested Region Size . . . : 0M
 User id . . . . . . . . . . : CICSUSER

Execution Environment:

 Operating System. . . . . . : z/OS     V01R11M00
 Data Facility Product . . . : DFSMS z/OS V1R11M0
 CPU Model . . . . . . . . . : 2097

SDUMP Parameter List:

 +0000  FLAG0.... 12        FLAG1.... A1        SDATA.... BFE2      DCBAD....
 +0010  ECBAD.... 00000000  SRBAD.... 00000000  CASID.... 0057      TASID....
 +0020  SDDAT.... 00000000  FLAG2.... 00        CNTL1.... C0        TYP1.....
 +002C  EXIT..... FD40      SDAT3.... 40        SDAT4.... 00        SPLST....
+002C  EXIT..... FD40      SDAT3.... 40        SDAT4.... 00        SPLST....
 +003C  DCBA..... 00000000  STRAL.... 00000000  HDRA..... 00000000  ASDLA....
 +0054  KEYLA.... 00000000  LSTDP.... 00000000  LSTDA.... 00000000  SMLLP....
 +006C  PSWRA.... 00000000  SYMAD.... 00000000  SYMA..... 00000000  IDAD.....
 +0084  SLALT.... 00000000  ITADR.... 0221F398  ITALT.... 00000000  RMADR....
 +009C  PDALT.... 00000000  JLADR.... 00000000  JLALT.... 00000000  DLADR....

SDATA Options:

 ALLNUC (All Nucleus). . . . . . .: Yes
 ALLPSA (All Prefix Save Areas). .: Yes
 COUPLE (Coupling Facility). . . .: Yes
 CSA (MVS Common Service Area) . .: Yes
 DEFAULTS. . . . . . . . . . . . .: No
 GRSQ (Resource Serialization) . .: Yes
 IO (Input/Output) . . . . . . . .: Yes
 LPA (Link Pack Area). . . . . . .: Yes
 LSQA (Local System Queue Area). .: Yes
 NUC (Nucleus) . . . . . . . . . .: Yes
 PSA (Prefix Save Area). . . . . .: No
 RGN (Private Region). . . . . . .: Yes
 SQA (System Queue Area) . . . . .: Yes
 SUM (Summary Dump). . . . . . . .: Yes
 SWA (Scheduler Work Area) . . . .: Yes
 TRT (MVS Trace Tables). . . . . .: Yes
---------------------------------- more data -------------
```

Figure 11-13   Abend Job Information display

3. CICS System Information

Selecting option 3 from the CICS System Abend Interactive Reanalysis Report display results in the presentation of the CICS System Information display, of which an example is shown in Figure 11-14.

```
SYSTEM=SCSCPAZ2 CODE=PI0001   ID=1/0001        SC54      2012/01/19  10:53:31

Select one of the following options and press Enter:

  1.   CICS Task Summary
  2.   Error History
  3.   Storage Usage by Task
  4.   MTRACE records

  AI   - AutoInstall Manager           AP   - Application Domain
  BR   - Bridge Information            CC   - Catalog Domains
  CQ   - Console Queue Component       CSA  - Common System Area
  DB2  - DB2 Information               DD   - Directory Domain
  DH   - Document Handler Domain       DLI  - DL/I Information
  DM   - Domain Manager                DP   - Debug Profile Domain
  DS   - Dispatcher Domain             DU   - Dump Domain
  EJ   - Enterprise Java Domain        FC   - File Control
  IC   - Interval Control              IS   - ISC/IP Domain
  KE   - Kernel Domain                 LD   - Loader Domain
  LG   - Log Manager Domain            LM   - Lock Manager Domain
  ME   - Message Domain                MN   - Monitoring Domain
  MRO  - Multiregion Option            MQ   - MQ Domain
  NQ   - Enqueue Domain                OT   - Object Transaction Domain
  PA   - Parameter Domain              PG   - Program Manager Domain
  PI   - Pipeline Manager Domain       PR   - Partner Resource Manager
  PT   - Partner Domain                RM   - Recovery Manager Domain
  RS   - Region Status Domain          RZ   - Request Stream Domain
  SIT  - System Initialization Table   SJ   - SJ (JVM) Domain
  SM   - Storage Manager Domain        SO   - Sockets Domain
  SSA  - Static Storage Areas          ST   - Statistics Domain
  TCP  - Terminal Control Definitions  TD   - Transient Data Domain
  TI   - Timer Domain                  TMP  - Table Manager
  TR   - Trace Domain                  TS   - Temporary Storage Domain
  US   - User Domain                   UEH  - Global User Exit Details
  WB   - Web Domain                    XM   - Transaction Manager Domain
  XS   - Security Domain
  LCK  - Lock Owner/Waiter Information
  TRC  - CICS Trace
  NMT  - MVS Name/Token Pairs
*** Bottom of data.
```

Figure 11-14 CICS System Information display

Error History

If you Select Option 2 in Figure 11-14, the Error History, all errors that have been found in the dump are displayed, as shown in Figure 11-15 on page 287.

If you would like to get detailed information for a specific entry, select the entry by using an S in the Err_Num column, as shown in Figure 11-15, to provide the error information, such as PSW, Registers, and much more, as shown in Figure 11-16 on page 288.

```
 KE Error Table Summary                                       Line 1 Col 1 80
Command ===> ________________________________________________ Scroll ===> HALF
SYSTEM=SCSCPAZ2 CODE=PI0001   ID=1/0001        SC54      2012/01/19  10:53:31

To review error data, tab to Err_Num and press Enter.

Err_Num   Err_Time  KE_NUM  Error Type            Err_Code  Module   Offset
S0000001  15:53:31  0028    PROGRAM CHECK         0C4/AKEA  DFHPIWR  00002B54

*** Bottom of data.
```

Figure 11-15 Error Table Summary

```
KE Domain Error Data                                             Line 1 Col 1 80
Command ===>                                                    Scroll ===> HALF
SYSTEM=SCSCPAZ2 CODE=PI0001   ID=1/0001        SC54      2012/01/19  10:53:31

Error Number: 00000001   Error Code: 0C4/AKEA   Error Type: PROGRAM CHECK

Date (GMT): 2012/01/19   Time (GMT): 15:53:31

KE Error Data Address: 14C86E50 KE_NUM: 0028   TCA Addr: 153D6100   DS_TASK: 3

Error occurred in program DFHPIWR  at offset 00002B54 under the CICS RB in bas

Execution key at Program Check/Abend:  8
Instruction Length: 6   Interrupt Code: 0010   Exception Address: 5722C000

Branch Event Address:  157EC206  Module DFHPIDML + X'EC206'

PSW:  078D1000 157EC14C Module DFHPIDML + X'EC14C'

CICS Registers:

R0:  00000108  1784 bytes of storage addressable
R1:  35380F90  65648 bytes of storage addressable
R2:  00000010  2032 bytes of storage addressable
R3:  157F1BC8  Module DFHPIDML + X'F1BC8'
R4:  00000001  2047 bytes of storage addressable
R5:  5722C050  Storage invalid
R6:  5722C050  Storage invalid
R7:  16E2BFD8  508563496 bytes of storage addressable
R8:  35380778  67720 bytes of storage addressable
R9:  00000015  2027 bytes of storage addressable
R10: 16A77BC0  512447552 bytes of storage addressable
R11: 16E28000  508579840 bytes of storage addressable
R12: 153D6100  Task 00032 User TCA + X'0'
R13: 35380990  KE STACK Entry, TranNum 00032. Module DFHPIWR  + X'0'
R14: 957EBEFA  Module DFHPIDML + X'EBEFA'
R15: 94B00400  Module DFHSIP + X'400'
```

Figure 11-16 PSW and Registers output

Obtain LE or trace information

If you would like to get LE or trace information for an entry shown in Figure 11-15 on page 287, you need the KE_NUM. The next panels show how to get debug information, in our case LE related, for KE_NUM 0028.

Select Option 1 in Figure 11-14 on page 286 and Figure 11-17 on page 289 is displayed, which shows KE_NUM 0028.

```
   File  View  Services  Help
------------------------------------------------------------------------------
 CICS Task Summary                                                 Line 1 Col 1 80
 Command ===>                                                     Scroll ===> HALF
 SYSTEM=SCSCPAZ2 CODE=PI0001   ID=1/0001         SC54      2012/01/19  10:53:31

 To review task details, tab to KE_Num or Tran# and press Enter.

                                      Initial   Facility
 KE_NUM  Status        Tran#  Tran ID  Program   ID       Error
 000A    Not Running   00030  CISE     DFHISEMP  n/a
 000D    Not Running   00033  CPIR     DFHPIITL  n/a
 000F    Not Running   00031  CISM     DFHISRSP  n/a
 0011    Not Running   00006  CSSY     DFHAPATT  n/a
 0014    Not Running   00004  CSOL     DFHSOL    n/a
 0015    Not Running   00029  CISR     DFHISRRP  n/a
 0017    Not Running   00007  CSSY     DFHAPATT  n/a
 0018    Not Running   00005  CEPM     DFHEPSY   n/a
 001C    Not Running   TCP    CSTP     DFHZCSTP  n/a
 S028    ***Running**  00032  CPIR     DFHPIITL  n/a      *YES*
 0029    Not Running   00027  CSHQ     DFHSHSY   n/a
 0038    Not Running   00023  CSNC     DFHCRNP   n/a

 *** Bottom of data.
```

Figure 11-17 Display of KEY_NUM 0028

Select this entry, KE_NUM 0028, as shown in Figure 11-17, and Figure 11-18 on page 290 is displayed.

```
CICS Task Detail                                                  Line 1 Col 1 80
Command ===>                                                     Scroll ===> HALF
SYSTEM=SCSCPAZ2 CODE=PI0001   ID=1/0001         SC54      2012/01/19  10:53:31

                     Tran           Initial  Facility
KE_NUM Status        Number Tran ID Program  Id       In Error Userid
0028   ***Running**  00032  CPIR    DFHPIITL n/a      *YES*    n/a

Attach Date/Time. .: 2012/01/19 15:53:31
Current program . .: DFHPIITL

AP Info                  Kernel Info             Storage Info
UTCA     : 153D6100      KE_TASK : 3537AA98      SMX : 152D4174
STCA     : 153D6200      KE_KTCB : 14CD6FF8
EIB      : 16A760D0
SEIB     : 153D6514
EIS      : 153D6408
EIUS     : 16A76008
TWA      : 00000000

XM Info                  DS Info                 Facility Info
TXN      : 1530AB00      DS_TASK : 35307200      Type    : n/a
TXD      : 16C17AD0                              Name    : n/a
                                                 Address : n/a

PG Link Levels (includes channel information)
AP Link Levels

Language Environment is not active in this task

Trace Entries for this Task

Task Interface Elements

Last EXEC CICS Command

*** Bottom of data.
```

Figure 11-18 CICS Task Detail display

Note: As shown in Figure 11-18, Language Environment is not active in this task.

From a dump where it was active, see Figure 11-19 on page 291. By placing the cursor to that line and pressing Enter, you receive LE debug information as shown in Figure 11-19 on page 291. Using the CAA pointer you can get more debug information from the dump.

```
 File  View  Services  Help
------------------------------------------------------------------------------
Language Environment Information For Task 95978
SYSTEM=FDOACIP3 CODE=4039     ID=4/0009         EGGD      2011/11/10  09:28:09

Link Level 2 (active at time of dump)

Program Name. . . . . . . . . . . . . . . . . . . : SLOJRLP
PPTE Address. . . . . . . . . . . . . . . . . . . : 19BFD088
Environment Type. . . . . . . . . . . . . . . . . : EXEC

Common Anchor Area (CAA) Address. . . . . . . . . : 1BC396E8
Region Control Block (RCB) Address. . . . . . . . : 0010B3F0
Enclave Data Block (EDB) Address. . . . . . . . . : 1BC374D8
Process Control Block (PCB) Address . . . . . . . : 19713240
Options Control Block (OCB) Address . . . . . . . : 1BC37BE0
LE Heap Analysis - ENSM Address . . . . . . . . . : 1BC379A0
Storage Management Control Block (SMCB) Address : 1BC39F58
Thread Work Area (TWA) Address. . . . . . . . . . : 19710478
Number Of Conditions (CIBs) . . . . . . . . . . . : 1

Link Level 1

Program Name. . . . . . . . . . . . . . . . . . . : EDQJROP
PPTE Address. . . . . . . . . . . . . . . . . . . : 19936920
Thread Work Area (TWA) Address. . . . . . . . . . : 19710478
Number Of Conditions (CIBs) . . . . . . . . . . . : 1

Link Level 1

Program Name. . . . . . . . . . . . . . . . . . . : EDQJROP
PPTE Address. . . . . . . . . . . . . . . . . . . : 19936920
Environment Type. . . . . . . . . . . . . . . . . : EXEC

Common Anchor Area (CAA) Address. . . . . . . . . : 1BC043A8
Region Control Block (RCB) Address. . . . . . . . : 0010B3F0
Enclave Data Block (EDB) Address. . . . . . . . . : 1BC02198
Process Control Block (PCB) Address . . . . . . . : 19713240
Options Control Block (OCB) Address . . . . . . . : 1BC028A0
LE Heap Analysis - ENSM Address . . . . . . . . . : 1BC02660
Storage Management Control Block (SMCB) Address : 1BC04C18
Thread Work Area (TWA) Address. . . . . . . . . . : 19710478
Number Of Conditions (CIBs) . . . . . . . . . . . : 0


*** Bottom of data.
```

Figure 11-19 LE debug output

4. Fault Analyzer options

Selecting option 4 from the CICS System Abend Interactive Reanalysis Report display results in the presentation of the Options in Effect display, of which an example is shown in Figure 11-20 on page 292.

```
SYSTEM=SCSCPAZ2 CODE=PI0001   ID=1/0001        SC54      2012/01/19  10:53:31

IBM Fault Analyzer Options in Effect:

  {These are the options that were used to generate the current interactive
  reanalysis report. To change any options, first return to the Fault Entry
  List display and select "Interactive Reanalysis Options" from the "Options"
  action-bar pull-down menu; then perform interactive reanalysis again.}

  NoErrorHandler
  FaultID(F01254)
  Language(ENU)
  NoLocale
  NoPermitLangx

  Data Sets:

    {The following Fault Analyzer data set or path names were either
    preallocated, specified via DataSets options, or provided as defaults.}

    DDname   Data Set or Path Name
    IDIBOOKS IDI.SIDIBOOK
    IDIDOC   IDI.SIDIDOC1
    IDIHIST  WTSCPLX1.IDI.HIST
    IDIMAPS  IDI.SIDIMAPS
    IDIVSENU WTSCPLX1.IDI.IDIVSENU
*** Bottom of data.
```

Figure 11-20 Fault Analyzer options

A

IPCS tools and lab exercises

The interactive problem control system (IPCS) is a tool provided in MVS to aid in diagnosing software failures. IPCS provides formatting and analysis support for dumps and traces produced by MVS, other program products, and applications that run on MVS.

Dumps produced by MVS fall into two categories:

- Formatted dumps: SYSABEND and SYSUDUMP ABEND dumps and SNAP dumps. IPCS cannot be used with formatted dumps.
- Unformatted dumps: SVC dumps, SYSMDUMP ABEND dumps, and stand-alone dumps. IPCS formats and analyzes unformatted dumps.

When you submit unformatted dump data sets to IPCS, it simulates dynamic address translation (DAT) and other storage management functions to recreate the system environment at the time of the dump. IPCS reads the unformatted dump data and translates it into words. For example, IPCS can identify the following:

- Jobs with error return codes
- Resource contention in the system
- Control block overlays
- Processor usage
- IPL information
- Sysplex and I/O problems

The information here should guide you in how to use IPCS and get information from a dump. The dump can be downloaded.

A.1 IPCS lab exercise agenda

- Introduction to IPCS and dumps
- IPCS tools
- Diagnosing loops and hangs
- Downloading dumps using FTP
  - IPCS default settings
  - Commands to analyze dump

Figure A-1 IPCS and dump analysis

Introduction to IPCS and dumps

The following topics are described is this appendix:

- How the lab is presented
- How to get into IPCS and set up to view the first dump
- Other related sessions

IPCS commands

This appendix describes the use of the following IPCS commands:

- List Title/List SLIP trap
- Status worksheet
- Formatting the RTCT
- ST REGS
- SYSTRACE
- VERBX MTRACE
- Key fields in SUMMARY FORMAT
- ANALYZE RESOURCE

How to start with debugging

You can download the following dumps from the Redbooks site:

- Dump of a job using excessive processor time
- Dump of a hung TSO user
- Abend dumps (0C1, 0C4)
- Message slip dump
- Storage abend 878
- Dump of a hung job that is a contention problem
  - Be warned there is a tremendous amount of material in this lab.
  - The on-page title indicates exercises on that page.
  - Each exercise details commands to be entered.

A flowchart available at the end of the presentation on diagnosing loops and hangs shows the methodology used to diagnose the dumps. Consider the following when using the dumps:

- Everybody develops their own method over time.
- Use them as a starting point in understanding how to look at dumps.

How to download dumps using FTP to locate the Web material

The Web material associated with this book is available in softcopy on the Internet from the IBM Redbooks Web server. The additional Web material that accompanies this book includes the following files:

File name	Description
SG246988.zip	Zipped DUMPs - (13 DUMPs)

> **Attention:** The dump data sets you are going to download are in tersed format.

Point your Web browser to:

`ftp://www.redbooks.ibm.com/redbooks/SG246988`

Alternatively, you can go to the IBM Redbooks Web site at:

ibm.com/redbooks

Select **Additional materials** and open the directory that corresponds with the book form number, SG246988.

Text from the IBM Redbooks Web site

The directories on our FTP server contain additional materials such as code samples for specific Redbooks. If there is additional media, such as a diskette or CD-ROM included with the hardcopy book, it should be located in the directory with the same name as the IBM Redbooks form number (SG24xxxx). Just click the specific directory and you will find the text or binary files. Normally they are zipped to make file transfer faster and more reliable.

If your browser does not properly recognize the file extension, it may try to display the file rather than present a download window. If this happens, right click the file and select **Save Link as** or **Save Target as**, and your browser's normal download window will be presented.

Click here to get to the directory listing of additional materials to download.

(The save directory is one that you select.) The SG246988.zip file is now saved in a directory on your workstation.

How to use the downloaded material

Perform the following tasks:

1. Unzip the supplied SG246988.zip to a temporary directory. The dumps in this file are tersed.

   The dump data set names are shown in Figure A-2.

```
Data sets                                         Tracks
ITSO.ABCVOL8.AB0C4.TERSE
ITSO.ABCVOL8.ENQHANG.TERSE
ITSO.ABCVOL8.USERCPU.TERSE
ITSO.ABCVOL8.WAIT083.TERSE
ITSO.ABCVOL8.AB047.TERSE
ITSO.ABCVOL8.AB0C1.TERSE
ITSO.ABCVOL8.SECURUSS.TERSE
ITSO.ABCVOL8.AB878CSA.TERSE
ITSO.ABCVOL8.AB878.TERSE
ITSO.ABCVOL8.ABU4083.TERSE
```

Figure A-2 The dump data set names that are downloaded

2. Use the following commands, shown in Figure A-3 on page 297, from the PC to upload the dumps to your MVS system. In the following example, the c:\temp directory is used. You need to specify where you saved the zip file if you did not use the c:\temp directory.

```
cd c:\temp
ftp 'your MVS system IP address'
C:\temp>ftp wtsc43.itso.ibm.com (our MVS system IP address)
Connected to wtsc43.itso.ibm.com.
220-FTP Server (user 'paulroge@us.ibm.com')
220 User (wtsc43.itso.ibm.com:(none)): 'enter your MVS user ID
331 Send password please.
Password: 'enter your password'
230-220-FTPMVS1 IBM FTP CS V1R7 at wtsc43.itso.ibm.com, 21:29:14 on 2007-02-26.
230-ROGERS is logged on.  Working directory is "ROGERS.".
ftp> quote site blk=6144 lrecl=1024 recfm=fb tracks unit=sysallda primary=90
200 Site command was accepted
ftp> binary
200 Representation type is IMAGE.
ftp> put ITSO.ABCVOL8.AB0C4.TERSE
200 Port request OK.
125 Storing data set ITSO.
250 Transfer completed successfully.
ftp> quote site blk=6144 lrecl=1024 recfm=fb tracks unit=sysallda primary=xxx
ftp> put ITSO.ABCVOL8.AB0C4.TERSE
ftp> quote site blk=6144 lrecl=1024 recfm=fb tracks unit=sysallda primary=xxx
ftp> put ITSO.ABCVOL8.ENQHANG.TERSE
ftp> quote site blk=6144 lrecl=1024 recfm=fb tracks unit=sysallda primary=xxx
ftp> put ITSO.ABCVOL8.USERCPU.TERSE
ftp> quote site blk=6144 lrecl=1024 recfm=fb tracks unit=sysallda primary=xxx
ftp> put ITSO.ABCVOL8.WAIT083.TERSE
ftp> quote site blk=6144 lrecl=1024 recfm=fb tracks unit=sysallda primary=xxx
ftp> put ITSO.ABCVOL8.AB047.TERSE
ftp> quote site blk=6144 lrecl=1024 recfm=fb tracks unit=sysallda primary=xxx
ftp> put ITSO.ABCVOL8.AB0C1.TERSE
ftp> quote site blk=6144 lrecl=1024 recfm=fb tracks unit=sysallda primary=xxx
ftp> put ITSO.ABCVOL8.SECURUSS.TERSE
ftp> quote site blk=6144 lrecl=1024 recfm=fb tracks unit=sysallda primary=xxx
ftp> put ITSO.ABCVOL8.AB878CSA.TERSE
ftp> quote site blk=6144 lrecl=1024 recfm=fb tracks unit=sysallda primary=xxx
ftp> put ITSO.ABCVOL8.AB878.TERSE
ftp> quote site blk=6144 lrecl=1024 recfm=fb tracks unit=sysallda primary=xxx
ftp> put ITSO.ABCVOL8.ABU4083.TERSE
```

Figure A-3 Commands to FTP dumps to the MVS system

3. Once the dump data sets have been copied to the MVS system, they must be untersed. If you do not have the terse utility as part of your TSO environment, see the following note.

Note: Decompress *all* data sets using TRSMAIN, which can be downloaded from:

- ftp://ftp.software.ibm.com/s390/mvs/tools/packlib/

A.2 IPCS lab setup instructions

- ❑ Choose Option 0 to set defaults
  - ➢ Specify processing to be performed by IPCS dialogs and subcommands
  - ➢ IPCS and dump release should be the same!

```
 ------------------- z/OS 01.08.00 IPCS PRIMARY OPTION MENU  -------------------
OPTION  ===>
                                                           ********************
   0  DEFAULTS     - Specify default dump and options      * USERID  - ROGERS
   1  BROWSE       - Browse dump data set                  * DATE    - 07/02/05
   2  ANALYSIS     - Analyze dump contents                 * JULIAN  - 07.036
   3  UTILITY      - Perform utility functions             * TIME    - 11:52
   4  INVENTORY    - Inventory of problem data             * PREFIX  - ROGERS
   5  SUBMIT       - Submit problem analysis job to batch  * TERMINAL- 3278T
   6  COMMAND      - Enter subcommand, CLIST or REXX exec  * PF KEYS - 24
   T  TUTORIAL     - Learn how to use the IPCS dialog      ********************
   X  EXIT         - Terminate using log and list defaults

Enter END command to terminate IPCS dialog
```

Figure A-4 IPCS PRIMARY OPTION MENU

IPCS primary options

At the IPCS primary options panel choose Option 0 for defaults, as shown in Figure A-4. When you press Enter, you receive the panel with the default settings. Add the dump data set name to the Source field to initialize the dump. Following are the IPCS default settings. Add your dump data set name and change Scope from local to both

```
Scope   ==> LOCAL (LOCAL, GLOBAL, or BOTH)
Source  ==> DSNAME('xxx.yyy.dump')
Address Space   ==>
Message Routing ==> NOPRINT TERMINAL
Message Control ==> CONFIRM VERIFY FLAG(WARNING)
Display Content ==> NOMACHINE REMARK REQUEST NOSTORAGE SYMBOL

Press ENTER to update defaults.
Use the END command to exit without an update.
```

A.3 Commands to analyze dumps

- Command to determine the dump type
  - IP LIST TITLE
- Command to determine what the dump represents
  - IP LIST SLIPTRAP
- Command to determine useful information
  - IP ST WORKSHEET
  - IP IPLDATA
  - IP SYSTRACE

Figure A-5 IPCS commands to analyze a dump

IP LIST TITLE

Use the IP LIST TITLE command to get a first guess as to what the dump represents. Look for the following kinds of information:

- System generated dumps typically have a COMPID= and other system-generated information, depending on the recovery routine that takes the dump.
- Console dumps have a title of whatever the user puts in COMM= as the dump title.
- Dumps taken as a result of a slip trap have a SLIP trap ID in them.
- Any program can issue an SDUMP macro and generate a title of its choosing. For IBM products a dump title directory can be found in Chapter 10 of *z/OS MVS Diagnosis: Reference*, GA22-7588.

The IP LIST TITLE command can be used to get the title of the dump, as follows:

```
IP LIST TITLE
TITLE
LIST 00000000 LITERAL LENGTH(X'58') CHARACTER
COMPON=BPX,COMPID=SCPX1,ISSUER=BPXMIPCE,MODULE=BPXFSCLS+16D6,ABEND=S00C4,REASON
=00000004
```

Lab exercise #1

Analyzing a SLIP trap dump.

Lab exercise #1:

- Enter IPCS.
- Specify the dump by typing `=0` (zero) on the IPCS command line.
- Change the DSNAME to ITSO.ABCVOL8.AB0C4.
- Press Enter and proceed back to IPCS Option 6 (commands) by typing `=6` on the command line. Proceed with the exercise.
- If you would like to browse storage select =1 and press Enter twice.
- The Problem: Diagnose a SLIP trap dump.

Diagnosing the dump

Use the IPCS commands LIST TITLE and LIST SLIPTRAP to determine the type of dump being analyzed.

Questions:

1. Use the IP LIST TITLE command if you have reason to believe that a slip trap was used to produce the dump and you want to know what was set. __________________

   If a SLIP trap was used you will see the following type of output:

   ```
   TITLE
   LIST 00. LITERAL LENGTH(X'11') CHARACTER
   00000000 ! SLIP DUMP ID=PHIL
   ```

2. Based on the title of the dump you can make a guess as to what type of dump this is. Choose one of the following by putting a circle around it:
   - STANDALONE DUMP
   - A CONSOLE DUMP
   - SLIP TRAP GENERATED DUMP
   - PROGRAM GENERATED DUMP
3. The IP LIST SLIPTRAP command can be used to show the SLIP trap used to obtain any dump, if a SLIP trap was used.
   - Was a SLIP trap used? YES / NO (circle one)
   - If a SLIP trap was used what was it? ______________________________________

Answers to questions: See Appendix A.14, “LIST TITLE and LIST SLIPTRAP - Answers” on page 330.

IP ST Worksheet

This command displays the MVS Diagnostic Worksheet. During the initial use, it is possible you may have to reply **Y** to get the displayed information the first time you use this command.

Issue the command to determine the useful information available in the dump. You can shorten the command and enter IP ST W. Figure A-6 shows the information that is displayed, for example.

- Dump title
  - Temptable: COMPON=BPX,COMPID=SCPX1,ISSUER=BPXMIPCE,....
- Date and time dump was taken:
  - Date: 01/10/2002 Time: 21:23:40.675321 Local
- Original dump data set name (can be useful for reference with Systoles):
  - Original dump data set: SYS0.DUMPSA6F.S00447
- System name (useful verification tool if more than one system exists)
  - CVT SNAME (154) SA6F
- For SVCDUMPS the PSW and ASIDs in control at the time of the dump:
  - HASID 0006 PASID 0006 SASID 0006 PSW 070C1000 82467428
- Number of CPUs and their numbers, which is useful for looking for loops:
  - Alive CPU mask: C000 No. of active CPUs: 0002
    - The mask shows CPU numbers 0-16 thus C=1100... or CPU0 and CPU1

Figure A-6 Display of initial information in the MVS Diagnostic Worksheet

```
MVS Diagnostic Worksheet
Dump Title: ECB WAIT
CPU Model 9672 Version 84 Serial no. 220A83 Address 02
Date: 07/22/2002     Time: 13:41:19.105252 Local
Original dump dataset: JJ.DUMP.PS01.D020722.T133948.S00007
Information at time of entry to SVCDUMP:
HASID 0089 PASID 0089 SASID 0089 PSW 070C1000 8BE3F9CC
CML ASCB address 00000000 Trace Table Control Header address 7F742000

Dump ID: 007
Error ID: N/A
SDWA address N/A

 SYSTEM RELATED DATA
 CVT SNAME (154) PS01       VERID (-18)
      CUCB   (64) 00FD00B0   PVTP (164) 00FF3548    GDA (230) 021C01A0
      RTMCT (23C) 00F47448   ASMVT (2C0) 00FD6390    RCEP (490) 0167E468
CSD Available CPU mask: C000 Alive CPU mask: C000 No. of active CPUs: 0002
```

Figure A-7 IP ST WORKSHEET command example results

Questions: Using the IP ST WORKSHEET command, answer the following questions. Refer to the previous page for information about what this information looks like in the output.

1. What is the dump title? ______________________
2. Does this agree with the list title output you saw before? ____
3. How many CPs are online in this dump? _____
4. What is the original dump data set name?
   ____
5. When was the dump taken? ____________________
6. What was the name of the system this dump was taken on? _____________________
7. What was the primary address space (PASID) in control at the time of the dump? It is important to know this due to we can only run our instructions in the primary address space. __________
8. When was the last IPL done? IP IPLDATA _____________
9. The IP SELECT ALL command provides a list of all the ASID numbers and the jobnames associated with them. Use this command to determine what the jobname is for the PASID found above _________________

Answers to questions: See Appendix A.15, “IP ST WORKSHEET - Answers” on page 330.

A.4 The RTCT control block

```
RRTCT: 00F50B20
   +0000  NAME..... RTCT      SAP...... 2FD0BE00  SUP...... 00100000
   +000C  SYD...... 4E800000  SDLA..... 0000      MECB..... 808DD1C8
   +0018  FASB..... 00000000  NAS...... 00000001  EEDA..... 024C5040
   +0024  SDDS..... 00000000  SDDC..... 0000      MTCT..... 0000
   +002C  DSV...... 00BAED98  SSTK..... 00000000  ADGL..... 00C8F490
   +0038  ADG1..... 00C8F530  ADG2..... 00C8F540  ADG3..... 00C8F4AE
   +0044  ADG4..... 00C8F5C0  ADG5..... 80C8FF0C  TABG..... 80CA90F0
   +0050  TABQ..... 80CA910E  TABR..... 80CA9150  DSCA..... 00F93F28
   +005C  DIND..... 0263C5B0  DIRS..... 0263C980  SDAT..... 0263CD50
   +0068  SMOD..... 024C8070  SCON..... 02436688  CPID..... 024B8100
   +0074  RPAR..... 0175CEF8  BPXP..... 00000000  TABO..... 00C83AC0
   +0080  SDSU..... 021E7000  SDPL..... 023D4E28  FMT...... 00000000
   +00A4  MLCK..... 00000001  MSRB..... 00FA2260  TEST..... 00000000
   +00B2  SEQ#..... 000B      SDSW..... 0261B000  TDCB..... 00000000
   +00BC            00000000  00000000  00000000  00000000  00000000
   +00D0            00000000  00000000  00000000  SDWK..... 00BAEE68
   +00E0  ESEQ..... 0000      ECPU..... 0000      EASD..... 0000
   +00E6  ETIM..... 00000000  SAO...... 2FD0BE00  SUO...... 00100000
   +00F4  SYO...... 4E800000  SDO...... 0D000000  SDNA..... 01
   +00FF  INDX..... 01        SDPR..... 00        BUFV..... 00000000
   +0108  SDF...... 6562      ZZZ3..... 0000
          ASTB
              SDAS  SDF4  SDF5
              ----  ----  ----
          001 0023  A0    00
          002 0000  00    00
          003 0000  00    00
```

Figure A-8 RTCT control block example (top part)

RTCT control block

The recovery termination control table (RTCT) contains information about what can be expected to be found in the dump. The RTCT provides a communication area between the various functions associated with dumping facilities, for SYSABEND, SYSMDUMP, SYSUDUMP, and SVC dumps. It is used for coordination of the dump-related processes of task and system recovery, the memory termination controller, installation- and operator-defined dump requirements.

IP CBF command

The IP CBF RTCT command shows what ASIDs were requested under the SDAS heading, as shown in Figure A-8.

The IP CBF RTCT+9C? STR(SDUMP) VIEW(FLAGS) command shows what options were requested. This may be important to verify that the storage required to diagnose a problem was requested. Of the flags formatted, the most useful often is the SDUSDATA flag. For example, the output below would indicate that nucleus modules and LPA modules loaded at the time of the dump should be viewable.

```
SDUMP_PL: 00F40458

   ==> FLAGS SET IN SDUFLAG0:
    DCB specified.
    Dump 4K buffer.
    HDR/HDRADR specified.
    ECB specified.
    BRANCH=YES specified.

   ==> FLAGS SET IN SDUFLAG1:
    SVC dump request.
    SYSMDUMP request.
TSO user extension is present.
    48+ byte parameter list.

   ==> FLAGS SET IN SDUSDATA:
    Dump all PSAs.
    Dump current PSA.
    Dump LPA mod. for RGN.
    Dump trace data.
    Dump CSA.
    Dump SWA.
    Dump summary dump data.
    Dump all nucleus.
    Dump all defaults.
```

Figure A-9 IP CBF RTCT+9C? STR(SDUMP) VIEW(FLAGS) command results

Questions: The IP CBF RTCT command formats the RTCT control block, which gives information such as what ASIDs where dumped (use the SDAS field).

1. Use the CBF RTCT command to find the ASID(s) included in this dump and list them here (you can see an example of what the output may look like in Figure A-8 on page 303).

   ____

   Additionally, the RTCT contains information about what SDATA options were used. To format this information, use the IP CBF RTCT+9C? STR(SDUMP) VIEW(FLAGS) command. Try this command and determine:

2. Was LSQA requested on the dump? YES/NO (circle one).
3. Was RGN requested (shown as RGN-Private)? YES/NO (circle one).

   The output will also indicate whether certain component exits receive control or not in the SDUEXIT flag.

4. Look at these flags to determine if GRSQ was specified. YES/NO (circle one).

Answers to questions: See Appendix A.16, “Using the RTCT control block - Answers” on page 330.

A.5 The IP ST REGS command

```
CPU STATUS:
PSW=07850000 00000000 00000000 00007026
    (Running in PRIMARY, key 8, AMODE 24, DAT ON)
    Disabled for PER
   ASID(X'0020') 7026. AREA(Subpool251Key08)+26 IN PRIVATE
   ASID(X'0020') 7026. ABEND0C4+26 IN PRIVATE
  ASCB32 at FCAE80, JOB(PHILGER1), for the home ASID
  ASXB32 at 7FDB60 and TCB32E at 7FF3A0 for the home ASID
  HOME ASID: 0020 PRIMARY ASID: 0020 SECONDARY ASID: 0020
  General purpose register values
     0-1   00000001_FD000008  00000000_00006000
     2-3   00000000_00000040  00000000_007D19D4
     4-5   00000000_007D19B0  00000000_007FF130
     6-7   00000000_007BAFC8  00000000_FD000000
     8-9   00000000_007FCAC8  00000000_007CF8F0
    10-11  00000000_00000000  00000000_007FF130
    12-13  00000000_40007006  00000000_00006008
    14-15  00000000_80FDCA98  00000000_00007000
  Access register values
      0-3   00000000  00000000  00000000  00000000
      4-7   00000000  00000000  00000000  00000000
      8-11  00000000  00000000  00000000  00000000
     12-15  00000000  00000000  00000000  00000000
```

Figure A-10 IP ST REGS command example

The IP ST REGS command

This command indicates what the registers were at the time of the dump for the following kinds of dumps:

- For SLIP dumps - REGS at the time SLIP matched.
- For console dumps - typically all zeros.
- For abend dumps - they are theoretically the REGS at the time of the abend.
- For standalone dumps - use the IP CPU REGS command to get the REGS from each CPU.

ST REGS example

These examples simply skim the surface of the wealth of technical information available with the IP ST REGS output. See the example shown in Figure A-10.

The sample output in Figure A-10 shows that the address in the PSW is X'07850000 00000000 00000000 00007026', the ASID is X'0020', and an abend occurred (ABEND0C4+26 IN PRIVATE). You could also use the information about the registers to find out more about the error if the address in the PSW does not point to the failing instruction.

If the calling program is in AR mode, all addresses that it passes, whether they are in a GPR or in a parameter list, must be ALET-qualified. A parameter list can be in an address space other than the calling program's primary address space or in a data space, but it cannot be in the calling program's secondary address space.

Note: You can use the IP ST FAILDATA command instead as it formats the SDWA *if it is present*. Generally it will give you a better overall picture but it may not always be there and may not be the same as IP ST REGS due to recovery actions. In AR mode, as is the case here, the General Purpose Registers will be qualified by the access registers (ARs). So to look at the storage pointed to by a GPR, you need to also determine what address space it refers to. An AR value of 00000000 means the Primary ASID; 00000001 means secondary ASI, and 00000002 means home ASID. For example, in this dump the value in R9 = 15756F00 would be browsed in ASID(x'105'). To check in which mode we are running you can also have a look at PSW bits 16 and 17 ASC mode (Address Space Control).

Information from IP ST REGS

The following questions can all be answered with the IP ST REGS command.

Questions:

1. What ABEND did we get? ____
2. To get the exception information enter IP SYSTRACE and do a find for *RCVY. PGM preceding tis entry will show the pic value too. _______
3. Have a look at the MVS System Codes manual to get the exception information.
4. Enter IP ST W or IP ST REGS again. What was the failing PSW address? _________
5. What ASID is this failing code executing in? _________
6. What was the failing TCB address? ________

   Now using the address portion of the PSW, you want to get more information about the module that was running. You also want to browse some of the register storage. Use IPCS browse, IPCS Option 1, as shown in Figure A-4 on page 298.
7. When you browse the PSW address and back up with PF7, what eyecatcher do you see? The first instruction preceding the eyecatcher is a 47F0C01C _________
8. Browsing the code 4 bytes before the PSW can you determine the reason for the ABEND0C4? The failing instruction is a STH (Store Halfword) If you are not so familiar with opcodes, you can use IP OPCODE command. In our case IP OPCODE 40404040 Which register do we use to execute the instruction? _____________________
9. ABEND0C4 pic 4 leads to accessing the page pointed to by register 4 using a wrong key. What key does our PSW show? ____________
10. Each storage is getmained using a key. To get the key from the page pointed to by register 4 enter the IP RSMDATA VIRTPAGE RANGE(7D1000). Does the key match with the one in PSW? _____

Answers to questions: See Appendix A.17, “Information from IP ST REGS - Answers” on page 331.

A.6 Browsing storage

```
DSNAME('ITSO.ABCVOL8.AB0C4') POINTERS
----------------------------------------
ASID(X'0020') is the default address space
PTR   Address   Address space                           Data type
S0001 00000000  ASID(X'0020')                           AREA
      Remarks:
**************************** END OF POINTER STACK *************************
Fill in the 's' under pointer to select the address you'd like to browse or
fill in the 's' as shown to get to address zero where you can use the L
command to display the storage your interested in as demonstrated below:
ASID(X'0020') ADDRESS(00.) STORAGE -----------------------------------------
Command ===>                                                  SCROLL ===> HA
00000000   000A0000   000130E1   00000000   00000000   | ................ |
00000010   00FDCA48   00000000   7FFFF000   7FFFF000   | ........".0.".0. |
00000020   7FFFF000   7FFFF000   7FFFF000   7FFFF000   | ".0.".0.".0.".0. |
00000030   00000000   00000000   7FFFF000   7FFFF000   | ........".0.".0. |
00000040   00000000   00000000   00000000   00FDCA48   | ................ |
00000050   00000000   00000000   000A0000   000140E1   | .............. . |
00000060   000A0000   000150E1   000A0000   000160E1   | ......&.......-. |
00000070   000A0000   000170E1   000A0000   000180E1   | ................ |
00000080   00008000   00001005   00020033   00040016   | ................ |
```

Figure A-11 Browsing storage example

Browsing storage using IPCS Option 1 (Browse)

To browse storage, on the IPCS primary panel, shown in Figure A-4 on page 298, select Option 1 or use =1 on any IPCS command line to obtain the panel shown in Figure A-12 on page 308. Fill in the dump data set name and the source and when you press Enter, the top portion of the panel shown in Figure A-11 on page 307 is displayed. The bottom appears after the following in Figure A-11:

```
S0001 00000000  ASID(X'0020')
```

Browsing storage

According to the PSW at the time of the error you found in your IP ST REGS or IP ST W output, you need now to browse the storage in the correct address space shown in Figure A-10 on page 305.

```
------------------------ IPCS - ENTRY PANEL  --------------------------------

 CURRENT DEFAULTS:
  Source ==> DSNAME('ITSO.ABCVOL8.AB0C4')
  Address space ==> ASID(X'0020')

 OVERRIDE DEFAULTS:                            (defaults used for blank fields)
  Source ==> DSNAME('ITSO.ABCVOL8.AB0C4')
  Address space ==> ASID(X'0020')
  Password      ==>

 POINTER:
  Address       ==>                            (blank to display pointer stack)
  Remark        ==>                                             (optional text)
```

Figure A-12   IPCS panel to enter dump defaults

Browsing storage

Next, press Enter on the panel in Figure A-13 and Figure A-14 is displayed.

```
DSNAME('ITSO.ABCVOL8.AB0C4') POINTERS  ---------------------------------------
Command ===>                                                      SCROLL ===> HALF
ASID(X'0020') is the default address space
PTR   Address           Address space                          Data type
S0001 00.               ASID(X'0020')                          AREA
      Remarks:
*************************** END OF POINTER STACK ****************************
```

Figure A-13   Panel displayed after an Enter on the previous panel

Select storage location

Use the S line command, as shown in Figure A-13, to choose a pointer from the address pointer stack on the pointer panel. It is possible to check storage from other address spaces which have been dumped and data spaces. IPCS then uses the pointer to display storage that is addressed by that pointer. The storage is then displayed is shown in Figure A-14. Notice that the storage selected in the example is at location 00000000.

```
ASID(X'0020') ADDRESS(00.) STORAGE -------------------------------------------
Command ===>                                                      SCROLL ===> HALF
00000000   000A0000   000130E1   00000000   00000000  | ................ |
00000010   00FDCA48   00000000   7FFFF000   7FFFF000  | ........".0.".0. |
00000020   7FFFF000   7FFFF000   7FFFF000   7FFFF000  | ".0.".0.".0.".0. |
00000030   00000000   00000000   7FFFF000   7FFFF000  | ........".0.".0. |
00000040   00000000   00000000   00000000   00FDCA48  | ................ |
00000050   00000000   00000000   000A0000   000140E1  | .............. . |
00000060   000A0000   000150E1   000A0000   000160E1  | ......&.......-. |
```

Figure A-14   Storage displayed when issuing the S command

Browse the PSW address

To browse the PSW address, issue the IP ST REGS command to obtain the PSW address, as shown in Figure A-15.

```
CPU STATUS:
PSW=07850000 00000000 00000000 00007026
    (Running in PRIMARY, key 8, AMODE 24, DAT ON)
    Disabled for PER
   ASID(X'0020') 7026. AREA(Subpool251Key08)+26 IN PRIVATE
   ASID(X'0020') 7026. ABEND0C4+26 IN PRIVATE
   ASID(X'0020') 7026. AREA(Jobphilger1)+5026 IN PRIVATE
   ASID(X'0020') 7026. AREA(Error)+5026 IN PRIVATE
   ASID(X'0020') 7026. AREA(Current)+5026 IN PRIVATE
  ASCB32 at FCAE80, JOB(PHILGER1), for the home ASID
  ASXB32 at 7FDB60 and TCB32E at 7FF3A0 for the home ASID
  HOME ASID: 0020 PRIMARY ASID: 0020 SECONDARY ASID: 0020
```

Questions:

1. What ABEND did we get? ____
2. To get the exception information, enter IP SYSTRACE and do a find for *RCVY. PGM preceding this entry will show the pic value too. _______
3. Have a look at the MVS System Codes manual to get the exception information.
4. Enter IP ST W or IP ST REGS again. What was the failing PSW address? _________
5. What ASID is this failing code executing in? _________
6. What was the failing TCB address? ________

   Now using the address portion of the PSW, you want to get more information about the module that was running. You also want to browse some of the register storage. Use IPCS browse, IPCS Option 1, as shown in Figure A-4 on page 298.
7. When you browse the PSW address and back up with PF7, what eyecatcher do you see? The first instruction preceding the eyecatcher is a 47F0C01C _________
8. Browsing the code 4 bytes before the PSW, can you determine the reason for the ABEND0C4? The failing instruction is an STH (Store Halfword). If you are not so familiar with opcodes, you can use the IP OPCODE command; in our case, IP OPCODE 40404040. Which register do we use to execute the instruction?

   ____
9. ABEND0C4 pic 4 leads to accessing the page pointed to by register 4 using a wrong key. What key does our PSW show? ____________
10. Each storage is getmained using a key. To get the key from the page pointed to by register 4 enter the IP RSMDATA VIRTPAGE RANGE(7D1000). Does the key match the one in the PSW? _____

Answers to questions: See Appendix A.17, "Information from IP ST REGS - Answers" on page 331. essing enter.

```
ASID(X'0020') ADDRESS(7026.) STORAGE -----------------------------------------
Command ===>                                              SCROLL ===> CSR
00007026                4040    404058F0   C02E50F0   !           .0ä.&0 !
00007030   C03605EF   70000000   7F000000   00000000   ! ä......."....... !
00007040.:7FFF.--All bytes contain X'00'
```

Figure A-15 Browse PSW storage

The preceding failing instruction could be 2, 4 or 6 bytes. The IP OPCODE command will translate the op code to a mnemonic, as follows:

```
IP OPCODE 40404040
Mnemonic for X'40404040' is STH
STH (Store Halfword)
```

To get the failing instruction or module name, press PF7 until you find a module start area. There may be modules where the names are not shown at the beginning of the module, such as (LE, JES).

```
00007000   90ECD00C   05C047F0   C01CC1C2   F0C3F440   ! ..ü..ä.0ä.AB0C4  !
00007010   4040F1F1   61F1F061   F1F14040   40404040   !   11/10/11       !
00007020   40404040   40404040   404058F0   C02E50F0   !           .0ä.&0 !
00007030   C03605EF   70000000   7F000000   00000000   ! ä......."....... !
```

Figure A-16 Browse module name and failing instruction

A.7 IPCS VERBX LOGDATA subcommand

- Specifying the IP VREBX LOGDATA subcommand
  - Formats the logrec buffer records that were in storage when the dump was generated
  - LOGDATA locates the logrec records to invoke the EREP program
  - The records are formatted as an EREP detail edit report
- Use the LOGDATA report to examine the system errors that occur
  - Before the error that caused the dump to be requested

Figure A-17 The IP VREBX LOGDATA subcommand

IPCS VERBX LOGDATA subcommand

IPCS formats the software error records. You can use the IPCS VERBEXIT LOGDATA subcommand to format and print or view the logrec data set records in a dump. For more information about the subcommand, see *z/OS MVS Interactive Problem Control System (IPCS) Commands*, SA22-7594.

If a problem occurs and a dump is available, the IP VERBX LOGDATA subcommand will show preceding abends from hardware, as shown in Figure A-18 on page 312 and software, as shown in Figure A-19 on page 313.

It could be important due to the fact that the dump you are looking at may not show the root cause of the problem. If there are abends shown in the same address space where you get an abend, you need to take care of them. If there are abend entries showing the same time, even if they are not reflecting the same address space, check them also.

```
DEVICE NUMBER: 06002 REPORT:  SLH EDIT               DAY YEAR JOB IDENTITY:
*MASTER*
                        SCP:  VS 2 REL.  3      DATE: 216  11
5CD4C1E2E3C5D95C
DEVICE NED:    002107.900.IBM.75.0000000PD021.0002
DEVICE TYPE:    3390
                   CPU MODEL:   2817XA         HH MM SS.TH
CHANNEL PATH ID: 48  LOGICAL CPU ID: 0157B6     TIME: 12 28 32.44

PHYSICAL CHAN ID: 05D0 PHYSICAL CPU ADDRESS:  02



          CC   CA   FL  CT
FAILING CCW  00 00000000 00 0000             VOLUME SERIAL
SYSX12
                                            SUBCHANNEL ID NUMBER
00011082
       K  FLAGS    CA     US SS  CT            ERROR TYPE
OTHER
SCSW              04 824017 00000008 00 02 0000
```

Figure A-18 Hardware entry (partial output)

Software error entry

The detail edit report for a software record, shown in Figure A-19 on page 313, shows the complete contents of an error record for an abnormal end, including the system diagnostic work area (SDWA). The report is produced by EREP and, through the VERBEXIT LOGDATA subcommand, under IPCS.

You can use the detail edit report for a software record to determine the cause of an abend, and the recovery action that the system or application has either taken or not taken. This report enables you to locate where an error occurred, similar to the analysis of an SVC dump. Once you locate the error, you can develop a search argument to obtain a fix for the problem.

Reference: See *Environmental Record Editing and Printing Program (EREP) User's Guide*, GC35-0151 for information about producing a detail edit report for an SDWA-type record.

Also see *z/OS MVS Interactive Problem Control System (IPCS) Commands*, SA22-7594 for information about the VERBEXIT LOGDATA subcommand.

```
TYPE:  SOFTWARE RECORD      REPORT:  SOFTWARE EDIT REPORT          DAY.YEAR
       (SVC 13)                                           REPORT DATE: 315.11
FORMATTED BY: IEAVTFDE  HBB7703                            ERROR DATE: 311.11
                            MODEL:   2094                                HH:MM:SS.T
                            SERIAL:  06991E                      TIME: 23:58:49.6

JOBNAME: INIT       SYSTEM NAME: SC64
ERRORID: SEQ=00377  CPU=0000  ASID=0020  TIME=23:58:49.6

SEARCH ARGUMENT ABSTRACT

  PIDS/5752SC1B6 RIDS/IEFSD060#L RIDS/IEFSD060 AB/S0822 PRCS/00000014 REGS/0C4
  RIDS/IEFIB620#R

  SYMPTOM            DESCRIPTION
  -------            -----------
  PIDS/5752SC1B6     PROGRAM ID: 5752SC1B6
  RIDS/IEFSD060#L    LOAD MODULE NAME: IEFSD060
  RIDS/IEFSD060      CSECT NAME: IEFSD060
  AB/S0822           SYSTEM ABEND CODE: 0822
  PRCS/00000014      ABEND REASON CODE: 00000014
  PRCS/00000014      ABEND REASON CODE: 00000014
  REGS/0C458         REGISTER/PSW DIFFERENCE FOR ROC: 458
  RIDS/IEFIB620#R    RECOVERY ROUTINE CSECT NAME: IEFIB620

OTHER SERVICEABILITY INFORMATION

  RECOVERY ROUTINE LABEL:  IEFIB620
  DATE ASSEMBLED:          11070
  MODULE LEVEL:            HBB7780
  SUBFUNCTION:             INITIATOR JOB PROCESS

TIME OF ERROR INFORMATION

  PSW: 07041000 80000000 00000000 0759F47A
  INSTRUCTION LENGTH: 02   INTERRUPT CODE: 000D
  FAILING INSTRUCTION TEXT: 00181610 0A0D5850 40005870

  BREAKING EVENT ADDRESS: 00000000_00000000
  AR/GR 0-1    007FF130/00000001_04000000  00000000/00000000_04822000
  AR/GR 2-3    00000000/00000000_00000010  00000000/00000000_007D19E0
  AR/GR 4-5    00000000/00000000_007D19B0  00000000/00000000_007FF130
  AR/GR 6-7    00000000/00000000_007FC594  00000000/00000000_FD000000
  AR/GR 8-9    00000000/00000000_007FCAC8  00000000/00000000_00000014
  AR/GR 10-11  00000000/00000000_007FC204  00000000/00000000_007CD1B8
  AR/GR 12-13  00000000/00000000_8759F022  00000000/00000000_007D1A18
  AR/GR 14-15  00000000/00000000_007CD1B8  01000002/00000000_00000014

  HOME ASID: 0020    PRIMARY ASID: 0020    SECONDARY ASID: 0020
  PKM: 8040          AX: 0000              EAX: 0000
```

Figure A-19 Software error entry (partial output)

A.8 IPCS SYSTRACE subcommand

```
{ SYSTRACE [ TIME(HEX | GMT | LOCAL) ]
 -------- Data Selection Parameters ---------------------
            [ EXCLUDE(BR) ]
            [ EXCLUDE(MODE) ]
            [ START(mm/dd/yy,hh.mm.ss.dddddd) ]
            [ STOP(mm/dd/yy,hh.mm.ss.dddddd) ]
            [ CPU(cpu-address) ]
            [ TCB(TCB-list) ]
            [ TTCH(TTCH-address | LIST) ]
            [ WEB(WEB-list) ]
 -------- Address Space Selection Parameters ---------------
            [ ALL ]
            [ CURRENT ]
            [ ERROR ]
            [ TCBERROR ]
            [ ASIDLIST(asidlist) ]
            [ JOBLIST(joblist) | JOBNAME(joblist) ]
 -------- SETDEF-Defined Parameters ------------------------
   Note: You can override the following SETDEF parameters.

            [ ACTIVE | MAIN | STORAGE          ]
            [ DSNAME(dsname) | DATASET(dsname) ]
            [ FILE(ddname) | DDNAME(ddname)    ]
            [ PATH(path-name)     ]
            [ FLAG(severity) ]
            [ PRINT | NOPRINT ]
            [ TERMINAL | NOTERMINAL ]
            [ TEST | NOTEST ]
```

Figure A-20 SYSTRACE subcommand parameters

System trace

System trace writes trace data in system trace tables in the trace address space. System trace maintains a trace table for each processor. Obtain the trace data in a dump that included option SDATA=TRT.

SYSTRACE subcommand

Use the SYSTRACE subcommand to format system trace entries for all address spaces. This command is used to determine what else was happening in the system at the time of the dump.

- Options:
  - IP SYSTRACE ALL - formats all active ASIDS at time of dump
  - IP SYSTRACE TIME(LOCAL) - converts the time to local time (readable)
  - IP SYSTRACE ASID(x'nn') - formats only trace records associated with the requested ASID
- If a WAIT entry is found in SYSTRACE, the system is not running 100% CPU.
- EXT 1005 entries for the same ASID may be indicative of a loop.
- The command only traces traceable events, for example, SVCs or PCs.

Chapter 8 of *z/OS MVS Diagnosis: Tools and Service Aids*, GA22-7589 has lots of details about system trace.

Note: For formatted dumps, system trace formats the system trace data and the system prints it directly.

For unformatted dumps, use the IPCS SYSTRACE subcommand to format and print or view the trace data in the dump.

SYSTRACE definitions

Figure A-21 shows the beginning columns of the system trace (SYSTRACE), shown in bold text. An SSRV trace entry represents entry to a system service. The service can be entered by a PC instruction or a branch.

Note: For every entry in the trace there are different mappings for the entry. Figure A-21 is only an example of what an entry can contain.

```
PR ASID WU-ADDR- IDENT  CD/D PSW----- ADDRESS-  UNIQUE-1 UNIQUE-2 UNIQUE-3
                                                UNIQUE-4/UNIQUE-5/UNIQUE-6
01-0001 00000000  WAIT
01-0028 01F5F200  SRB        070C0000 80FE1CD8  00000028 062817AC 86281780
                                                007FF510 00
01-0028 00000000  SSRV    78          80FE1E58  4060E552 00000058 007BEFA8
                                                00280000
01-0028 00000000  SSRV    78          80FE1E78  0000FD02 00000098 007F0780
                                                00280000
```

Figure A-21 First columns of the system trace

The remainder of the system trace columns are in Figure A-22.

```
PSACLHS- PSALOCAL PASD SASD TIMESTAMP-RECORD CP
PSACLHSE
                            BF65FF0E4BA5E728 28
      00          0028 0028 BF65FF0E4EA51F68 28

Getmain                     BF65FF0E4EA58DE8 28

Getmain                     BF65FF0E4EA5A3E8 28
```

Figure A-22 Remaining columns of the system trace

The columns are as follows:

PR pr: Identifier of the processor that produced the TTE.

ASID home: Home address space identifier (ASID) associated with the TTE.

WU-ADDR wu-addr: Address of the task control block (TCB) for the current task or the work element block (WEB).

IDENT The TTE identifier, as follows:

- DSP - Task dispatch
- SRB - Initial service request dispatch
- SSRB - Suspended service request dispatch

- WAIT - Wait task dispatch

CD/D ssid

PSW-address Address of the PSW:

- dsp-new- psw: Program status word (PSW) to be dispatched
- srb-new- psw: PSW to receive control on the SRB dispatch
- ssrb-new- psw: PSW to receive control on the SSRB redispatch

UNIQUE-1-6 (6 values as follows:)

- **gpr0----:** General register 0
- **gpr1----:** General register 1
- **psamodew:** PSAMODEW field in the PSA
- **safnasid:** LCCASAFN field in the logical configuration communication area (LCCA) and the related ASID
- **flg-srb:** SRBFLGS field from the SRB
- **purgetcb:** TCB (located in address space of the scheduler of the SRB) that gets control if the SRB abends and percolates

PSACLHS One of the following:

- **psaclhs-:** String for the current lock held, from the PSACLHS field of the PSA.
- **psaclhs4:** PSACLHS4 field of the PSA
- **srbhlhi-:** SRBHLHI field in the SRB

This field contains descriptive text for some SVC, SSRV, and PC trace entries. The descriptive text does not appear in SNAP, SYSUDUMP, or SYSABEND output.

PSALOCAL **psalocal:** Locally locked address space indicator, from the PSALOCAL field of the PSA. This field will contain descriptive text for some SVC, SSRV, and PC trace entries. The descriptive text will not appear in SNAP, SYSUDUMP, or SYSABEND output.

PASD **cpsd:** Primary ASID (PASID) at trace entry. This field will contain descriptive text for some SVC, SSRV, and PC trace entries. The descriptive text will not appear in SNAP, SYSUDUMP, or SYSABEND output.

SASD **sasd:** Secondary ASID (SASID) at trace entry. This field will contain descriptive text for some SVC, SSRV, and PC trace entries. The descriptive text will not appear in SNAP, SYSUDUMP, or SYSABEND output.

TIMESTAMP **timestamp-------:** Time-of-day (TOD) clock value when system trace created the trace entry. The value is in the same format as the time stamp on logrec data set records.

CP The CP column contains 2 hex digits of the processor model-dependent information, which is intended to identify the physical CP that made the trace entry. CP is only provided when formatting SYSTRACE under IPCS. CP is not provided for SYSUDUMP, SYSABEND, or SNAP.

Questions:

1. By using IP SYSTRACE ASID(X'20') TIME(LOCAL) and looking in the output for the PGM 004 entry, when did the abend occur? __________________
2. Does the time match with our IP ST W output?______
3. Do we call RTM (Recovery Termination Manager)? Look for *RCVY ____
4. Is there a FRR (Functional Recovery Routine) between *RCVY and *SVC? ___
5. Which module requested *SVC D to give control to RTM2? Browse the PSW from this entry in our address space storage. To get the module name you can either enter IP W X or IP W 14601C2. W is the short form for WHERE and X can be used when you did a locate PSW address before. ______________
6. What is the TCB that got the abend? ___________
7. What CPU number is shown? ___
8. Are we running in cross memory mode? See PASD SASD. If they show different address space numbers we are running in cross memory mode. ____

Answers to questions: See Appendix A.18, "IP SYSTRACE - Answers" on page 332.

A.9 IPCS VERBX MTRACE subcommand

- ❑ Provides a snapshot of what happens just before the dump in the system log, as follows:
  - ➢ If a job was started
  - ➢ If a message was issued
  - ➢ If a command was issued just prior to the problem

Sample output:

```
13:41:16.48 STC00761 00000210  DUMP COMM(DUMP OF JOEO400S)
13:41:16.88 P1       00000010  IEE311I DUMP     PARAMETER MISSING
13:41:16.89 P1       00000010  IEE711I SYSTEM DUMP NOT TAKEN. DUMP SPECIFICATION NOT VALID
13:41:18.27 P1 S8738 00000014  B092I- VSAM     01/30/98 08.40 STARTED
13:41:18.27 P1 S8738 00000014  B092I- KSDS     01/30/98 08.41 STARTED
13:41:18.27 P1 S8738 00000014  B054I- SESSION LIMIT SET TO 2048
13:41:18.29 P1 S8738 00000014  B015I- VTAMAPPL VERSION  6.1 TAPE LC2681 INITIALIZATION
complete
```

Figure A-23 VERBX MTRACE subcommand

VERBX MTRACE subcommand

This command displays the following:

- The master trace table entries for the dumped system. This table is a wraparound data area that holds the most recently issued console messages in a first-in, first-out order.
- The NIP hard-copy message buffer.
- The branch entry and NIP time messages on the delayed issue queue.

This trace gives you a snapshot of what is taking place just before the dump in the system log and is useful to see if a job was started, a message was issued or a command was issued just prior to the problem.

In the example, shown in Figure A-24 on page 319, the operator apparently was trying to capture a console dump and entered DUMP COMM(DUMP OF JOE0400S) instead of the correct syntax, which would have been DUMP COMM=(DUMP OF JOE0400S). Note also that this is a JES2 log. A JES3 log looks quite different.

```
13:41:16.48 STC00761 00000210  DUMP COMM(DUMP OF JOE0400S)
13:41:16.88 P1       00000010  IEE311I DUMP     PARAMETER MISSING
13:41:16.89 P1       00000010  IEE711I SYSTEM DUMP NOT TAKEN. DUMP SPECIFICATION NOT VALID
13:41:18.27 P1 S8738 00000014  B092I- VSAM     01/30/98 08.40 STARTED
13:41:18.27 P1 S8738 00000014  B092I- KSDS     01/30/98 08.41 STARTED
13:41:18.27 P1 S8738 00000014  B054I- SESSION LIMIT SET TO 2048
13:41:18.29  P1 S8738 00000014  B015I- VTAMAPPL VERSION  6.1 TAPE LC2681 INITIALIZATION complete
```

Figure A-24 Sample MTRACE output

Questions:

1. Have a look at the IP VEBX MTRACE output. Are other abends reported? _____
2. Have dumps been taken? _____
3. Did we use slip processing? _________
4. User PHILGER submitted a job. Which step ended with an abend indication? Check for message IEF450I. ______

Answers to questions: See Appendix A.19, “IP VERBX MTRACE - Answers” on page 332.

A.10 IP SUMMARY FORMAT subcommand

- Use the SUMMARY subcommand to:
  - Display or print dump data associated with one or more specified address spaces.
- Specify different parameters to selectively display the information you want to see.
  - SUMMARY produces different diagnostic reports depending on the report type parameter:
    - FORMAT, KEYFIELD, JOBSUMMARY, or TCBSUMMARY,
  - Address space selection parameters
    - ALL, CURRENT, ERROR, TCBERROR, ASIDLIST, or JOBLIST

Figure A-25 SUMMARY subcommand and parameters

The SUMMARY subcommand

Use the SUMMARY subcommand to display or print dump data associated with one or more specified address spaces.

SUMMARY produces different diagnostic reports depending on the report type parameter, FORMAT, KEYFIELD, JOBSUMMARY, and TCBSUMMARY, and the address space selection parameters, ALL, CURRENT, ERROR, TCBERROR, ASIDLIST, and JOBLIST. Specify parameters to selectively display the information you want to see.

Question information: The IP SUMM FORMAT ASID(x'nn') command will format lots of data about the specified address space. In this lab you are interested in the following control blocks and fields: failing TCB and CMP fields, RTM2 work area and RBs.

failing TCB At the end of the output all TCBs are named including the CMP field.

RTM2 WA Any time you see an RTM2 work area for a TCB, it means the error could not be recovered. RTM2 will show time of error information.

PRB,SVRB Request blocks which show the abend sequence.

The IP SUMMARY FORMAT ASID(x'20') command provides the control block flow starting with the main address space control block ASCB. ASXB, ASSB followed by TCBs and RBs.

```
ASCB: 00FCAE80
   +0000  ASCB..... ASCB      FWDP..... 00FCAB80  BWDP..... 00FB8000
   +000C  LTCS..... 00000000  R010..... 00000000  00000000
   +0018  IOSP..... 00000000  R01C..... 0000      WQID..... 0000
   +0020  R020..... 00000000  ASID..... 0020      R026..... 00
   +0027  SRMF..... 00        LL5...... 00        HLHI..... 01
   +002A  DPH...... 00F0      TCBE..... 00000000  LDA...... 7FF16E10
```

Figure A-26 Partial ASCB output

Figure A-27 is the result of issuing the command to get to the bottom (BOTTOM command and press F8).

Note: The TCB summary at the end of the output will show two TCBs' CMP fields nonzero. As mentioned before, if an RTM2 WA is provided, we need to have a look at this abend. If no RTMWA is available, the error was recovered.

```
JOB PHILGER1 ASID 0020 ASCB 00FCAE80 FWDP 00FCAB80 BWDP 00FB8000 PAGE
00000006
    TCB AT    CMP      NTC      OTC      LTC      TCB      BACK     PAGE
   007FE040 00000000 00000000 00000000 007FF890 007FD0C0 00000000 00000056
   007FD0C0 00000000 00000000 007FE040 00000000 007FF890 007FE040 00000061
   007FF890 00000000 007FD0C0 007FE040 007FF130 007FF130 007FD0C0 00000066
   007FF130 04822000 00000000 007FF890 007FF3A0 007FF3A0 007FF890 00000073
   007FF3A0 940C4000 00000000 007FF130 00000000 00000000 007FF130 00000083
```

Figure A-27 IP SUMM FORMAT command

SUMM FORMAT subcommand questions

Questions:

1. Use the IP SUMM FORMAT ASID(X'20') command to determine what TCBs have a nonzero CMP field. You may have a look at the *z/OS V1R13.0 MVS System Codes* manual to get the error explanation ________
2. Look at the control block flow from our TCB getting the ABEND0C4 error. Do a find for RTM2 and locate the SEQ#. If you have more than one RTM2 WA, you can use this information to determine which RTM was the first one we got. The one with the lowest number shows the first error. What does it show? ____
3. Have a look at RTM"WA SUMMARY. Do the PSW and registers match with our abend information in IP ST REGS? ____
4. Check the PRB. Which module is pointed to by OPSW? _________
5. The registers that belong to this OPSW are saved in the following SVRB. Do they show the same value like the registers in RTM2WA? _____

Answers to questions: See Appendix A.20, “SUMMARY FORMAT - Answers” on page 332.

A.11 The IP ANALYZE RESOURCE subcommand

- ANALYZE produces different diagnostic reports depending on the report type parameter
  - EXCEPTION displays contention information when a unit of work holds at least one resource for which contention exists and that unit of work is not waiting for another resource
  - RESOURCE displays contention information organized by resource name
  - ASID displays contention information organized by ASID
  - ALL displays all contention information

Figure A-28 IPCS ANALYZE subcommand

ANALYZE subcommand

Use the ANALYZE subcommand to gather contention information from component analysis exits and format the data to show where contention exists in the dump. ANALYZE obtains contention information for I/O, ENQs, suspend locks, allocatable devices, real frames, global resource serialization latches, and other resources.

The command is used to detect resource contention. Specifying GRSQ in the SDATA options makes the information more reliable. Generally the most useful information is found at the bottom of this report. The top is generally I/O device contention and isn't usually relevant. Figure A-29 on page 323 is an example of some contention, as follows:

- NAME=MAJOR=IGDCDSXS MINOR=SYSD.DFSMS.COMMDS is the resource name in contention.
- Note that the scope of the resource name is scope=systems.

Contention analysis

IPCS gathers contention information once for each dump. ANALYZE invokes each ANALYZE exit routine specified by parmlib members embedded in the BLSCECT parmlib member. When contention information has not been previously gathered, IPCS issues this message:

```
BLS01000I Contention data initialization is in progress
```

The amount of time required to gather contention information depends on the size of the dump, how many address spaces it contains, the number of I/O devices, and the amount of contention in the dump. IPCS recommends that you run the ANALYZE subcommand in the background as part of a preliminary screening report.

In the event that no contention information is detected, IPCS issues:

```
BLS01002I No resource contention detected. Undetected contention is possible.
```

```
RESOURCE #0011:
   NAME=MAJOR=IGDCDSXS MINOR=SYSD.DFSMS.COMMDS
SCOPE=SYSTEMS
RESOURCE #0011 IS HELD BY:
  JOBNAME=SMS     ASID=0025  TCB=009EB0F0  SYSNAME=CM01
RESOURCE #0011 IS REQUIRED BY:
  JOBNAME=SMS     ASID=0026  TCB=009EB0F0  SYSNAME=PR02
  JOBNAME=SMS     ASID=0026  TCB=009EB0F0  SYSNAME=PR03
  JOBNAME=SMS     ASID=0028  TCB=009EC660  SYSNAME=SP02
  JOBNAME=SMS     ASID=0027  TCB=009EB0F0   SYSNAME=TS01
```

Figure A-29 IP ANALYZE RESOURCE subcommand

Note: Holders and waiters are identified in the output. ASID and TCB (where appropriate) are provided and whether a scope=systems resource is the holding system name.

Lab exercise #1:

- Switch dumps by typing =0 (zero) on the IPCS command line.
- Change the DSNAME to ITSO.ABCVOL8.ENQHANG.
- Press Enter and proceed back to IPCS Option 6 (commands) by typing =6 on the command line. Proceed with the exercise.
- Customer reported job PHILGERB is not running. The problem we are looking at in dump ITSO.ABCVOL9.ENQHANG shows enqueue contention. Address space 20 jobname PHILGERA is holding a resource. PHILGERB needs this resource to continue the execution. Job PHILGERA is in a wait scenario.

Questions:

1. What is the dump title? ____
2. What address spaces are dumped? ____________________________
3. Due to jobname PHILGERB is not running, have a look at ASCB DPH value, which shows the dispatching priority for the job. Use IP SUMM FO ASID(X'1D'). What is the dispatching priority? __________
4. The dispatching priority is very high, so we need to concentrate on resource problems. Enter IP ANALYZE RESOURCE command and check whether we have an enqueue contention. Name the address space ids ___________________
5. Get following information: MAJOR=_____ MINOR=__________ SCOPE=____________ The Scope information will show whether the enqueue is only on the local system or sysplex wide. A Scope name ending with an S means sysplex-wide enqueue.
6. Which job holds the resource? __________________What TCB? ________________
7. Which job is waiting? ________________ What TCB? _____________
8. Do you see any activities for these two address spaces in the systrace? __________

Have a look at the MTRACE whether an D GRS,C command was issued. If yes, does it show the same information? _______

Note: The next step would be to look at the TCB which helds the resource to get the information, why does this TCB not release the lock. Have a look at the PSW and what module had control last.

Additional hints

What to check if an address space is not running:

- Contention: Is there contention involving my address space?
  - Check the ANALYZE RESOURCE report
  - Check address space local lock status
- Address Space Dispatchability
  - Check address space-level non-dispatchability bits
- Task Dispatchability
  - Focus on the task(s) that should be driving the workload
  - Check TCB-level non-dispatchability bits
  - Examine TCB's RB chain, linkage stack
    - a. Look for WAITs/SUSPENDs.
    - b. Establish problem chronology.
- Errors preceding or accompanying hang
  - Check LOGDATA, LOGREC
  - Check MTRACE, SYSLOG

Recognizing resource contention

Resource contention can cause bottlenecks, as follows:

- Suspend locks
- ENQ resources
- Page faults

The IPCS ANALYZE RESOURCE processing does the following:

- Identifies bottlenecking units of work.
- Identifies resources, their owners, and their requesters; therefore look for the hung function as a requester.

A.12 Diagnosing excessive processor time

A high processor usage can influence the throughput on any system. To get the processor usage at the time of the dump, you can use L 10?+25C?+E4?+38 in IPCS when browsing the dump. Take the first 2 bytes from the output and divide by ten. Due to the fact that this is a hexa decimal value, convert it to decimal.

```
Browse the dump and enter L 10?+25C?+E4?+38
Let's assume you get the following storage area lsited:
01AAB798                        06400000   00000748
Take the first two bytes. In our case 0640
Devide it by 10
This hex value needs to be converted into decimal
x'064' >>> dec 100
This shows, that our CPU is 100% busy
```

Figure A-30 How to calculate processor *usage*

Customer reported job PHILGER was looping.

> **Note:** If a program is looping with an ABEND071 RC30 entry, this should be seen in the system log and in our case in the dump. An IP SYSTRACE shows the looping scenario and at least the mentioned abend. A RC30 means that, the system abnormally ended the program that was causing a system excessive spin-loop condition.

Lab exercise #2:

- Switch dumps by typing `=0` (zero) on the IPCS command line.
- Change the DSNAME to ITSO.ABCVOL8.USERCPU.
- Press Enter and proceed back to IPCS Option 6 (commands) by typing `=6` on the command line. Proceed with the exercise.
- The problem we are looking at in dump ITSO.ABCVOL8.USERCPU shows high CPU usage and a loop in address space 20. To get information who is eating up CPU, RMF MON III will show it. We will have a look at the looping asid.

Diagnosing the dump

To diagnose this dump, the questions that follow will walk you through the relevant questions that will lead you to the diagnosis.

Questions:

1. Check the total amount of CPU usage? ______
2. Get the address space id for jobname PHILGER1. Use IP SELECT ALL. What address space was the user running in? _____
3. Have a look at the systrace entries for asid number you found. Do you see a loop? _____
4. What TCB is running the loop? _________
5. Looking at the TCB using IP SUMM FO ASID(X'20'), does it show and abend indication? ____
6. Was the looping pgm ended by the system? ____
7. If the question 3 was answered with yes, which entry in the systrace leads to your opinion?

8. Get the module name where the loop takes place. Loops can be recognized by EXCP entries in the systrace. Get the PSW and locate it in the storage. Hit PF7 until you get the module name. _______________
9. Has the loop been interrupted? _____
10. If yes, which systrace entry shows the interrupt? _________

Answers to questions: See Appendix A.22, “Diagnosing excessive processor time - Answers” on page 333.

A.13 A standalone dump example

Lab exercise #5:

- Switch dumps by typing =0 (zero) on the IPCS command line.
- Change the DSNAME to ITSO.ABCVOL8.WAIT083. Use any ASID from (0 to 20).
- Press Enter and proceed back to IPCS Option 6 (commands) by typing =6 on the command line. Proceed with the exercise.
- The Problem: The system crashed, ending up in a non-restartable wait state. A standalone dump was taken.

IPCS command hints

A standalone dump provides huge amounts of data depending on the dump options. There may be additional trace or SVC dump information in the standalone dump.

Using the IP SYSTRACE TTCH(LIST) TIME(LOCAL) command you can check whether additional systraces are available. To make them readable, enter the IPCS SYSTRACE TTCH(x'xxxxxxxx') command, which will format the trace entries in this TTCH.

You may check for an SVC dump provided by the standalone dump. Enter the following IPCS command: IP COPYCAPD. You may get output as shown in Figure A-31.

```
Number  Time stamp           Title
 ------  -------------------  ----------------------------------------------


      1  01/02/2003 22:45:42  SRM RECOVERY ENTERED, COMPON=SRM, COMPID=SC1CX,
         ISSUER=IRARMER2
         SYSDUMP.A004.D030102.T224540.#MASTER#.S00010
      2  01/02/2003 22:45:48  COMPON=VSM-STORAGE,COMPID=SC1CH,ISSUER=IGVRSTOR
         SYSDUMP.A004.D030102.T224545.CONSOLE.S00011
```

Figure A-31 COPYCAPD IPCS command output

To make the dumps ready for IPCS use, issue:

```
IP COPYCAPD  1  OUTDSN(MY.CAP.DUMP) COPYCAPD
```

This command will capture the dump number and output data set name and will cause the dump to be extracted.

Another useful IPCS command is provided to make an instruction flow that makes what you find in the dump readable. If you would like to get instruction formatting for the following instruction flow in the dump:

```
0108BD56                  5810   90008910   000C5410
0108BD60   C570A51A   0400BFFF   D9F40A0D   90E6D1D0
```

Use the following IPCS command to get the output shown in Example A-1 on page 327:

```
IP L 108BD56 L(x'1A') INSTR
```

Example: A-1 OP codes

```
LIST 0108BD56. ASID(X'002B') LENGTH(X'1A') INSTRUCTION
0108BD56 ! 5810 9000      ! L       R1,X'0'(,R9)
0108BD5A ! 8910 000C      ! SLL     R1,X'C'
0108BD5E ! 5410 C570      ! N       R1,X'570'(,R12)
```

```
0108BD62 ! A51A 0400      ! OILH    R1,X'0400'
0108BD66 ! BFFF D9F4      ! ICM     R15,X'F',X'9F4'(R13)
0108BD6A ! 0A0D           ! SVC     X'0D' ABEND, type 4, calls IEAVTRT2
0108BD6C ! 90E6 D1D0      ! STM     R14,R6,X'1D0'(R13)
```

Standalone dump debug

To get a quick overview why this dump was taken and what were the last actions in the system, you may use the following commands:

- IP ST SYSTEM
  - It shows information about dump taken time.
- IP ST WORKSHEET
  - Information about why did we take this dump
  - System name
  - Available CPs
  - zIIP and zAAP
  - IP SYSTRACE ALL
  - Which address spaces have been running last
- IP VERBX SADMPMSG
  - Standalone dump request information
  - Shows dumped date areas
- IP VERBX LODATA
  - Look for any abend error indication preceding the standalone dump request.

Diagnosing the dump

To diagnose this dump, the questions that follow will walk you through the relevant questions that will lead you to the diagnosis.

Questions:

1. First issue IP ST WORKSHEET and note the title: ____
2. Get IEA020W message information___________
3. Get the wait state information from PSW at time of dump
4. If you look up the meaning of this wait state you will note that it means the FRR stack is corrupted. The FRR stacks are located at PSA+380. Since the PSA starts at virtual address 0 for each processor we can simply browse address 380 to see what's there. Note if there were more than one CPU we'd need to browse each PSA separately as they are processor dependent. So on the **L** (locate) command use the keyword CP(1). Browse the storage address 00000380, using the IPCS browse function and write down the eyecatcher that appears there: ____
5. Try issuing the command L 380. cpu(0) while still looking at storage. What does this indicate? Do this for all CPs ____

The next step is to find out what caused the overlay you found above. To do that we can look in logdata, MTRACE or SYSTRACE in the hope that whatever overlaid the storage left some “footprints.” In this case let us start with IP VERBX MTRACE. Whatever did this overlay would have been one of the last things running before the wait state (the system would not survive long from an overlay of this magnitude).

6. What was the last entry in VERBX MTRACE? Which job started shortly before we get the problem? ______________________________
7. Use IP SELECT ALL to find the ASID of the item found above. ___________
8. Use IP SYSTRACE ALL. What was the last SVC issued? _____________________

SVC 8A is a pageser SVC that will allow a program to be in supervisor state, allowing it to write to locations such as PSA+380.

Browse the PSW shown in the SYSTRACE entry found above. Be aware to select the correct address space to look for the storage. The PSW address is 7230. Page back (and sometimes you may have to page forward and then page back to get the correct address, which is 7000) and record the eyecatcher found there:

____

Answers to questions: See Appendix A.23, “A standalone dump example - Answers” on page 333.

Conclusion

You have now completed the lab exercises. If you wish to go back and use any of the dumps to try some other IPCS items you may have learned, feel free to do so.

Remember that the dumps used are available via FTP for download as stated in the introduction.

The answers to the labs are on the following pages.

A.14 LIST TITLE and LIST SLIPTRAP - Answers

1. IP LIST TITLE can be used to get the title of the dump.
   – Record the tile here:___ SLIP DUMP ID=PHIL_______
2. Based on the title of the dump you can make a guess as to what type of dump this is. Is this a (answers are highlighted):
   – STANDALONE DUMP
   – A CONSOLE DUMP
   – SLIP TRAP GENERATED DUMP
   – PROGRAM GENERATED DUMP
3. IP LIST SLIPTRAP can be used to show the slip trap used to obtain any dump, if a slip trap was used.
   – Was a slip trap used? YES/ NO (circle one)
   – If a slip trap was used, what was it?
     - SLIP SET,C=0C4,ID=PHIL___________

A.15 IP ST WORKSHEET - Answers

Using the IP ST WORKSHEET command answer the following questions. Refer to the previous page for information on what this information looks like in the output.

1. What is the dump title? __SLIP DUMP ID=PHIL________
2. Does this agree with the list title output you saw before? _YES_
3. How many CPs are online in this dump? __6__
4. What is the original dump data set name?

   __DUMP.D111110.H20.SC64.PHILGER1.S00022 ___
5. When was the dump taken? _ 15:26:13.270200 Local_____

Note: You could use the above information to prove that everyone in this lab session is using a copy of the same dump.

6. What was the name of the system this dump was taken on? SC64___
7. What was the primary address space (PASID) in control at the time of the dump?__20_
8. The IP SELECT ALL command provides a list of all the ASID numbers and the jobnames associated with them. Use this command to determine what the jobname is for the PASID found above __PHILGER1__

A.16 Using the RTCT control block - Answers

IP CBF RTCT formats the RTCT control block, which gives information such as what ASIDs where dumped.

1. Use the CBF RTCT command to find the ASID(s) included in this dump and list them here:

   _____20_____

Additionally, the RTCT contains information on what SDATA options were used. To format this information, use the IP CBF RTCT+9C? STR(SDUMP) VIEW(FLAGS) command. Try this command and determine:

2. Was LSQA requested on the dump? YES
3. Was RGN requested (shown as RGN-Private)? YES

The output above will also indicate whether certain component exits receive control or not in the SDUEXIT flag.

4. Look at these flags to determine if GRSQ was specified. YES

A.17 Information from IP ST REGS - Answers

The following questions can all be answered by using the IP ST REGS command (as before, refer to the previous page for an example):

Questions:

1. What ABEND did we get? __0C4__
2. To get the exception information enter IP SYSTRACE and do a find for *RCVY. PGM preceding tis entry will show the pic value too. __PGM 004_____
3. Have a look at MVS System Codes manual to get the exception information. Protection Exception.
4. Enter IP ST W or IP ST REGS again. What was the failing PSW address? __PSW 07850000 00000000 00000000_00007026_______
5. What ASID is this failing code executing in? ____20_____
6. What was the failing TCB address? __7FF3A0______

   Now using the address portion of the PSW, you want to get more information about the module that was running. You also want to browse some of the register storage. Use IPCS browse, IPCS Option 1, as shown in Figure A-4 on page 298.
7. When you browse the PSW address and back up with PF7, what eyecatcher do you see? The first instruction preceding the eyecatcher is a 47F0C01C ___AB0C4______
8. Browsing the code 4 bytes before the PSW can you determine the reason for the ABEND0C4? The failing instruction is a STH (Store Halfword) If you are not so familiar with opcodes, you can use IP OPCODE command. In our case IP OPCODE 40404040 Which register do we use to execute the instruction? __4__
9. ABEND0C4 pic 4 leads to accessing the page pointed to by register 4 using a wrong key. What key does our PSW show? ___key 8__
10. Each storage is getmained using a key. To get the key from the page pointed to by register 4 enter the IP RSMDATA VIRTPAGE RANGE(7D1000). Does the key match with the one in PSW? _NO key 1____

Answers to questions: See Appendix A.17, “Information from IP ST REGS - Answers” on page 331.

> **Note:** The error occurred due to the storage where we expect an instruction shows blanks. (40404040) Due to this is a correct OP code, in our case STH, we try to execute it. But the reason for our abend 0C4 could in this case be an overlay or a bad branch.

A.18 IP SYSTRACE - Answers

1. By using IP SYSTRACE ASID(X’20’) TIME(LOCAL) and looking in the output for the PGM 004 entry, when did the abend occur? __15:26:12.8699____
2. Does the time match our IP ST W output?_ No because the dump was taken at systrace entry *SVC D_15:26:13.270200 Local.
3. Do we call RTM (Recovery Termination Manager)? Look for *RCVY _YES_
4. Is there an FRR (Functional Recovery Routine) between *RCVY and *SVC? _NO
5. Which module requested *SVC D to give control to RTM2? Browse the PSW from tis entry in our address space storage. To get the module name you can either enter IP W X or IP W 14601C2. W is the short form for WHERE and X can be used when you did a locate PSW address before. ___IEAVTRTM+261A_
6. What is the TCB that got the abend? __007FF3A0__
7. What processor number is shown? _3__
8. Are we running in cross memory mode? See PASD SASD. If they show different address space numbers we are running in cross memory mode. _NO. HOME,PRIMARY and SECONDARY show the same address space number_

A.19 IP VERBX MTRACE - Answers

The D GRS,C console command can be used to determine whether there is any resource contention on the active system. Looking at IP VERBX MTRACE output, determine if there were any GRS displays recently.

1. Have a look at the IP VEBX MTRACE output. Are other abends reported? __YES___
2. Have dumps been taken? __YES. Dump data sets have been allocated__
3. Did we use slip processing? __YES_

   User PHILGER submitted a job. Which step ended with an abend indication? Check for message IEF450I. __GO__

A.20 SUMMARY FORMAT - Answers

1. Use the IP SUMM FORMAT ASID(X'20') command to determine which TCBs have a nonzero CMP field. You may have a look at the *z/OS V1R13.0 MVS System Codes* manual to get the error explanation ___ TCB 007FF130 and TCB 007FF3A0
2. Look at the control block flow from our TCB getting the ABEND0C4 error. Do a find for RTM2 and locate the SEQ#. If you have more than one RTM2 WA, you can use this information to determine which RTM was the first one we got. The one with the lowest number shows the first error. What does it show? _Completion code 840C4000___
3. Have a look at RTM”WA SUMMARY. Do the PSW and registers match our abend information in IP ST REGS? _YES_
4. Check the PRB. Which module is pointed to by OPSW? ___AB0C4___
5. The registers that belong to this OPSW are saved in the following SVRB. Do they show the same value like the registers in RTM2WA? __YES__

A.21 ANALYZE RESOURCE - Answers

1. What is the dump title? _____ENGHANG_____
2. What address spaces are dumped? ___0001, 001D, 0020, 001F, 0039, 001E, 0013 __
3. Because jobname PHILGERB is not running, have a look at ASCB DPH value, which shows the dispatching priority for the job. Use IP SUMM FO ASID(X'1D'). What is the dispatching priority? ___FE___
4. The dispatching priority is very high, so we need to concentrate on resource problems. Enter the IP ANALYZE RESOURCE command and check whether we have an enqueue contention. Name the address space ids __20, 1D____
5. Get the following information: MAJOR=_PAUL_ MINOR=_ROGERS__SCOPE=_SZSTEMS_ The Scope information will show whether the enqueue is only on the local system or sysplex wide. A Scope name ending with an S means sysplex-wide enqueue.
6. Which job holds the resource? __PHILGERA__What TCB? _007FF3A0_
7. Which job is waiting? _PHILGERB_ What TCB? __007FF3A0_
8. Do you see any activities for these two address spaces in the systrace? _YES. Asid 20 seems to be looping and asid 1D is in a WAIT scenario___
9. Have a look at the MTRACE whether an D GRS,C command was issued. If yes, does it show the same information? __YES__

A.22 Diagnosing excessive processor time - Answers

1. Check the total amount of processor usage? _x 4B dec 75%_____
2. Get the address space ID for jobname PHILGER1. Use IP SELECT ALL. What address space was the user running in? _20___
3. Have a look at the systrace entries for the asid number you found. Do you see a loop? _YES_
4. What TCB is running the loop? _007FE040_
5. Looking at the TCB using IP SUMM FO ASID(X'20'), does it show an abend indication? _YES_071
6. Was the looping pgm ended by the system? _YES___
7. If the question 3 was answered with yes, which entry in the systrace leads to your opinion? EXPL entries.
8. Get the module name where the loop takes place. Loops can be recognized by EXCP entries in the systrace. Get the PSW and locate it in the storage. Hit PF7 until you get the module name. _IGC079 _
9. Has the loop been interrupted? _YES__
10. If yes, which systrace entry shows the interrupt? _DSP and EXPL entries show this__

A.23 A standalone dump example - Answers

A.24 Diagnosing loops and hangs

Questions:

1. First issue IP ST WORKSHEET and note the title: ___SADUMP FOR WAIT083__
2. Get IEA020W message information __AN FRR STACK POINTER FOR CPU 02 IS DAMAGED____
3. Get the wait state information from PSW at time of dump 00004084
4. If you look up the meaning of this wait state you will note that it means the FRR stack is corrupted. The FRR stacks are located at PSA+380. Since the PSA starts at virtual address 0 for each processor we can simply browse address 380 to see what's there. Note if there were more than one CPU we'd need to browse each PSA separately as they are processor dependent. So on the **L** (locate) command use the keyword CP(1). Browse the storage address 00000380, using the IPCS browse function and write down the eyecatcher that appears there: __02A64A80__
5. Try issuing the command L 380. cpu(2) while still looking at storage. What does this indicate? Do this for all CPs __NG NG NG NG__

The next step is to find out what caused the overlay you found above. To do that we can look in logdata, MTRACE or SYSTRACE in the hope that whatever overlaid the storage left some "footprints." In this case let us start with IP VERBX MTRACE. Whatever did this overlay would have been one of the last things running before the wait state (the system would not survive long from an overlay of this magnitude).

6. What was the last entry in VERBX MTRACE? Which job started shortly before we get the problem? ___PHILGER1 STARTED___
7. Use IP SELECT ALL to find the ASID of the item found above. __20__
8. Use IP SYSTRACE ALL. What was the last SVC issued? ___8A______

SVC 8A is a pageser SVC that will allow a program to be in supervisor state, allowing it to write to locations such as PSA+380.

Browse the PSW shown in the SYSTRACE entry found above. Be aware to select the correct address space to look for the storage. The PSW address is 7230. Page back (and sometimes you may have to page forward and then page back to get the correct address, which is 7000) and record the eyecatcher found there:

Answers to questions: See Appendix A.23, "A standalone dump example - Answers" on page 333.

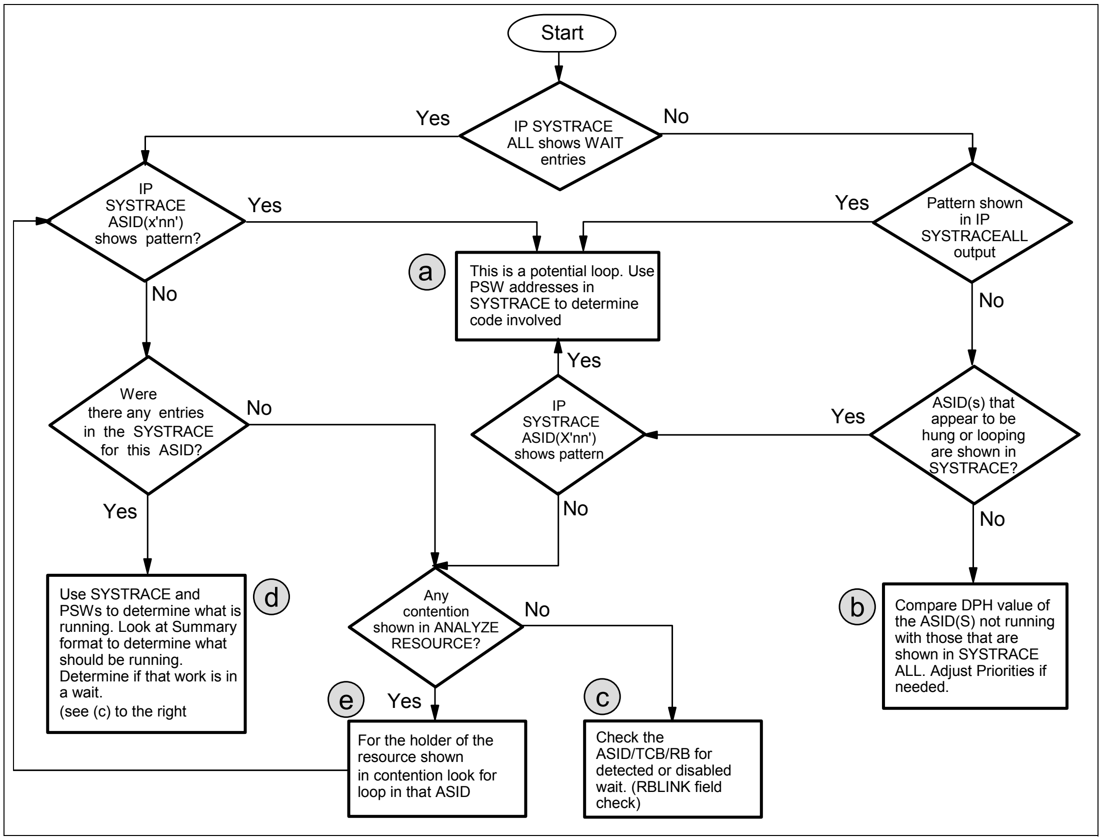


Figure A-32 Flowchart for loops and hangs

Loops and hangs

The flowchart shown in Figure A-32 can be used to diagnose possible loops and system hangs that may occur during processing.

- Step a

  To get to this point a pattern of entries has been found in SYSTRACE. Use the PSW address in the SYSTRACE entries to determine what modules may be involved in the potential loop that has been found. If EXT 1005 entries have been found, this indicates that the code running is not executing traceable events. Even a couple of these entries can be significant if the PSW is in the same area of code on each entry.

- Step b

  At this point a dispatching priority problem should be suspected. While this is not the only possible reason for the ASIDs being hung, it should be checked. Pick a couple of the ASIDs that occur frequently in the SYSTRACE ALL and look at the DPH values. Compare this to the DPH value of the job that should be running. If the DPH values in SYSTRACE ALL are higher, then suspect that perhaps the job or ASID simply cannot get the processor. If this does not work out, analyze resource for contention and look to see if the job that should be running is in a detected wait. (See steps c and e.)

- Step c

  In A.10, “IP SUMMARY FORMAT subcommand” on page 320, some of the key fields in the SUMMARY FORMAT were described. To check to see if the address space is in a detected wait, the RBLINK field of the TCB that should be running (assume this is the last TCB unless there is a specific reason to believe that another TCB may be involved). Also, the ASCBENST field can be used to check the last time this ASID went into a wait (compare with time stamps in system trace).

- Step d

  If the ASID in question is running in SYSTRACE then the goal is to determine what is supposed to be running in the address space that is not. To accomplish this requires some knowledge of the address space, looking at SUMMARY FORMAT with all individual TCBs to be examined, to determine what ones should be running. If these TCBs are not in detected waits then SYSTRACE ASID(x'nn') can be checked to see if those tasks are looping.

- Step e

  If contention is noted in the ANALYZE RESOURCE command (more than a couple tasks waiting for a resource), then the goal becomes finding out why the task holding the resource is not releasing it. This can be treated as though the resource holder is a hung address space, which means going back to look for patterns in IP SYSTRACE ASID(x'nn') where nn is the ASID number holding the resource.

B

Using IPCS to diagnose abends

This appendix describes certain abend types and how to analyze them. Following are the procedures to analyze the dumps:

- First symptoms

  Messages indicate a system or user abend. For example, message IEA995I has been issued to the operator console. A dump was produced. An error was recorded in the logrec data set.

- Information and tools needed for analysis
  - IPCS installed
  - SVC dump, SYSUDUMP, SYSMDUMP, or SYSABEND dump
  - Logrec error record
  - Master trace
  - Job log
- Types of dumps to be analyzed:
  - Abend0C1: PSW, REGS and some basics
  - ABEND0C4
  - High CPU
  - Enqueue Contention
  - Wait
  - Storage
  - LE

B.1 Lab exercises

There are xxxx dumps that you can work on. You do not need to go through each sequentially. An index to the dumps follows:

- An “Introduction to IPCS tools” dump.
- An abend0C1: PSW, REGS and some basics

Lab setup instructions

At the IPCS primary options panel, shown in Figure B-1, choose Option 0 for defaults.

```
------------------- z/OS 01.08.00 IPCS PRIMARY OPTION MENU  -------------------
OPTION  ===>
                                                             ********************
   0  DEFAULTS    - Specify default dump and options         * USERID  - ROGERS
   1  BROWSE      - Browse dump data set                     * DATE    - 07/02/05
   2  ANALYSIS    - Analyze dump contents                    * JULIAN  - 07.036
   3  UTILITY     - Perform utility functions                * TIME    - 11:52
   4  INVENTORY   - Inventory of problem data                * PREFIX  - ROGERS
   5  SUBMIT      - Submit problem analysis job to batch     * TERMINAL- 3278T
   6  COMMAND     - Enter subcommand, CLIST or REXX exec     * PF KEYS - 24
   T  TUTORIAL    - Learn how to use the IPCS dialog         ********************
   X  EXIT        - Terminate using log and list defaults

Enter END command to terminate IPCS dialog
```

Figure B-1 IPCS PRIMARY OPTION MENU

Lab exercise #1:

- Switch dumps by typing `=0` (zero) on the IPCS command line.
- Change the DSNAME to ITSOE.ABCVOL8.AB047.
- Press Enter and proceed back to IPCS Option 6 (commands) by typing `=6` on the command line. Proceed with the exercise.

The Problem: Diagnose a SLIP dump.

When selecting Option 0, Figure B-2 on page 339 is displayed. Add the dump data set name to the Source field to initialize the dump, as follows:

```
Source  ==> DSNAME('ITSO.ABCVOL8.AB047')
```

```
------------------------ IPCS Default Values ------------------------------
Command ===>

  You may change any of the defaults listed below.  The defaults shown before
  any changes are LOCAL.  Change scope to GLOBAL to display global defaults.

  Scope   ==> LOCAL   (LOCAL, GLOBAL, or BOTH)

  If you change the Source default, IPCS will display the current default
  Address Space for the new source and will ignore any data entered in
  the Address Space field.

  Source  ==> DSNAME('ITSO.ABCVOL8.AB047')
  Address Space   ==>
  Message Routing ==> NOPRINT TERMINAL
  Message Control ==> CONFIRM VERIFY FLAG(WARNING)
  Display Content ==> NOMACHINE REMARK REQUEST NOSTORAGE SYMBOL

Press ENTER to update defaults.

Use the END command to exit without an update.
```

Figure B-2 Default panel after selecting Option 0

Use IPCS commands

The IP ST REGS command tells you what the registers were at the time of the dump, as follows:

- For SLIP dump REGS at time slip matched.
- For console dump - typically all zeros.
- For abend dump - they are theoretically the REGS at time of abend.
- For standalone dump use IP CPU REGs to get REGS from each CPU.
- The IP ST FAILDATA command formats the SDWA if it is present. Generally it will give you a better overall picture but may not always be there and may not be the same as ST REGS due to recovery actions.

Information from the IP ST REGS command

If the calling program is in AR mode, all addresses that it passes, whether they are in a GPR or in a parameter list, must be ALET-qualified. A parameter list can be in an address space other than the calling program's primary address space or in a data space, but it cannot be in the calling program's secondary address space.

What does an AR contain? An AR contains a token, an access list entry token (ALET). An ALET is an index to an entry on the access list. An access list is a table of entries, each of which points to an address space, data space, or hiperspace to which a program has access.

The following questions can all be answered by using the IP ST REGS command.

Questions

1. What dump is it? Console or slip dump_____
2. What abend does this dump show?______

3. Was this dump in AR mode at the time of the failure? _______________
4. What was the failing PSW address? _________
5. What ASID is this failing code executing in? _________
6. What was the failing TCB address? ________
7. What is the value in R14? ________
8. Where does register 14 point to? When you browse the address, be aware to get rid of the high order bit which is used for addressing mode. __________

Answers to questions: See “Lab exercise #1 - Answers IP ST REGS” on page 355.

IP SYSTRACE

Use to determine what else was happening on the system at the time of the dump.

Options to use:

- IP SYSTRACE ALL - formats all ASIDs.
- IP SYSTRACE TIME(LOCAL) - converts the time to local time (readable).
- IP SYSTRACE ASID(X'nn') - formats only trace records associated with the requested ASID.

Things to look for in the SYSTRACE:

- If a WAIT entry is found in SYSTRACE the system is not running 100% CPU.
- EXT 1005 entries for the same ASID may be indicative of a loop.
- Only traces traceable events such as SVCs, PCs.

> **Note:** See Chapter 8 in *z/OS MVS Diagnosis: Tools and Service Aids*, SY28-1085 for examples and details of SYSTRACE. See “SYSTRACE definitions” on page 315 for sample output.

Questions

1. Looking at the systrace for asid x’20’, at what time do we get the first *RCVY ABT entry? Use IP SYSTRACE TIME(LOCAL) ASID(x'20')
2. What was the preceding SVC good for?_______________
3. Do we call FRR service?____
4. What does the abend047 mean? ____________
5. Could we recover the error? _______

Answers to questions: See “Lab exercise #1 - Answers IP SYSTRACE” on page 355.

Some Key Fields in IP SUMM FORMAT

The IP SUMM FORMAT ASID(X'nn') command will format lots of data about the specified address space. In this lab we will be interested in the following fields:

- RBOPSW - (contained in the RB under the TCB: of interest) - Can be found by going to the bottom and issuing F 'TCB: 00nnnnnn' PREV, then F ACTIVE to find the most recently active RB. This field shows the last running PSW address at the time the dump was taken or the address that the TCB entered a wait at.
- WLIC - (found in the same manner as RBOPSW above) shows the last interrupt that occurred on a given RB.

- GPR values - Show the register values at the time of the interrupt in the *previous* RB. That means that the RB with the WLIC value stores its registers in the next RB, or in the TCB if there is not a following RB.
- TCB summary at the very bottom of the output - Contains a CMP field that shows the last completion code issued for a TCB.

Figure B-3 shows an example of a TCB summary where the last TCB shows a completion code of ABEND 047.

```
JOB PHILGER1 ASID 0020 ASCB 00FCAE80 FWDP 00FCAB80 BWDP 00FB8000 PAGE
00000006
    TCB AT    CMP      NTC      OTC      LTC      TCB      BACK     PAGE
   007FE040 00000000 00000000 00000000 007FF890 007FD0C0 00000000 00000056
   007FD0C0 00000000 00000000 007FE040 00000000 007FF890 007FE040 00000062
   007FF890 00000000 007FD0C0 007FE040 007FF130 007FF130 007FD0C0 00000067
   007FF130 04822000 00000000 007FF890 007FF3A0 007FF3A0 007FF890 00000074
   007FF3A0 80047000 00000000 007FF130 00000000 00000000 007FF130 00000084
```

Figure B-3 TCB summary

Figure B-4 shows the result of issuing the BOTTOM command followed by the F 'ACTIVE' previous command to locate the TOP RB of the Last Task in the address space. Note that this task is issuing an SVC 6B.

Note: The WLIC field shows 00026B, which means the last SVC this task issued was SVC 6B modeset.

```
  PRB: 007FF020
     -0020  XSB...... 7FFFDD60  FLAGS2... 00        RTPSW1... 078D0000
     -0014            A4B000C2  RTPSW2... 0002006B  00000000
     -0008  FLAGS1... 00000000  WLIC..... 0002006B
     +0000  RSV...... 00000000  00000000            SZSTAB... 00110082
     +000C  CDE...... 007FE000  OPSW..... 078D0000  A4B000C2
     +0018  SQE...... 00000000  LINK..... 007FF3A0
     +0020  GPR0-3... FD000008  00006000  00000040  007D19D4
     +0030  GPR4-7... 007D19B0  007FF130  007BAFC8  FD000000
     +0040  GPR8-11.. 007FCAC8  007CF8F0  00000000  007FF130
     +0050  GPR12-15. 8759F022  00006008  007FCB14  007FCAF8
```

Figure B-4 PRB layout

SUMMARY FORMAT exercises

Questions

1. Use IP SUMM FORMAT ASID(X'20') followed by the BOTTOM command. Looking at the TCB summary, what are the TCBs ending with a non-zero completion code: ________________
2. Could we recover the errors? ______________________
3. What shows that we could not recover abend047? ___________________
4. Use F 'TCB: 00' PREV command to find the TCB that took the ABEND047 then issue F 'ACTIVE' to find the top RB.
   - From that RB what are the values of OPSW _______________________

– And the WLIC value _______________

– What does WLIC field tell? _____________

5. Where does the EP point to? ___________________________
6. What is the start area pointed to by ENTPT?_____________________
7. Does the task run secure? ________
8. Where do we find the registers at time of OPSW shown in PRB: 007FF020? ________

Answers to questions: See “Lab exercise #1 - Answers Summary Format” on page 355.

Diagnosing an ABEND0C1 dump

The exercises on the following pages are designed to demonstrate how to diagnose an ABEND0C1. An ABEND0C1 is an attempt by the processor to execute an instruction that is not valid or not coded correctly.

Typically the abend will occur when a program executes a bad branch. Thus, often the PSW where the abend occurs is less important than where the last valid instruction was executed. There are a couple of ways to determine that.

- Find a base register. Many programs use a base register to establish addressability. This may be one or more registers but typically R12 is chosen. Thus looking at R12 may point to code that was last in control.
- Find the source of the branch. By convention often the BALR 14,15 instruction is used to get from one program to another. If this is the case, R14 will point to the source of the call.
- Look at the TCB/RBs of the abending task. In some cases the previous RB can give a clue as to what program was to get control next. For instance, perhaps the previous RB has a WLIC of 00010006 which would be a LINK SVC and will enable you to look at the parmlist for the link to find the information about what program got control as a result.
- Examine SYSTRACE for the ASID/TCB that abended. Perhaps there was a traceable event that occurred prior to the abend that will give you a clue as to what program was in control leading up to the abend.

Use any details you get from the above to search problem databases for a known fix for a vendor problem or to feed back to the programmer for a customer-written program.

Lab exercise #2:

- Switch dumps by typing `=0` (zero) on the IPCS command line.
- Change the DSNAME to ITSO.ABCVOL8.AB0C1.
- Press Enter and proceed back to IPCS Option 6 (commands) by typing `=6` on the command line. Proceed with the exercise.

The Problem: Diagnose an ABEND0C1 ABEND dump.

Questions

1. Determine what this dump is all about: Issue the IP LIST TITLE command.? ______.
2. Using the IP SYSTRACE ALL command and issuing a F '*PGM', what PSW address was the PGM 001 (a.k.a. ABEND0C1) taken at? ________________________
3. Fill in the abend code in the *RCVY entry below based on the *RCVY entry that immediately follows the *PGM 001:

– *RCVY PROG 94 __ __ __ 000 (file in the 3 missing characters)

4. Use the IP ST REGS command to get the relevant information about the abend 0C1. Record the following:
   – PSW ______________________________________
   – R14 ______________________________________
   – Primary ASID (PASN) _________________________
   – Abending JOBNAME ______________________
   – Failing TCB address
5. Use the =1 command to get into IPCS browse:
   – Browse the PSW address what 'instruction' does the PSW point to? ________________
6. Often, branches are accomplished with BALR 14,15, making R14 point to the caller. Check R14 in this dump and see what instruction reg 14 points to: Browse the address in R14.______
7. Get the module name which issues the SVC 3 instruction. Use IP WHERE 00FDCA98 __________________________
8. Get the module name pointed to PSW at time of error ______________
9. Due to we know that abend 0C1 PSW points to the failing instruction, what does this area show? _________
10. What offset is it in the module? In our case the module starts with 90ECD00C. ______

Answers to questions: See "Lab exercise #2 - Answers diagnosing an ABEND0C1" on page 356.

Diagnosing an USS ICH408I security violation

This exercise is designed to show how to diagnose an ICH408I related abend. The dump we will look at was taken due to an USS file access was denied. From the dump we will get the users RACF definitions and USS related UID which is defined in OMVS segment for this user.

Lab exercise #3:

- Switch dumps by typing `=0` (zero) on the IPCS command line.
- Change the DSNAME to ITSO.ABCVOL8.SECURUSS.
- Press Enter and proceed back to IPCS Option 6 (commands) by typing `=6` on the command line. Proceed with the exercise.

The Problem: Diagnose an ICH408I slip dump.

Questions:

1. Have a look at the IP VERBX MTRACE and get the last ICH408I message
2. Which user failed to access a file? ______________
3. What is the file name he would like to access? _________
4. According to the permission bits he was not allowed to work with this file. To get the users RACF and OMVS security related definitions we need to check the ACEE. The ACEE is pointed to by SENV which will be provided in our ASXB control block which is pointed to by ASCB. If a TCB has its own ACEE security, it will show the ACEE address in its own SENV

field. In this dump we have only one SENV pointed to by ASXB. Browse this address and get user name and default group. You need to look at RACF data area manual to get ACEE layout. Be aware to look at the correct address space. ____________________

5. To get the information to which RACF groups the userid is connected, have a look at ACEE offset x’74’. Browse this address and you will get the group related information. ______________

6. If a user is requesting USS service a USP (User Security Packet) is provided which show the user permission. Get the following control blocks in the dump:

   a. ACEE points to ACEX at offset x'98'. Browse the address and check the eye catcher ___________

   b. ACEX points to USP at offset x'48’. Browse area pointed to by the address at offset x’48’ ___________

Answers to questions: See “Lab exercise #3 - Answers diagnosing ICH408I” on page 356. To get RACF control block layout have a look at *z/OS V1R13.0 Security Server RACF Data Areas* GA22-7680-13.

RACF provides trace possibilities to get access violation information. Have a look at Figure B-5 on page 345 where we trace ch_access using service number 6.

```
1. Add following member into your SYS1.PROCLIB
    //GTFRACF PROC MEMBER=GTFPRMUS
   //BR14     EXEC PGM=IEFBR14,REGION=512K
   //SYSPRINT DD SYSOUT=*
   //D DD DISP=(OLD,DELETE),UNIT=3380,VOL=SER=VSMI04,
   //  DSN=HILG.TRACE
   //IEFPROC EXEC PGM=AHLGTF,PARM='MODE=EXT,DEBUG=NO,SA=100K,AB=100K',
   //            REGION=2880K,TIME=NOLIMIT
   //IEFRDER DD   DSNAME=HILG.TRACE,UNIT=3380,VOL=SER=VSMI04,
   //            DISP=(NEW,CATLG),SPACE=(TRK,(100))
   //SYSLIB  DD   DSNAME=SYS1.IBM.PARMLIB(&MEMBER),DISP=SHR
2. Allocate a parm member like GTFPRMUS in one of your Parmlibs.
   Add :
     TRACE=USRP
     USR=(F44),END
3. Start GTFRACF with the following command:
     S GTFRACF.GTFR
**
     GTFRACF will be submitted and the GTF name will be GTFR.
4. Activate the trace options using the SDSF command:
      #set trace(callable(TYPE(6)) jobname(xxxx)) list
***************************************************************
    You need to check the prefix for the command in the IEFSSNxx
    Parmlib member.
    My IEFSSN member shows RACF entry
    SUBSYS SUBNAME(RACF) INITRTN(IRRSSI00) INITPARM(#)
    Which leads to # command prefix.(on my system)
**************************************************************
5.  Stop USS Ctrace
    TRACE CT,OFF,COMP=SYSOMVS           enter
6.  Start USS CTRACE
    TRACE CT,64M,COMP=SYSOMVS           enter
    Replyid,OPTIONS=(ALL),END           enter
7.  Activate the following slip:
    SLIP SET,MSGID=ICH408I,
    JL=OMVS,ID=yyyy,
    DSPNAME=('OMVS'.*),
    SDATA=(ALLNUC,PSA,CSA,LPA,TRT,SQA,RGN,LSQA,SUM),END
**************************************************************
8. Recreate problem
```

Figure B-5 RACF trace

Note: Service number information can be found in z/OS Security Server RACF Diagnosis Guide Tracing the Callable Services, RACROUTE, and RACF Database Manager Request calls, GA22-7689-14.

Diagnosing storage problems - ABEND878

To diagnose storage problems with a dump, it is best to use the VERBX VSMDATA 'SUMMARY' command in IPCS. There is a wealth of information about the output of this command. Chapter 29 of *z/OS MVS Diagnosis: Reference*, GA22-7588 provides details.

In general the approach is to determine whether this is a common or local storage problem. The exercise that follows details a common storage shortage problem. The steps for diagnosing a local (ASID) storage problem are similar.

SSRV trace entries

For virtual storage management, use the following information:

- For SSRV 132 (Storage Obtain)
- SSRV 133 (Storage Release)

SSRV requests for VSM

For an SSRV request to virtual storage management, the data is:

- Under UNIQUE-1: Information input to the VSM storage service, the bytes are as follows:

```
0       Flags:
        X...   ....   RESERVED
        .1..   ....   KEY was specified
        ..1.   ....   AR 15 is in use
        ..0.   ....   AR 15 is not in use
        ...1   ....   LOC=(nnn,64) was specified. Storage can be backed abov
                      the bar
        ....   1...   CHECKZERO=YES was specified
        ....   0...   CHECKZERO=NO was specified explicitly, or by default
        ....   .1..   TCBADDR was specified on STORAGE OBTAIN or RELEASE
        ....   ..00   OWNER=HOME was specified explicitly, or by default
        ....   ..01   OWNER=PRIMARY was specified
        ....   ..10   OWNER=SECONDARY was specified
        ....   ..11   OWNER=SYSTEM was specified
1       Storage key (bits 8 through 11)
2       Subpool number
3       Request flags:
        1...   ....   ALET operand specified
        .1..   ....   Storage can be backed anywhere
        ..00   ....   Storage must have callers residency
        ..01   ....   Storage must have a 24-bit address
        ..10   ....   The request is for an explicit address
        ..11   ....   Storage can have a 24- or 31-bit address
        ....   1...   Maximum and minimum request
        ....   .1..   Storage must be on a page boundary
        ....   ..1.   Unconditional request
        ....   ...0   OBTAIN request
        ....   ...1   FREEMAIN request
```

SSRV storage size

Under UNIQUE-2, the following information is needed for question # 2:

- In an SSRV trace entry for a VSM STORAGE OBTAIN or GETMAIN, one of the following:

- The length of the storage successfully obtained
- The minimum storage requested, if the storage was not obtained

ABEND878 - finding the request

Lab exercise #4:

- Switch dumps by typing =0 (zero) on the IPCS command line.
- Change the DSNAME to ITSO.ABCVOL8.AB878CSA.
- Press Enter and proceed back to IPCS Option 6 (commands) by typing =6 on the command line. Proceed with the exercise.

The Problem: Diagnose an ABEND878 ABEND dump.

Questions

1. What kind of dump is this? Use IP ST to get title. __________
2. According to the dump type we should use IP ST REGS to get the abend and reason code. Look at register 1 for abend and register 15 for reason code. _______________
3. Have a look at *z/OS V1R13.0 MVS System Codes SA22-7626-23 to get the error code information. Where doe we get the storage problem? RGN CSA SQA?*
4. Issue the IP SYSTRACE command and then F '*S' to find the failing SVC. Have a look at the preceding SVC 78.
   - What request does SVC 78 represent? ______________________________________
   - Note: this request had been an SVC entered, the mapping you need to use is found in *z/OS MVS Diagnosis: Reference*, GA22-7588 under SVC 10 (0A0A) or SVC 132 (0A78).
   - What was the PSW address of the request? _______________________________
   - Note: if it was PC entered as this one was you will need to get the PSW address from the PC entry, which in this case is a 30B (storage obtain) and use the information provided above.
   - What subpool was requested? ______________________
   - Was storage requested above or below the line? ________________________
   - What was the size requested for the storage? _________________________
5. Looking backward in the system trace, is there an apparent pattern? To do this, issue F '78' prev .__________________________

Answers to questions: See "Lab exercise #5 - Answers diagnosing storage - ABEND878" on page 357.

ABEND878 - analyzing storage use

Using the same dump, issue the VERBX VSMDATA 'SUMMARY' command.

Questions

1. Issue the F 'GLOBAL DATA' command. Using the table found, fill in the following information from the Global Data Area:
   - SIZE OF:
   - CSA _______________________________
   - SQA_______________________________

- ECSA_______________________________
- ESQA_______________________________
- Was any of CSA or ECSA converted to SQA in this dump? This information is provided in CSACV field. ______

If large amounts of CSA have been converted to SQA, suspect an SQA problem.

2. Use the F 'CSA TOTAL' command to find the total current usage of CSA/ECSA (note: CSA is the lower number and ECSA is the upper number). Use SQA Total to get the SQA information and fill in the information below:
   - Current usage of:
   - CSA _______________________________
   - SQA_______________________________
3. Do we have sufficient storage available in our CSA below? Check IP VERBX VSMDATA output for CSASZ and CSAALLO. ________

Answers to questions: See "Lab exercise #5 - Answers ABEND878 - Analyzing storage use" on page 357.

ABEND878 - CSA/SQA tracker

Enter the VERBEXIT VSMDATA OWNCOMM command to display information about jobs or address spaces that hold storage in the common service area (CSA), extended CSA, system queue area (SQA), or extended SQA. The dump being analyzed with VERBEXIT VSMDATA OWNCOMM must contain the SQA and ESQA subpools. If you use the SDUMP or SDUMPX macro or the DUMP command to obtain the dump, make sure to specify the SQA option of the SDATA parameter.

Enter the VERBEXIT VSMDATA 'OWNCOMM DETAIL' command to obtain a report that displays a list of storage ranges owned by one or more jobs.

Lab exercise #5:

- Switch dumps by typing `=0` (zero) on the IPCS command line.
- Change the DSNAME to ITSO.S2895.DUMP2.
- Press Enter and proceed back to IPCS Option 6 (commands) by typing `=6` on the command line. Proceed with the exercise.

The Problem: Diagnose an ABEND878 ABEND dump.

Questions

Use *z/OS MVS Diagnosis: Reference*, GA22-7588, which describes the output of the VERBX VSMDATA OWNCOMM command to complete this exercise.

1. . Using the same dump as on the previous page, issue the IP VERBX VSMDATA 'OWNCOMM SUMMARY' command
   - What jobname consumed the most below CSA? _________________
   - How much CSA was allocated to that jobname? ________________
2. Issue the IPVERBX VSMDATA 'OWNCOMM DETAIL ASIDLIST(32)' command. Answer the following questions about the storage:
   - What jobname allocated this storage? __________________________________
   - What was the length of the storage requested? ___________________________

– What was the return address of the storage request in the first entry?
____

– What were the first 16 bytes of the storage area in question?
____

– Is there an obvious pattern here? ____________

: See “Lab exercise #5 - Answers ABEND878 - CSA/SQA tracker” on page 358.

Diagnosing local storage shortage

This exercise will shorten the process by:

- Understanding the failing request
- Getting a picture of current local storage usage
- Using that picture to evaluate where (high private or user region) the problem lies.
- Using VSM control blocks to specifically identify the problem pattern
- Using IPCS tools to identify the problem program

Lab exercise #5:

- Switch dumps by typing `=0` (zero) on the IPCS command line.
- Change the DSNAME to `ITSO.ABCVOL8.AB878`
- Press Enter and proceed back to IPCS Option 6 (commands) by typing `=6` on the command line. Proceed with the exercise.

The Problem: Diagnose local storage shortages.

SSRV trace entries

For this exercise, in the SYSTRACE, use the following information. An example of a SYSTRACE entry is shown in Figure A-21 on page 315 and Figure A-22 on page 315.

Under UNIQUE-1:

- Byte 2 - Contains the subpool number.
- Byte 3 - Request flags.

```
1...   ....   ALET operand specified
.1..   ....   Storage can be backed anywhere
..00   ....   Storage must have callers residency
..01   ....   Storage must have a 24-bit address
..10   ....   The request is for an explicit address
..11   ....   Storage can have a 24- or 31-bit address
....   1...   Maximum and minimum request
....   .1..   Storage must be on a page boundary
....   ..1.   Unconditional request
....   ...0   OBTAIN request
....   ...1   FREEMAIN request
```

Under UNIQUE-2:

- In an SSRV trace entry for a VSM STORAGE OBTAIN or GETMAIN, one of the following:

– The length of the storage successfully obtained
– The minimum storage requested, if the storage was not obtained

Under UNIQUE-3:

- In an SSRV trace entry for a VSM STORAGE OBTAIN or GETMAIN, one of the following:
  – The address of the storage successfully obtained, if you specified address; otherwise, zero.
  – The maximum storage requested, if the storage was not obtained
- In an SSRV trace entry for a VSM STORAGE RELEASE or FREEMAIN:

  The address of the storage to be released.

Under UNIQUE-4:

- Left 2 bytes: ASID of the target address space
- Next byte4: Reserved
- Right byte:

  If the GETMAIN/FREEMAIN/STORAGE OBTAIN/STORAGE RELEASE is unconditional, an abend will be issued and the SSRV trace entry 3rd byte of UNIQUE-4 will contain X'FF'. If the GETMAIN/FREEMAIN/STORAGE OBTAIN/STORAGE RELEASE is conditional, no abend will be issued and the SSRV trace entry 3rd byte of UNIQUE4 will contain the actual return code from the storage service.

Questions

1. Issue the IP SYSTRACE ALL followed by the F *SVC command to find the SVC D request for this error. Back up a couple of lines with the UP 5 command. Use the mappings provided in *z/OS MVS Diagnosis: Tools and Service Aids*, SY28-1085 (SSRV trace entries) to fill in the following information:
   – What was the ASID where the failure occurred? ____________
   – What was the size requested of the failing GETMAIN? ______________________
     • Does this seem excessive? ________________
   – What was the requested subpool? ___________________
   – Based on the Subpool requested, is this a global or local problem? ____________
     • SP 0-127 are low private (Region) subpools.
2. Issue the IP VERBX VSMDATA 'SUMMARY NOG ASIDLIST(32)' command, go to the bottom of this output and find the local storage map. Fill in the following values from the map:
   – _________________ <- Max Ext. User Region Address
   – _________________ <- Ext. User Region Top
   – __________________ <- Ext. User Region Start
3. Extended private storage grows down until it reaches the current top of region; subsequent local storage may then fail as a result. Based on the storage map, did this happen? _____
4. The user region grows up until the current top of the region approaches the maximum user region. Subsequent region requests that would push the current top of the region over the max will fail. Did this occur in this case? ___________

At this point we can assume that the problem is with the user region. This is not always as obvious when REGION and PRIVATE storage “collide.” To determine whether the problem is that the user region is exhausted or whether instead it is somehow fragmented, look for

FBQEs that describe storage in the USER REGION range if there are any. Get the FBQEs for below storage, How many bytes are free? Do a find for 00006000.

____

5. Find a pattern in the user region subpools. Look at the Local Subpool Summary near the bottom of the report. What TCB has the largest storage allocation in total? __________
6. Is the storage getmained by this TCB in the same subpool?
7. How much storage did this TCB allocate below? Search for “Total allocation to TCB at address 7FF3A0”.
8. Even we requested size x’EA60’to allocate storage what storage did we get for each of these allocation request. Check the DQEs for this TCB________________
9. Pick any one of the addresses to browse and record the data you found:
   - ____
10. Go back to SYSTRACE ALL and determine the PSW address where the GETMAIN was issued from. Browse that storage and record the eyecatcher of the offending module:
    - Have a look at the previous instruction. Does it show the getmain SVC? __________
    - Module name _______
11. Use the SUMMARY FORMAT ASID(X'20') command to find the EP name (under the RB that took the abend). Max to the bottom using PF8. Select the TCB address with a completion code. Find the TCB above with the command F 'TCB: NNNNNNNN' PREV (address must be 8 digits). Then find the first active RB with F ‘ACTIVE’. What is the EP...... name under the RB. ___________________________________

Answers to questions: See “Lab exercise #5- Answers diagnosing local storage shortages” on page 358.

Diagnosing LE U4083 abend

The most important part to catch useful dumps is to use the correct LE runtime options. You should contact the IBM support center an discuss what runopts should be used for your error scenario. For example there are differences for z/OS and CICS errors how to get a dump. This exercise will guide you through an LE dump. It will show that the abend we got the dump for may not be the original abend. It’s important to check whether ZMCH control blocks are available. Look for CAA and DSA areas. If they are present, we will get useful LE information.

Lab exercise #6:

- Switch dumps by typing `=0` (zero) on the IPCS command line.
- Change the DSNAME to `ITSO.ABCVOL8.ABU4083`

Press Enter and proceed back to IPCS Option 6 (commands) by typing `=6` on the command line. Proceed with the exercise.

The Problem: Diagnose LE abend dump

If you look at the LE TraceBack in the dump, which shows the module calling sequence, you need to read it from bottom to top. The last accessed module is at the top of the output and the first called module at the end of the listing. As shown in Example B-1, module CEEBBEXT was called first.

Example: B-1 TraceBack output

```
Traceback:
  DSA  Entry     E  Offset  Load Mod   Program

  1    EQA00HKS  -19EF4530  EQA00EVH   EQA00HKS
  2    EQA00EVH  +0000616A  EQA00EVH   EQA00EVH
  3    CEEZIDT   +000004BC  CEEPLPKA   CEEZIDT
  4    CEEBBEXT  -0AE90C8C  CEEPLPKA   CEEBBEXT
```

Questions

1. What is the dump title? ________________
2. Get the abend and reason code from IP ST or IP ST W output. _______
3. Get the load module name. ________________
4. Get the csect name. _________________
5. Does the breaking event address, which provides the last branch instruction, provide a non zero value? _____
6. What does register 1 show? ____________ Is this our abend code? _________
7. What does the abend and reason code mean? Have a look at Debugging Guide and Runtime Messages GC33-6681. ____
8. Do you find an abend entry in the systrace? _______
9. Due to we need the CAA and DSA pointer. Do we have these control blocks pointed to by register 12 (CAA) and register 13 (DSA)?. Get the register values from IP ST or IP ST W. CAA should show for byte 2 and 3 ‘0800’ and the save are can be checked using the information provided in Table B-1 on page 353 ________________
10. Get the following runtime options from IP VERBX LEDATA output.
    a. ABTERMENC ________________
    a. TERMTHDACT _______________
    a. TRAP ______________________
11. Get the LE TraceBack. IP VERBX LEDATA ‘CEEDUMP’. Which module was called
    – first? _____________
    – last? ______________
    – Which module got the exception? ___________
12. Enter IP VERBX LEDATA ‘CM’ to get condition. Can you find the ZMCH control block which belongs to our abend?______
13. What abend information do the ZMCH control blocks show? Check the preceding CIBH and look for ABCD: and ABRC:
14. ZMCH points to the original error. If you do not have any ZMCH information in any of the IPCS LE data output do a find for ZMCH in the browsed storage. You may find one. Due to we have 2 ZMCH control blocks, where do the PSWs point to? Enter ‘IP W psw address’

    ____
15. To check whether we have HEAP storage overlays you can use: IP VERBX LEDATA ‘HEAP’
16. To check whether we have STACK storage overlays you can use: IP VERBX LEDATA ‘STACK’
17. Have a look at the save are chain. Browse to register 13 address area at time of error. Use the address at offset 4 to get the previous save area. Browse the register 15 address. What eye catcher do you find? ________
18. To get the original module name you need to get the value at offset x’C’. Add this value to the module start address or do a L +2C60 (assuming you found the correct module.

Compare offset x'C' with 2C60). Offset x'14' will show the name. See Figure B-6 on page 353 ________

19. Not all module names can be found using the offset at x'C'. If the value is negative, which means the first bit is on, the module name is preceding this line. See Figure B-7 on page 354

Answers to questions: See "Lab exercise #6- Answers diagnosing U4083 LE abend" on page 359.

> **Note:** There are different ways to save register information. The one shown in Table B-1 is the most common one.

Table B-1 Save area layout

RES(0) (reserved area)	**HSA (previous sa ptr)**	**LSA (next sa ptr)**	Register 14
Register 15	Register 0	Register 1	Register 2
Register 3	Register 4	Register 5	Register 6
Register 7	Register 8	Register 9	Register 10
Register 11	Register 12		

To get the save area chain starting from the last save area you can use the runchain command:

```
IP RUNC  ADDR(addr of previous save area ptr)  LINK(4)
```

To get the save area chain starting from the first save area you can use the runchain command:

```
IP RUNC  ADDR(addr of next save area ptr)  LINK(8)
```

> **Note:** According to question 10, the output will show the LE run options. This output shows who activated the runopts and whether we can override it.
>
> - PROGRAMMER DEFAULT
> - INSTALLATION DEFAULT
> - DD:CEEOPTS
> - OVERRIDE
> - IGNORED
> - DEFAULT SETTING

```
Command ===> l +2C60
2580B1E8                        47F0F014   00C3C5C5   !         .00..CEE !
2580B1F0   00000358   00002C60   47F0F001   90ECD00C   ! .......-.00...ü. !
**********
2580DE48                        10CEB000   2580DE64   !         ........
2580DE50   00000000   00000000   0008C5D8   C1F0F0C8   ! ..........EQA00H
2580DE60   D2E20000   06000001   00000000   00000000   ! KS..............
```

Figure B-6 CEE module name

```
257FBBF0   E014A7F4   00090700   C5D8C1F0   F0C7C6E4   ! Ö.x4....EQA00GFU !
257FBC00   C3C5C500   18F358E0   D00C980C   D01407FE   ! CEE..3.Öü.q.ü... !
257FBC10   90ECD12C   5880C2F4   58608010   BF9F6218   ! ..J...B4.-...... !
```

Figure B-7 CEE module name preceding

Lab exercise #1 - Answers IP ST REGS

The following questions can all be answered by using the IP ST REGS command.

1. What dump is it? Console or slip dump__SLIP___
2. What abend does this dump show?__047____
3. Was this dump in AR mode at the time of the failure? __NO_
4. What was the failing PSW address? __24B000C2_
5. What ASID is this failing code executing in? _20__
6. What was the failing TCB address? _007FF3A0_
7. What is the value in R14? _80FDCA98_
8. Where does register 14 point to? _0A03 in module IEAVCVT_

Lab exercise #1 - Answers IP SYSTRACE

1. Looking at the systrace for asid x’20’, at what time do we get the first *RCVY ABT entry? Use IP SYSTRACE TIME(LOCAL) ASID(x'20') __09:46:16.733432_
2. What was the preceding SVC good for?__SVC 6B modeset__
3. Do we call FRR service?_NO_
4. What does the abend047 mean? ___An unauthorized program issued a restricted Supervisor Call (SVC) instruction_
   - Could we recover the error? __NO__

Lab exercise #1 - Answers Summary Format

1. Use IP SUMM FORMAT ASID(X'20') followed by the BOTTOM command. Looking at the TCB summary, what are the TCBs ending with a non-zero completion code: 007FF130>>> 04822000 and 007FF3A0>>>> 80047000_
2. Could we recover the errors? __822 was recovered, 047 not____
3. What shows that we could not recover abend047? __RTM2 work area________
4. Use F 'TCB: 00' PREV command to find the TCB that took the ABEND047 then issue F 'ACTIVE' to find the top RB.
   - From that RB what is the address pointed to by OPSW_078D0000 A4B000C2_
   - And the WLIC value _WLIC..... 0002006B___
5. What does WLIC field tell? ______SVC 6B length 2 bytes
6. Where does the EP point to? _EP....... ABEND0C1__
7. What is the start area pointed to by ENTPT?__ENTPT.... A4B00000__
8. Does the task run secure? _NO__
9. Where do we find the registers at the time of OPSW shown in PRB: 007FF020? ________
   _

Lab exercise #2 - Answers diagnosing an ABEND0C1

1. Determine what this dump is all about: Issue the IP LIST TITLE command.? _SLIP DUMP.
2. Using the IP SYSTRACE ALL command and issuing a F '*PGM', what PSW address was the PGM 001 (a.k.a. ABEND0C1) taken at? _24B00008__
3. Fill in the abend code in the *RCVY entry below based on the *RCVY entry that immediately follows the *PGM 001:
   - *RCVY PROG 94 0c1 000 (file in the 3 missing characters)
4. Use the IP ST REGS command to get the relevant information about the abend 0C1. Record the following:
   - PSW __24B00008___
   - R14 ___80FDCA98__
   - Primary ASID (PASN) _0020_
   - Abending JOBNAME _PHILGER1__
   - Failing TCB address _007FF3A0__
5. Use the =1 command to get into IPCS browse:
   - Browse the PSW address what 'instruction' does the PSW point to? __0000___
6. Often, branches are accomplished with BALR 14,15, making R14 point to the caller. Check R14 in this dump and see what instruction reg 14 points to: Browse the address in R14.____0A03 >>> SVC 3_____
7. Get the module name that issues the SVC 3 instruction. Use IP WHERE 00FDCA98 __IEAVCVT+90__
8. Get the module name pointed to by PSW at time of error _ABEND0C1_____________
9. Because we know that abend 0C1 PSW points to the failing instruction, what does this area show? _00000000________
10. What offset is it in the module? In our case the module starts with 90ECD00C. _6__

Lab exercise #3 - Answers diagnosing ICH408I

1. Have a look at the IP VERBX MTRACE and get the last ICH408I message. _ICH408I USER(HILGER) GROUP(SYS1) NAME(PETER HILGER__
2. Which user failed to access a file? _HILGER__
3. What is the file name he/she would like to access? _/u/philger/secure__
4. According to the permission bits the user was not allowed to work with this file. To get the user's RACF and OMVS security related definitions we need to check the ACEE. The ACEE is pointed to by SENV that will be provided in our ASXB control block, which is pointed to by ASCB. If a TCB has its own ACEE security, it will show the ACEE address in its own SENV field. In this dump we have only one SENV pointed to by ASXB. Browse this address and get user name and default group. You need to look at RACF data area manual to get the ACEE layout. __HILGER____ SYS1___
5. To get the information to which RACF groups the userid is connected, have a look at ACEE offset x'74'. Browse this address and you will get the group-related information. __ACEX___

6. If a user is requesting USS service, a User Security Packet (USP) is provided, which shows the user permission. Get the following control blocks in the dump:
   a. ACEE points to ACEX at offset x'98'. Browse the address and check the eyecatcher. _ACEX_
   b. ACEX points to USP at offset x'48'. Browse the area pointed to by the address at offset x48 __________.

```
7F6447C0   E4E2D740   01000038   000004BA   000004BA   ! USP
7F6447D0   000004BA   00000002   00000002   00000002   ! .........
7F6447E0   000001FF   00000000   00000000   00000000   ! .........
7F6447F0   00000001   00000002
```

Figure B-8 USS User security packet

Lab exercise #5 - Answers diagnosing storage - ABEND878

1. What kind of dump is this? Use IP ST to get the title. _SLIP DUMP ID=A878_
2. According to the dump type we should use IP ST REGS to get the abend and reason code. Look at register 1 for abend and register 15 for reason code. _878 / 8__
3. Have a look at *z/OS V1R13.0 MVS System Codes SA22-7626-23 to get the error code information. Where doe we get the storage problem? RGN CSA SQA?*
4. Issue the IP SYSTRACE command and then F '*S' to find the failing SVC. Have a look at the preceding SVC 78.
   – What request does SVC 78 represent? ___getmain__
   – Note: this request had been an SVC entered, the mapping you need to use is found in *z/OS MVS Diagnosis: Reference*, GA22-7588 under SVC 10 (0A0A) or SVC 132 (0A78).
   – What was the PSW address of the request? __0000710C_____
   – Note: if it was PC entered as this one was you will need to get the PSW address from the PC entry, which in this case is a 30B (storage obtain) and use the information provided above.
   – What subpool was requested? __F1 >>> 241__
   – Was storage requested above or below the line? ___below__
   – What was the size requested for the storage? __EA60 >>> 60000__
5. Looking backward in the system trace, is there an apparent pattern? To do this, issue F ‘78’ prev .___Yes....seems to be a loop__

Lab exercise #5 - Answers ABEND878 - Analyzing storage use

Using the same dump as on the previous page, issue the VERBX VSMDATA 'SUMMARY' command.

1. Issue the F 'GLOBAL DATA' command. Using the table found, fill in the following information from the Global Data Area:
   – SIZE OF:
     • CSA ______235000_____

- SQA______3C7000_____
- ECSA____190AB000____
- ESQA______4D0C000__

– Was any of CSA or ECSA converted to SQA in this dump? __NO___

If large amounts of CSA have been converted to SQA, suspect an SQA problem.

2. Use the F 'CSA TOTAL' command to find the total current usage of CSA/ECSA (note CSA is the below number and ECSA is the above number). Use SQA Total to get the SQA information and fill in the information below:

   Current usage of:

   – CSA ____227000____

   – SQA___484B000____

3. Do we have sufficient storage available in our CSA below? Check IP VERBX VSMDATA output for CSASZ and CSAALLO. __NO__

Lab exercise #5 - Answers ABEND878 - CSA/SQA tracker

Use the output of the VERBX VSMDATA ‘OWNCOMM’ command to complete this exercise.

1. Using the same dump as on the previous page, issue the IP VERBX VSMDATA 'OWNCOMM SUMMARY' command.

   – What jobname consumed the most below CSA? __PHILGER1___

   – How much CSA was allocated to that jobname? ___1A8CE0___

2. Issue the IP VERBX VSMDATA 'OWNCOMM DETAIL ASIDLIST(32)' command. Answer the following questions about the storage:

   – What jobname allocated this storage? ___PHILGER1______

   – What was the length of the storage requested? _____EA60 >>> 60000__

   – What was the return address of the storage request in the first entry? _000070F4__

   – What were the first 16 bytes of the storage area in question? __00000000 00000000 00000000 00000000_____

   – Is there an obvious pattern here? __YES___

Lab exercise #5- Answers diagnosing local storage shortages

1. Issue IP SYSTRACE ALL followed by the F *SVC command to find the SVC D request for this error. Back up a couple of lines with the UP 5 command. Use the mappings provided in z/OS MVS Diagnosis: Tools and Service Aids, SY28-1085 (SSRV trace entries) to fill in the following information.

   – What was the ASID where the failure occurred? ___20____

   – What was the size requested of the failing GETMAIN? ___EA60 >>> 60000___

   – Does this seem excessive? ___YES__

   – What was the requested subpool? __12__

   – Based on the Subpool requested, is this a global or local problem? __Local_____

   SP 0-127 are low private (Region) subpools.

2. Issue IP VERBX VSMDATA 'SUMMARY NOG ASIDLIST(32)', go to the bottom of this output and find the local storage map. Fill in the following values from the map:
   - __27400000_________ <- Max Ext. User Region Address
   - __273FF000_________ <- Ext. User Region Top
   - __25400000__________ <- Ext. User Region Start
3. Extended private storage grows down until it reaches the current top of the region and subsequent local storage may then fail as a result. Based on the storage map, did this happen? __NO___
4. The user region grows up until the current top of the region approaches the Max user region. Subsequent region requests that would push the current top of the region over the Max will fail. Did this occur in this case? ___YES____
5. At this point we can assume that the problem is with the user region. This isn't always as obvious when REGION and PRIVATE Storage “collide”. To determine whether the problem is that the user region is exhausted, or whether instead it is somehow fragmented, look for FBQEs that describe storage in the USER REGION range; are there any? Get the FBQEs for the storage, How many bytes are free? Do a find for 00006000.
   - ____NO_____
   - Does this suggest fragmentation or storage exhaustion? ___Exhaustion__________
6. Find a pattern in the user region subpools. Look at the Local Subpool Summary near the bottom of the report. What TCB has the largest storage allocation in total: _7FF3A0_
7. Is the storage getmained by this TCB in the same subpool? _NO____
8. How much storage did this TCB allocate below? Search for: ‘Total allocation to TCB at address 7FF3A0’ _7AE000_
9. Even if we requested size x’EA60’ to allocate storage, what storage did we get for each of these allocation requests. Check the DQEs for this TCB __F000__
10. Pick any one of the addresses to browse and record the data you found:
    - __00000000___
11. Go back to SYSTRACE ALL and determine the PSW address where the GETMAIN was issued from. Browse that storage and record the eyecatcher of the offending module:
    - Have a look at the previous instruction. Does it show the getmain SVC? _YES 0A78_
    - This module actually does not show an eyecatcher. You may use IP W xxxxxxxx__
12. Use the SUMMARY FORMAT ASID(X'20') command to find the EP name (under the RB: that took the abend). Max to the bottom using PF8. Select the TCB address with a completion code. Find the TCB above with the command F 'TCB: NNNNNNNN' PREV (address must be 8 digits). Then find the first active RB with F ‘ACTIVE’. What is the EP...... name under the RB? _______GETMAIN____

Lab exercise #6- Answers diagnosing U4083 LE abend

1. What is the dump title? __JOBNAME BCDRUN STEPNAME JAVA USER 4083__
2. Get the abend and reason code from IP ST or IP ST W output. _U4082 / 2______
3. Get the load module name. __CEEPLPKA___
4. Get the CSECT name. ___UNKNOWN________
5. Does the breaking event address, which provides the last branch instruction, provide a non zero value? __NO___

6. What does register 1 show? _84000FF3__ Is this our abend code? _YES hex value_
7. What does the abend and reason code mean? Have a look at *Debugging Guide and Runtime Messages*, GC33-6681. _The back chain was found in error. / Traversal of the back chain resulted in a program check __
8. Do you find an abend entry in the SYSTRACE? __YES___*SVC D entry___
9. Because we need the CAA and DSA pointer. Do we have these control blocks pointed to by register 12 (CAA) and register 13 (DSA)? Get the register values from IP ST or IP ST W. CAA should show for byte 2 and 3 ‘0800’ and the save area can be checked using the information provided in Table B-1 on page 353 ____YES____
10. Get the following runtime options from IP VERBX LEDATA output.
    - ABTERMENC __(NONE)_______
    - TERMTHDACT _(TRACE,CESE,00000096)__
    - TRAP ___(ON,SPIE)___
11. Get the LE TraceBack. IP VERBX LEDATA ‘CEEDUMP’. Which module was called
    - first? _CEEBBEXT__
    - last? _EQA00HKS__
    - Which module got the exception? __EQA00EVH__
12. Enter IP VERBX LEDATA ‘CM’ to get condition. Can you find the ZMCH control block that belongs to our abend?__NO__
13. What abend information do the ZMCH control blocks show? Check the preceding CIBH and look for ABCD: and ABRC: _ABCD:940C4000 ABRC:00000004_
14. ZMCH points to the original error. If you do not have any ZMCH information in any of the IPCS LE data outputs, do a find for ZMCH in the browsed storage. You may find one. Because we have 2 ZMCH control blocks, where do the PSWs point to? Enter ‘IP W psw address’ __EQACSUTP+026A__and _EQA00EVH+1227D6_
15. To check whether we have HEAP storage overlays you can use: IP VERBX LEDATA ‘HEAP’
16. To check whether we have STACK storage overlays you can use: IP VERBX LEDATA ‘STACK’
17. Have a look at the save area chain. Browse to register 13 address area at the time of error. Use the address at offset 4 to get the previous save area. Browse the register 15 address. What eyecatcher do you find? __CEE
18. To get the original module name you need to get the value at offset x’C’. Add this value to the module start address or do a L +2C60 (assuming you found the correct module). Compare offset x’C’ with 2C60). Offset x’14’ will show the name. See Figure B-6 on page 353 __EQA00HKS_

C

z/OS trace processing data

This appendix contains trace processing data information and information related to z/OS trace capabilities.

The trace output data sets must be specific to each instance of GTF and can be defined in the cataloged procedure. Each instance of GTF to be started must have a separate cataloged procedure, or if the same cataloged procedure is used, then a different trace data set must be supplied with the GTF START command.

C.1 GFS trace information

GFS trace is a diagnostic tool that collects information about the use of the GETMAIN, FREEMAIN, or STORAGE macro. You can use GFS trace to analyze the allocation of virtual storage and identify users of large amounts of virtual storage.

You must use the generalized trace facility (GTF) to get the GFS trace data output.

C.1.1 DIAGxx parmlib member syntax

When creating a DIAGxx parmlib member, enter data only in columns 1 through 71. Do not enter data in columns 72 through 80; the system ignores these columns.

If the system finds a syntax error in DIAGxx, it issues an error message, and then attempts to continue processing the next keyword.

The syntax for the DIAGxx parmlib member is as follows:

```
[VSM TRACE                                                        ]
[ {GETFREE(ON)|GET(ON|OFF) FREE(ON|OFF)                         } ]
[    [ASID({asid1|asid1-asidx}[,{asid2|asid2-asidx}]...)]         ]
[    [DATA(data1[,data2]...)                                      ]
[    [KEY({key1|key1-keyx}[,{key2|key2-keyx}]...)]                ]
[    [LENGTH({len1|len1-lenx}[,{len2|len2-lenx}]...)]             ]
[    [SUBPOOL({sub1|sub1-subx}[,{sub2|sub2-subx}]...)]            ]
[    [JOBNAME([job1,job2...])                                     ]
[    [ADDRESS([addr1|addr1-addrx][,addr2-|addr2-addrx..)]         ]
[    [LOCREAL(loc1[,loc2]...)                                 ]
[ {GETFREE (OFF)                                                } ]
[VSM TRACK                                                        ]
[ {CSA (ON|OFF)                                                 } ]
[ {SQA (ON|OFF)                                                 } ]
[ {CSA (ON|OFF) SQA (ON|OFF)                                    } ]
[VSM CHECKREGIONLOSS(bbb{K|M},aaa{K|M})                           ]
```

C.1.2 GFS trace data

When GTF writes trace data in a data set, format and print the trace data with the IPCS GTFTRACE subcommand.

When GTF writes trace data only in the GTF address space, use a dump to see the data. Request the GTF trace data in the dump through the SDATA=TRT dump option.

Issue the IPCS GTFTRACE subcommand to format and see the trace in an unformatted dump. An example of formatted GETMAIN/FREEMAIN (GFS) trace data, which is output from IPCS in GTFTRACE format, is shown in Figure C-1 on page 363.

```
IPCS
GTFTRACE DA('MY.GTF.TRACE')   USR(F65)
IKJ56650I TIME-03:42:20 PM. CPU-00:00:01 SERVICE-52291 SESSION-00:00:20
BLS18122I Initialization in progress for DSNAME(¢ MY.GTF.TRACE¢ )
IKJ56650I TIME-03:42:21 PM. CPU-00:00:01 SERVICE-54062 SESSION-00:00:20
**** GTFTRACE DISPLAY OPTIONS IN EFFECT ****
USR=SEL

**** GTF DATA COLLECTION OPTIONS IN EFFECT: ****
USRP option

**** GTF TRACING ENVIRONMENT ****
Release: SP6.0.6 FMID: HBB6606 System name: CMN
CPU Model: 9672 Version: FF Serial no. 270067

USRDA F65 ASCB 00FA0800 JOBN MYGTF2
Getmain SVC(120) Cond=Yes
Loc=(Below,Below) Bndry=Dblwd
Return address=849CA064 Asid=001A Jobname=MYGTF2
Subpool=229 Key=0 Asid=001A Jobname=MYGTF2 TCB=008DCA70 Retcode=0
Storage address=008D6768 Length=10392 X¢2898¢
GPR Values
0-3 00002898 00000000 7FFFC918 0B601E88
4-7 01FE3240 008FF830 849CA000 00FA0800
8-11 00000000 00000DE8 049CBFFE 849CA000
12-15 049CAFFF 0B601A9C 00FE9500 0000E510
GMT-01/06/1998 21:15:43.111628 LOC-01/06/1998 21:15:43.1

USRDA F65 ASCB 00FA0800 JOBN MYGTF2
Freemain SVC(120) Cond=No
Return address=8B2D608A Asid=001A Jobname=MYGTF2
Subpool=230 Key=0 Asid=001A Jobname=MYGTF2 TCB=008DCA70 Retcode=0
Storage address=7F73DFF8 Length=8 X¢ 8 ¢
GPR Values
0-3 00000000 7F73DFF8 008D82D8 008D7BC0
4-7 008D8958 008D6B08 008D85C8 0B335000
8-11 00000002 00000000 7F73DFF8 008D862C
12-15 8B2D6044 008D8C98 849D242A 0000E603
GMT-01/06/1998 21:15:43.111984 LOC-01/06/1998 21:15:43.1
```

Figure C-1 Output from IPCS GTFTRACE

C.1.3 IPCS MVS dump component data analysis panel

This panel is displayed by entering Option 2.6 on the IPCS primary option menu panel. You then see displayed the Dump Component Data Analysis panel, bypassing the Analysis of Dump Contents Menu panel. The panel is shown in Figure C-2 on page 364.

To display information, specify "S option name" or enter `S` to the left of the option desired. Enter a ? to the left of an option to display help regarding the component support.

```
 S Name     Abstract
------------------------------------------------
_ IMSDUMP  IMS analysis
_ IOSCHECK Active input/output requests
_ IPCSDATA IPCS control data
_ IPHDR    TCP/IP IP Header Formatter
_ IRLM     IMS Resource Lock Manager analysis
_ JESXCF   JESXCF Address Space Analysis
_ JES2     JES2 analysis
_ JES3     JES3 analysis
_ LEDATA   Language Environment formatter
_ LISTEDT  Format eligible device table
_ LLATRACE Library Lookaside trace
_ LOGDATA  LOGREC formatter
_ LOGGER   System logger formatter
_ LPAMAP   Map link pack area
_ MERGE    Merge GTF/CTRACE output
_ MMSDATA  MMS control block analysis
_ MTRACE   Master TRACE formatter
_ NUCMAP   Nucleus CSECT Map
_ OAMDATA  OAM Control Block Analysis
_ OMVSDATA OpenMVS analysis
_ RESOLVER TCP/IP Resolver Analysis
_ RMMDATA  RMM Control Block Analysis
_ RMMPDA   RMM PDA Trace Analysis
_ RSMDATA  Real storage manager summary
_ SADMPMSG Format SADMP console messages
_ SKMSG    TCP/IP Streams Message Formatter
_ SMSDATA  SMS control block analysis
_ SMSXDATA SMSX Control Block Formatter
_ SRMDATA  SRM control block analysis
_ SSIDATA  Subsystem Interface analysis
_ STRDATA  Coupling Facility Structure Data
_ SUMDUMP  Format summary dump data
_ SYMDEF   Static Symbol Table Formatter
_ SYMPTOMS Format symptoms
_ SYSTRACE Format system trace
_ TCAMMAP  TCAM control block analysis
_ TCPHDR   TCP/IP TCP Header Formatter
_ TCPIPCS  TCP/IP Analysis
_ TSODATA  TSO analysis
_ UDPHDR   TCP/IP UDP Header Formatter
_ VLFDATA  Virtual Lookaside Facility data
_ VLFTRACE Virtual Lookaside Facility trace
_ VSMDATA  VSM control block analysis
_ VTAMMAP  VTAM control block analysis
_ XESDATA  XES analysis
```

Figure C-2 Dump Component Data Analysis panel

C.1.4 SUMMARY subcommand parameters

Use the SUMMARY subcommand, shown in Figure C-3 on page 365, to display or print dump data associated with one or more specified address spaces.

SUMMARY produces different diagnostic reports depending on the report type parameter, FORMAT, KEYFIELD, JOBSUMMARY, and TCBSUMMARY, and the address space selection parameters, ALL, CURRENT, ERROR, TCBERROR, ASIDLIST, and JOBLIST. Specify different parameters to selectively display the information you want to see.

```
{ SUMMARY }
{ SUMM    }

 -------- Report Type Parameters ----------------------------

           [ KEYFIELD [REGISTERS | NOREGISTERS]  ]
           [ FORMAT ]
           [ TCBSUMMARY ]
           [ JOBSUMMARY ]

 -------- Address Space Selection Parameters ----------------

           [ ALL ]
           [ CURRENT ]
           [ ERROR ]
           [ TCBERROR | ANOMALY ]
           [ ASIDLIST(asidlist) ]
           [ JOBLIST(joblist) | JOBNAME(joblist) ]

 -------- SETDEF-Defined Parameters -------------------------
          [ ACTIVE | MAIN | STORAGE            ]
          [ DSNAME(dsname) | DATASET(dsname) ]
          [ FILE(ddname) | DDNAME(ddname)    ]
          [ PATH(path-name)     ]


         [ FLAG(severity) ]
         [ PRINT | NOPRINT ]
         [ TERMINAL | NOTERMINAL ]
         [ TEST | NOTEST ]
```

Figure C-3 SUMMARY command parameters

C.1.5 VERBEXIT subcommand

Use the VERBEXIT subcommand, shown in Figure C-4 on page 366, to run an installation-supplied or IBM-supplied verb exit routine.

```
{ VERBEXIT }  { pgmname  }
{ VERBX    }  { verbname }
              [ 'parameter [,parameter]...' ]
              [ AMASK(mask) ]
              [ SYNTAX | NOSYNTAX ]
              [ TOC | NOTOC  ]

  -------- SETDEF-Defined Parameters -------------------------
              [ ACTIVE | MAIN | STORAGE           ]
              [ DSNAME(dsname) | DATASET(dsname) ]
              [ FILE(ddname) | DDNAME(ddname)    ]
              [ PATH(path-name)     ]

              [ PRINT | NOPRINT ]
              [ TERMINAL | NOTERMINAL ]
              [ TEST | NOTEST ]
```

Figure C-4 VERBEXIT subcommand parameters

C.1.6 VERBX VSMDATA subcommand

Specify the VSMDATA verb name and optional parameters on the VERBEXIT subcommand, shown in Figure C-5, to format diagnostic data from virtual storage management (VSM).

```
 VERBEXIT VSMDATA [ 'parameter [,parameter]...' ]
The parameters are:
 [CONTROLBLOCKS] [ALL] [DETAIL]
                     [SUMMARY]
                 [CURRENT]
                 [ERROR]
                 [TCBERROR]
                 [NOASIDS]
                 [ASIDLIST(asidlist)]
                 [JOBNAME(joblist) | JOBLIST(joblist)]
                 [GLOBAL|NOGLOBAL]
  [OWNCOMM [([CSA] [SQA])]
                 [SUMMARY  ]
            [DETAIL ]
                 [ALL]
                 [ASIDLIST(asidlist)]
                 [SYSTEM]
                 [SORTBY(ASIDADDR|ASIDLEN|ADDRESS|TIME|LENGTH)]
                 [CONTENTS(YES|NO)]
```

Figure C-5 VERBX VSMDATA subcommand parameters

C.1.7 STATUS FAILDATA subcommand

Figure C-6 on page 367 and Figure C-7 on page 368 show the output from a STATUS FAILDATA subcommand described in 6.21, “Using IPCS to find the failing instruction” on page 198.

```
 *  *  *  DIAGNOSTIC DATA REPORT  *  *  *
SEARCH ARGUMENT ABSTRACT

  PIDS/5752SC1B6 RIDS/IEFSD060#L RIDS/IEFSD060 AB/S023E PRCS/00000008 REGS/0E0
  REGS/06110 RIDS/IEFIB620#R

  Symptom             Description
  -------             -----------
  PIDS/5752SC1B6      Program id: 5752SC1B6
  RIDS/IEFSD060#L     Load module name: IEFSD060
  RIDS/IEFSD060       Csect name: IEFSD060
  AB/S023E            System abend code: 023E
  PRCS/00000008       Abend reason code: 00000008
  REGS/0E018          Register/PSW difference for R0E: 018
  REGS/06110          Register/PSW difference for R06: 110
  RIDS/IEFIB620#R     Recovery routine csect name: IEFIB620

OTHER SERVICEABILITY INFORMATION

  Recovery Routine Label:  IEFIB620
  Date Assembled:          04328
  Module Level:            HBB7720
Subfunction:             INITIATOR JOB PROCESS

Time of Error Information

  PSW: 070C1000 81329D48   Instruction length: 02   Interrupt code: 000D
  Failing instruction text: 00181610 0A0D50E0 D0049180

  Registers 0-7
  GR: 84000000 8423E000 7FFEFF0C 007FF3D0  007FF448 00000BE0 81329C38 007C9E1C
  AR: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
  Registers 8-15
  GR: 00000000 0167BFA0 7F775A68 00000B80  00000BD8 007FDB28 81329D30 00000008
  AR: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000C05
Home ASID: 008A    Primary ASID: 008A    Secondary ASID: 008A
  PKM: 8040          AX: 0000              EAX: 0000

  RTM was entered because an SVC was issued in an improper mode.
  The error occurred while a locked or disabled routine was in control.
  No locks were held.
  No super bits were set.

STATUS FROM THE RB WHICH ESTABLISHED THE ESTAE EXIT

  PSW: 070C3000 840F55D8   Instruction length: 02   Interrupt code: 003E
  Registers 0-7
  GR: 840F48A2 007F0B18 00000020 007FF708  007CA9B0 007FF448 007F0DC4 007EAEC1
AR: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
  Registers 8-15
  GR: 007F0B18 840F5372 00FC0200 007FF448  840F48A2 007CAA18 840F55C0 00000000
  AR: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000C05
```

Figure C-6 Output from a STATUS FAILDATA subcommand

```
RECOVERY ENVIRONMENT

  Recovery routine type: ESTAE recovery routine
  Recovery routine entry point: 040EC0F0
  The RB associated with this exit was not in control at the time of error.
  User requested no I/O processing.

VARIABLE RECORDING AREA (SDWAVRA)

  +000    Key: 22     Length: 14
  +002    C9D5C9E3    C9C1E3D6    D940C6D6    D6E3D7D9    |INITIATOR FOOTPR|
  +012    C9D5E3E2                                        |INTS            |

  +016    Key: 23     Length: 50
  +018    C9D5C9E3    C6D7D5E3    80BF00C0    00CCE3F0    |INITFPNT...{..T0|
  +028    E0000EEC    80000080    C000F0C0    EE3FC000    |\.......{.0{..{.|
  +038    00000000    E63C0300    000000E0    E068009F    |....W......\\...|
  +048    EFFE8000    00A0B87F    E3003C00    0017FFFF    |......."T.......|
  +058    80000000    FFE0A000    00000000    00000000    |.....\..........|

  +068    Key: 50     Length: 02
  +06A    0023                                            |..              |

  +06C    Key: 53     Length: 00

IEA24013I FORMATTING COMPLETED SUCCESSFULLY.
```

Figure C-7 Completion of STATUS FAILDATA output

D

IPCS commands

This appendix discusses IPCS commands. Use the IPCS primary command to invoke an IPCS subcommand, CLIST, or REXX EXEC from any of the panels of the IPCS dialog. The subcommand, CLIST, or REXX EXEC is entered exactly as though it was being invoked under IPCS inline mode. If the subcommand, CLIST, or REXX EXEC sends a report to the terminal, you view the report using the dump display reporter panel.

Note: Do not use the IPCS primary command to invoke a CLIST that contains a combination of a TSO/E CLIST function, such as SYSOUTTRAP, and an authorized TSO/E command, such as LISTD. Such a CLIST should be invoked only in IPCS line or batch mode or in a TSO/E environment.

D.1 IPCS commands

There are two ways to enter subcommands from the IPCS dialog:

- Choose option 4 (COMMAND) and enter the subcommand on the command line:

```
===> ANALYZE EXCEPTION
```

- Use the IPCS primary command to prefix the subcommand invocation from any command or option line of the IPCS dialog. For example:

```
COMMAND  ===> IPCS ANALYZE EXCEPTION
COMMAND  ===> IP ANALYZE EXCEPTION
```

Example D-1 shows a list of IPCS subcommands.

Example: D-1   IPCS commands and subcommands

```
ip analyze exception        : shows lock contention
ip asmk                     : ASM info
ip verbx asmdata            : formats asm cb's ( part, parte etc)
ip cbstat @ str(ascb)       : ascb status.
ip cbstat @ str(srb) asid(1): SSRB and SRB status.
ip cbstat @ str(tcb) asid(1): tcb status from TCBFLGS8.
ip cbstat str(storestatus)  : data about failing NIP RIMs
ip cbf (xxx)                : any CB in the symbol table, see ip listsym)
ip cbf cvt                  : Communications Vector Table
ip cbf gda                  : +D8=VSM tracker flags 08=CSA on 04=SQA on.
ip cbf lcca1                : first lcca for wait064 rc9 at IPL
ip cbf rtct                 : Recov. Term. Cont. Tbl. (asids dumped)
ip cbf rtct str(sdump) view(flags) : shows SDUMP flag output
ip cbf ucbxxx
ip cbf @ str(asid ucb)
ip cbf @. str(tcb)
ip ctrace comp(syslla) full : LLA @ space must be in the dump
ip ctrace comp(sysrsm) full
ip ctrace comp(sysrsm) asid(x'nn') full
                            : abendA78 rc18, 'f defer' for fixed pg.
                            : See VSMHELP file for output explanation.
ip ctrace query(sysrsm)     : Start & end times if RSM tracing is on.
ip divdata                  : Exception report is the default.
ip divdata detail           : DIB DIBX DOA WCB for curr error asid.
ip divdata exception        : exception
ip divdata summ             : DOA queue sumary.
ip divdata trace            : Output of RSM DIV component trace.
ip divdata trace full       : RSM DIV component trace for all ASIDs.
ip divdata trace asid(x'ff'): output for rsm div comp. trace in asid ff
ip eq labelname @@. str(control block type EX; svrb, rb ascb)
ip eq labelname @@. l(x'20'): ex: eq gxl 1F1888E0 L(X'20')
   find ' SSRV   78'
ip gtf svc                  : formats SVCs in an SVC trace.
ip gtf svc(6,9)             : formats SVC 6 and 9's in an SVC trace.
ip gtf usr(f65)             : formats get/free trace data in the dump
                              see GTF info above
ip gtf usr(f65) startloc(ddd,hh.mm.ss) ddd=date
ip ioscheck smgrblks        : SMGR blks from IECVEXSM sp226 do a find
  on smgr:, then look at nopages, repeat, one smgr blk should have a lot of pages
(mine had DF), do a find on '0076 ' and asid doing the EXCP is previous to the
```

```
0076, keep track of them and see whom is doing the most, there will be a pattern
or type of job doing the majority.
ip iosk actvucbs            : active UCB's
ip iosk capture             : max to bott to see captured UCB @'s
ip ipcsdata                 : IPCS r10+ cmd. See what rel of IPCS used.
ip list @      l(x'nnn')    : list storage at virt. location x'nnn'
ip list E0. l(16) block(0)  : Partial dump rsn codes per iea611/iea911
                              also mapped by SDRSN control block.
IP L 208?+4 L(2)            : If is a FF (x'C6C6') we are under VM.
                            : PSA+208->PCCA+4 = CPU id (serial number)
ip l cvt+8c?+188?           : lists where IPLINFO get its info from.
ip l cvt+128?+68?           : lists out the PPT. see section above on PPT
ip l cvt+2AC?+8?            : Processor type & model(see also below).
ip l cvt+3e0?               : what CVTRAC pts 2. RACF/ACF/TSS used?
ip l CVT+24c?+2c? l(4096)   : reg6= Fetch work area in a IEWFETCH,10 slip
ip l CVT+4c0?+10 l(4)       : word with: if DFSMS is used (byte 1>0) and
                              3 bytes w/SMS version,release,mod lvl
ip l CVT+42C?+1A l(26)      : Type & model of processor. See CPU DIAG
                              CVT+42C->HID+1A = CPU related data
                              ** may not be filled in too early in IPL?
ip l CVT+340?+50 L(1)       : If x'80' bit is on we are in LPAR mode.
                              CVT+340->SCCB+50 = byte w/BFY bit
ip l ecvt+150 l(8)          : hardware name, ECVTHDNM, HWNAME
ip l ecvt+158 l(8)          : ECVTLPNM, LPARNAME
ip l ecvt+160 l(8)          : ECVTVMNM, VMUSERID X'40's if not used.
ip l inittcb@.+b4?+15C?+148?: +x'10'=SCT, +x'50'(byte 1)= jobstep#
                              +148= SCT header, SCT starts at +158,
                              +40=step # for restart.
ip list 0 dspname(nnn) nnn  : the dataspace name dump directory LD cmd
ip list 0 dspname(nnn) asid(x'nn') nn if asid is other than your own
ip list 0 dspname(nnn) asid(x'nn') len(x'1000')
ip E0. l(16) block(0)       : partial dump reasons, formats SDRSN cb.
ip list cvt+24c? len(800)   : slip sdump buffer PSW & regs when slip hit.
ip l cvt+10C? len(400)      : shows the qmsg area, see iea705I in notes
ip list cvt+7c%+D0?+8?      : V5.2+ shows the ucb lookup @'s.
ip list IEAVESLA            : system resources lock list.
ip list sliptrap            : shows slip trap creating dump if so.
ip list title
ip list PSAn len(4000)      : N is the CPU PSA you want to look at.
ip list sliptrap
ip listsym                  : lists all symbols.
ip list ucbxxx              : lists ucb #xxx.
ip listu xxx                : lists ucb storage for device #xxx.
ip listucb xxx              : lists ucb storage for device #xxx.
ip lpamap                   : lists lpa mods and locations
ip rsmdata all              : for all asid's.
ip rsmdata                  : see ASKQ RTA000153245 for output explan.
            - with rsmdata options, asid(x'n'), all, jobname, can be used
ip rsmdata divmap           : divmapped areas within the address space
ip rsmdata summ             : Expanded, In configuration # / 256 =
                              total meg of estor defined to system.<
                              each gig defined requires 8 meg of ESQA
                              storage pg tables to be getmained.
ip rsmdata addrspace   { Diag reference chapter 21 RSM explains outputs }
ip rsmdata addrspace all
```

```
ip rsmdata realframe   { Diag reference chapter 21 RSM explains outputs }
ip rsmdata realframe ra(nnn) : nn is real rame address of storage.
ip rsmdata virtpage    { Diag reference chapter 21 RSM explains outputs }
ip rsmdata virtpage ra(virt @ of pg of storage) asid(x'nnnn')

Note: if stat = fref (first reference) then storage was never
            referenced (used) and will not be available in the dump
            G = is it getmained,        K = key of storage,
            F = is pg fetch protected, PSW key must match pg key
            P = is pg pg protected, pg cannot be storage to

ip select                    : tells which asid dump is taken of...
ip select all                : gives all asid assignments
ip stack @. remark('comment') : puts @ on IPCS dump pointers page
ip status                    : time and error psw
ip status cpu
ip status faildata           : format SDWA (none for a slip dump)
ip status faildata cpu reg5
ip status system             : IEAVTSDT=scheduled, SVCDUMP=sync.dump
ip status worksheet          : SDUMP SDATA tells what storage is dumped.
ip summ format               : format out RTM2WA
ip summ format asid(x'nn')
ip summ jobsummary all       : lists all CPU and job status info.
ip summ tcberror             : format the tcb in error.
ip symdef                    : Displays symbols symbolics
ip systrace time(local)      : verbx systrace if mvs 5.1 or older.
ip systrace exc(br)          : excluds branch entries in systrace.
ip tcbexit iecdafmt tcb@. asid(x'nn')
ip verbx cnmipcs 'cpool'     : Netview cell pool cellpool stats
ip verbx csvllipc 'stats,lib=SYS1.SCEERUN,member=*,fetched'
                             : shows dasd and VLF fetch stats for lib
ip verbx DFHPDxxx 'SM=3'     : shows CICS storage (x is release ex:410)
                                           & lvls of cics mods
ip verbx iplstats            :
ip verbx ledata              : LE envirment data, there heap options.
ip verbx ledata 'all'        :
ip verbx ledata 'heap'       : f @, tells if user/anywhere/below CB's
ip verbx logdata             : formatted sys1.logrec records
ip verbx mtrace              :
ip verbx nucmap              :
ip verbx sadmpmsg            : SAD messages not yet avilable??
ip verbx srmdata             :
ip verbx smsdata                    : DFSMS and PDSE data for the dump
ip verbx smsxdata                   : See DFSMS Diagnosis Reference
ip verbx smsxdata active            : SMSXDATA against active storage.
ip verbx smsxdata 'comp(pml)'       : See DFSMS Diag Ref pg378
ip verbx smsxdata 'nog map asid(nn)' : for these and PDSE MVS commands.
ip verbx trace              :systrace info for >r520 systems, default: all
ip verbx utrace             : shows systrace all for problem inhouse SADs.
ip verbx vtammap            : find 'BPCB' each bpcp +2C is size of that
                              vtam buffer, large one (>1000) is suspect.
                              output same as MVS 'd net,bfruse' command.
ip verbx vsmdata 'noa summ'           :
ip verbx vsmdata 'nog summ'           :
ip verbx vsmdata 'asidlist(NN) nog'   :
```

```
ip verbx vsmdata 'o d'                 :
ip verbx vsmdata 'o d conte(no) so(time)'
ip verbx vsmdata 'o d sortby(address)' :
ip verbx vsmdata 'o d sortby(asidaddr)':
ip verbx vsmdata 'o d sortby(asidlen)' :
ip verbx vsmdata 'o d sortby(length)'  : storage length
ip verbx vsmdata 'o d sortby(time)'
ip verbx vsmdata 'o summ'      : lists asids total global storage usage
ip verbx wtlb                  : unwritten syslog buffer
ip webcount all                : inhouse only, produces global web report
ip where @.                    : shows mod in which @ resides, done via a
                                 LPDE CB (LPA Dir. Entry) or CDE for a
                                 local storage address.
ip w structurename             : any structure in symbol table EX:ascb1>
```

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this book.

IBM Redbooks

For information about ordering these publications, see "How to get Redbooks" on page 376. Note that some of the documents referenced here may be available in softcopy only.

- *z/OS Diagnostic Data Collection and Analysis*, SG24-7110
- *ABCs of z/OS System Programming Volume 9*, SG24-6989-05
- *ABCs of z/OS System Programming Volume 10*, SG24-6990-03
- *ABCs of z/OS System Programming Volume 6*, SG24-6986-00
- *ABCs of z/OS System Programming Volume 5*, SG24-6985-02
- *ABCs of z/OS System Programming Volume 3*, SG24-6983-03
- *ABCs of z/OS System Programming Volume 2*, SG24-6982-02
- *ABCs of z/OS System Programming Volume 1*, SG24-6981-02
- *ABCs of z/OS System Programming Volume 11*, SG24-6327-01
- *ABCs of z/OS System Programming Volume 7*, SG24-6987-01
- *ABCs of z/OS System Programming Volume 12*, SG24-7621-00
- *ABCs of z/OS System Programming Volume 4*, SG24-6984-00
- *ABCs of z/OS System Programming Volume 13*, SG24-7717-01
- *IBM Application Development and Problem Determination*, SG24-7661

Other publications

These publications are also relevant as further information sources:

- *Environmental Record Editing and Printing Program (EREP) User's Guide*, GC35-0151
- *z/OS MVS Installation Exits*, SA22-7593
- *z/OS MVS Diagnosis: Tools and Service Aids*, SY28-1085
- *z/OS MVS Diagnosis: Reference*, GA22-7588
- *z/OS Language Environment Programming Guide*, SA22-7561
- *z/OS Language Environment Debugging Guide*, GA22-7560
- *z/OS Language Environment Vendor Interfaces*, SA22-7568
- *z/OS MVS Initialization and Tuning Reference*, SA22-7592
- *z/OS XL C/C++ User's Guide*, SC09-4767
- *z/OS MVS Interactive Problem Control System (IPCS) Commands*, SA22-7594
- *z/OS MVS Interactive Problem Control System (IPCS) User's Guide,* SA22-7596

- *z/OS MVS System Codes*, SA22-7626
- *z/OS MVS System Messages, Vol 1 (ABA-AOM)*, SA22-7631
- *z/OS MVS System Messages, Vol 2 (ARC-ASA),* SA22-7632
- *z/OS MVS System Messages, Vol 3 (ASB-BPX),* SA22-7633
- *z/OS MVS System Messages, Vol 4 (CBD-DMO),* SA22-7634
- *z/OS MVS System Messages, Vol 5 (EDG-GFS)*, SA22-7635
- *z/OS MVS System Messages, Vol 6 (GOS-IEA)*, SA22-7636
- *z/OS MVS System Messages, Vol 7 (IEB-IEE),* SA22-7637
- *z/OS MVS System Messages, Vol 8 (IEF-IGD),* SA22-7638
- *z/OS MVS System Messages, Vol 9 (IGF-IWM)*, SA22-7639
- *z/OS MVS System Messages, Vol 10 (IXC-IZP),* SA22-7640
- *z/OS UNIX System Services Messages and Codes,* SA22-7807
- *z/OS UNIX System Services Programming: Assembler Callable Services Reference*, SA22-7803
- *z/OS MVS Data Areas, Volume 1 (ABEP - DALT)*, GA22-7581
- *z/OS MVS Data Areas, Volume 2 (DCCB - ITZYRETC)*, GA22-7582
- *z/OS MVS Data Areas, Volume 3 (IVT - RCWK)*, GA22-7583
- *z/OS MVS Data Areas, Volume 4 (RD - SRRA)*, GA22-7584
- *z/OS MVS Data Areas, Volume 5 (SSAG - XTLST)*, GA22-7585
- *z/OS Resource Measurement Facility User's Guide*, SC33-7990

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Dump analysis, problem diagnosis

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