VMS Software

VSI OpenVMS System Analysis Tools Manual

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VSI OpenVMS System Analysis Tools Manual

VMS Software

Part II. OpenVMS System Code Debugger and System Dump Debugger

Preface

1. About VSI

VMS Software, Inc. (VSI) is an independent software company licensed by Hewlett Packard Enterprise to develop and support the OpenVMS operating system.

2. About This Manual

The *VSI OpenVMS System Analysis Tools Manual* is intended primarily for the system programmer or analyst who must investigate the causes of system failures and debug kernel-mode code, such as a device driver.

This manual also includes system management information for maintaining the system resources necessary to capture and store system crash dumps, including the use of dump-off-system-disk (DOSD). To help determine the cause of a hung process or improve system performance, consult this manual for instructions on using the appropriate system analysis tool to analyze your system.

3. Document Structure

This *VSI OpenVMS System Analysis Tools Manual* contains an introductory chapter and four parts.

Chapter 1 presents an overview of the system analysis tools, which are:

- System Dump Analyzer Utility including Crash Log Utility Extractor, several other extensions, and descriptions of the callable routines available to user-written extensions
- System Code and System Dump debuggers
- Alpha Watchpoint Utility
- System Service Logging Utility
- Delta/XDelta Debugger
- Dump-Off-System-Disk

Part I describes the System Dump Analyzer (SDA), its use and commands, the SDA Crash Log Utility Extractor (CLUE), several other SDA extensions, and the SDA callable routines.

Part II describes the System Code Debugger (SCD) and the System Dump Debugger (SDD).

Part III describes the Alpha Watchpoint Utility (WP).

Part IV describes the System Service Logging Utility (SSLOG).

4. Related Documents

For additional information, refer to the following documents:

- *VSI OpenVMS Version 8.4 Upgrade and Installation Manual*

- *VSI OpenVMS Calling Standard*
- *VSI OpenVMS System Manager's Manual, Volume 1: Essentials*
- *VSI OpenVMS System Manager's Manual, Volume 2: Tuning, Monitoring, and Complex Systems*
- *VSI OpenVMS Programming Concepts Manual, Volume II*
- *Writing OpenVMS Alpha Device Drivers in C*
- *OpenVMS AXP Internals and Data Structures*
- *Alpha Architecture Reference Manual*
- *Intel IA-64 Architecture Software Developer's Manual*
- *MACRO-64 Assembler for OpenVMS AXP Systems Reference Manual*

5. VSI Encourages Your Comments

You may send comments or suggestions regarding this manual or any VSI document by sending electronic mail to the following Internet address: `<docinfo@vmssoftware.com>`. Users who have VSI OpenVMS support contracts through VSI can contact `<support@vmssoftware.com>` for help with this product.

6. OpenVMS Documentation

The full VSI OpenVMS documentation set can be found on the VMS Software Documentation webpage at https://docs.vmssoftware.com.

7. Typographical Conventions

The following conventions may be used in this manual:

Convention	Meaning
Ctrl/ *x*	A sequence such as **Ctrl/** *x* indicates that you must hold down the key labeled Ctrl while you press another key or a pointing device button.
PF1 *x*	A sequence such as PF1 *x* indicates that you must first press and release the key labeled PF1 and then press and release another key or a pointing device button.
Return	In examples, a key name enclosed in a box indicates that you press a key on the keyboard. (In text, a key name is not enclosed in a box.)
. . .	A horizontal ellipsis in examples indicates one of the following possibilities: • Additional optional arguments in a statement have been omitted. • The preceding item or items can be repeated one or more times. • Additional parameters, values, or other information can be entered.
. . .	A vertical ellipsis indicates the omission of items from a code example or command format; the items are omitted because they are not important to the topic being discussed.

Convention	Meaning
( )	In command format descriptions, parentheses indicate that you must enclose the options in parentheses if you choose more than one.
[ ]	In command format descriptions, brackets indicate optional choices. You can choose one or more items or no items. Do not type the brackets on the command line. However, you must include the brackets in the syntax for OpenVMS directory specifications and for a substring specification in an assignment statement.
[|]	In command format descriptions, vertical bars separate choices within brackets or braces. Within brackets, the choices are options; within braces, at least one choice is required. Do not type the vertical bars on the command line.
{ }	In command format descriptions, braces indicate required choices; you must choose at least one of the items listed. Do not type the braces on the command line.
bold text	This typeface represents the introduction of a new term. It also represents the name of an argument, an attribute, or a reason.
italic text	Italic text indicates important information, complete titles of manuals, or variables. Variables include information that varies in system output (Internal error *number*), in command lines (/PRODUCER= *name*), and in command parameters in text (where *dd* represents the predefined code for the device type).
UPPERCASE TEXT	Uppercase text indicates a command, the name of a routine, the name of a file, or the abbreviation for a system privilege.
`Monospace type`	Monospace type indicates code examples and interactive screen displays. In the C programming language, monospace type in text identifies the following elements: keywords, the names of independently compiled external functions and files, syntax summaries, and references to variables or identifiers introduced in an example.
-	A hyphen at the end of a command format description, command line, or code line indicates that the command or statement continues on the following line.
numbers	All numbers in text are assumed to be decimal unless otherwise noted. Nondecimal radixes—binary, octal, or hexadecimal—are explicitly indicated.

Chapter 1. Overview of System Analysis Tools

This chapter presents an overview of the following system dump analysis tools and features:

- System Dump Analyzer (SDA)
- System Code Debugger (SCD)
- System Dump Debugger (SDD)
- Alpha Watchpoint Utility (WP)
- Delta Debugger
- XDelta Debugger
- Dump-Off-System-Disk (DOSD)
- System Service Logging Utility (SSLOG)
- On-Chip Logic Analyzer (OCLA)

To do the following:	Use this utility:	Described in:
Analyze a running system.	SDA	Chapter 2
Analyze a dump file.	SDA	Chapter 2
Automate the analysis of crash dumps and maintain a fatal-bugcheck history.	CLUE	Chapter 5
Debug nonpagable system code and device drivers running at any IPL.	SCD	Chapter 11
Analyze certain system dumps, display source code, variables or registers in use at the time of a system failure.	SDD	Chapter 12
Maintain a history of modifications made to a specific location in shared memory on an Alpha system.	WP	Chapter 13
Monitor execution of user programs and OpenVMS running at IPL 0.	Delta Debugger	Section 1.6
Debug system code that runs early in booting or when there is no Ethernet adapter dedicated to SCD.	Xdelta Debugger	Section 1.6
Write the system dump file to a device other than the system disk.	DOSD	Section 1.7

Characterize spinlock usage and collect per-CPU spinlock performance data.	SPL	Chapter 8
Display XFC data structures and statistics to help tune the extended file cache.	XFC	Chapter 9
Extend the functionality of SDA.	SDA Extension Callable Routines	Chapter 10
Log system services.	SSLOG	Chapter 14
Determine which instructions have executed in a specific Alpha EV7 CPU.	OCLA	Chapter 7

1.1. System Dump Analyzer (SDA)

The OpenVMS system dump analyzer (SDA) utility enables you to analyze a running system or a system dump after a system failure occurs. With a system failure, the operating system copies the contents of memory to a system dump file or the primary page file. Additionally, it records the hardware context of each processor. With SDA, you can interpret the contents of the dump file, examine the status of each processor at the time of the system failure, and investigate possible causes of failure.

See Part I for more complete information about SDA, SDA CLUE (Crash Log Utility Extractor), SPL (Spinlock Tracing Utility), other SDA extensions, and the SDA Extension routines.

1.2. System Code Debugger (SCD)

The OpenVMS System Code Debugger (SCD) allows you to debug nonpageable system code and device drivers running at any interrupt priority level (IPL). You can use the SCD to perform the following tasks:

- Control the system software's execution----stop at points of interest, resume execution, intercept fatal exceptions, and so on
- Trace the execution path of the system software
- Display the source code where the software is executing, and step by source line
- Monitor exception conditions
- Examine and modify the values of variables
- In some cases, test the effect of modifications without having to edit the source code, recompile, and relink

SCD is a symbolic debugger. You can specify variable names, routine names, and so on, precisely as they appear in your source code.

SCD recognizes the syntax, data typing, operators, expressions, scoping rules, and other constructs of a given language. If your code or driver is written in more than one language, you can change the debugging context from one language to another during a debugging session.

See Part II for complete information about SCD.

1.3. System Dump Debugger (SDD)

The OpenVMS System Dump Debugger allows you to analyze certain system dumps using the commands and semantics of SCD. You can use SDD to perform the following tasks:

- Display the source code where the software was executing at the time of the system failure
- Examine the values of variables and registers at the time of the system failure

SDD is a symbolic debugger. You can specify variable names, routine names, and so on, precisely as they appear in your source code.

SDD recognizes the syntax, data typing, operators, expressions, scoping rules, and other constructs of a given language. If your code or driver is written in more than one language, you can change the debugging context from one language to another during a debugging session.

See Part II for complete information about SCD.

1.4. Watchpoint Utility (Alpha Only)

The OpenVMS Watchpoint utility allows you to maintain a history of modifications that are made to a particular location in shared system space. It sets watchpoints on 32-bit and 64-bit addresses, and watches any system addresses whether in S0, S1, or S2 space.

See Part III for complete information about the Watchpoint utility.

1.5. System Service Logging

To log system services, use the System Service Logging (SSLOG) Utility. For additional information, see Chapter 14.

1.6. Delta/XDelta Debugger

The OpenVMS Delta/XDelta debugger allows you to monitor the execution of user programs and the OpenVMS operating system. The Delta/XDelta debuggers both use the same commands and expressions, but they are different in how they operate. Delta operates as an exception handler in a process context; whereas XDelta is invoked directly from the hardware system control block (SCB) vector in a system context.

You use OpenVMS Delta instead of the OpenVMS symbolic debugger to debug programs that run in privileged processor mode at interrupt priority level (IPL) 0. Because Delta operates in a process context, you can use it to debug user-mode programs or programs that execute at interrupt priority level (IPL) 0 in any processor mode---user, supervisor, executive, and kernel. To run Delta in a processor mode other than user mode, your process must have the privilege that allows Delta to change to that mode: change-mode-to-executive (CMEXEC), or change-mode-to-kernel (CMKRNL) privilege. You cannot use Delta to debug code that executes at an elevated IPL. To debug with Delta, you invoke it from within your process by specifying it as the debugger instead of the symbolic debugger.

You use OpenVMS XDelta instead of the System Code Debugger when debugging system code that runs early in booting or when there is no Ethernet adapter that can be dedicated to SCD. Because XDelta is invoked directly from the hardware system control block (SCB), it can be used to debug programs executing in any processor mode or at any IPL level. To use XDelta, you must have system privileges, and you must include XDelta when you boot the system. Since XDelta is not process specific, it is not invoked from a process. To debug with XDelta, you must boot the system with a command to include XDelta in memory. XDelta's existence terminates when you reboot the system without XDelta.

On OpenVMS systems, XDelta supports 64-bit addressing. Quadword display mode displays full quadwords of information. The 64-bit address display mode accepts and displays all addresses as 64-bit quantities. XDelta has predefined command strings for displaying the contents of the page frame number (PFN) database.

You can use Delta/XDelta commands to perform the following debugging tasks:

- Open, display, and change the value of a particular location
- Set, clear, and display breakpoints
- Set, display modes in byte, word, longword, or ASCII
- Display instructions
- Execute the program in a single step with the option to step over a subroutine
- Set base registers
- List the names and locations of all loaded modules of the executive
- Map an address to an executive module

See the *VSI OpenVMS Delta/XDelta Debugger Manual* for complete information about using the Delta/XDelta debugging utility.

1.7. Dump-Off-System-Disk (DOSD)

The OpenVMS system allows you to write the system dump file to a device other than the system disk. This is useful in large memory systems and in clusters with common system disks where sufficient disk space, on one disk, is not always available to support your dump file requirements. To perform this activity, you must correctly enable the DUMPSTYLE system parameter to allow the bugcheck code to write the system dump file to an alternative device.

See the *VSI OpenVMS System Manager's Manual, Volume 2: Tuning, Monitoring, and Complex Systems* for complete information about how to write the system dump file to a disk other than the system disk.

1.8. On-Chip Logic Analyzer (OCLA)

The Alpha EV7 On-chip Logic Analyzer utility (OCLA) enables a user to determine which instructions have executed on an Alpha EV7 CPU. One-seventh of the Alpha EV7 cache is set aside as acquisition memory where the virtual addresses of instructions executed by the Alpha EV7 CPU are stored. The acquisition memory can later by analyzed with SDA. For more information on OCLA, see Chapter 7.

Part I. OpenVMS System Dump Analyzer (SDA)

Part I describes the capabilities and system management of SDA. It describes how to use SDA to perform the following tasks:

- Analyzing a system dump and a running system
- Understanding SDA context and commands
- Investigating system failures
- Inducing system failures
- Understanding the ANALYZE command and qualifiers
- Invoking SDA commands, SDA CLUE extension commands, SDA Spinlock Tracing commands, and SDA extension routines
- Determining which instructions have executed in a specific system CPU, with SDA OCLA commands (Alpha only)

Chapter 2. SDA Description

This chapter describes the functions and the system management of SDA. It describes initialization, operation, and procedures in analyzing a system dump and analyzing a running system. This chapter also describes the SDA context, the command format, and the way both to investigate system failures and induce system failures.

2.1. Capabilities of SDA

When a system failure occurs, the operating system copies the contents of memory to a system dump file or the primary page file, recording the hardware context of each processor in the system as well. The System Dump Analyzer (SDA) is a utility that allows you to interpret the contents of this file, examine the status of each processor at the time of the system failure, and investigate the probable causes of the failure.

You can invoke SDA to analyze a system dump, using the DCL command ANALYZE/CRASH_DUMP. You can then use SDA commands to perform the following operations:

- Direct (or echo) the output of an SDA session to a file or device (SET OUTPUT or SET LOG).
- Display the condition of the operating system and the hardware context of each processor in the system at the time of the system failure (SHOW CRASH or CLUE CRASH).
- Select a specific processor in a multiprocessing system as the subject of analysis (SET CPU).
- Select the default size of address data manipulated by the EXAMINE and EVALUATE commands (SET FETCH).
- Enable or disable the sign extension of 32-bit addresses (SET SIGN_EXTEND).
- Display the contents of a specific process stack (SHOW STACK or CLUE STACK).
- Format a call frame from a stack location (SHOW CALL_FRAME).
- Read a set of global symbols into the SDA symbol table (READ).
- Define symbols to represent values or locations in memory and add them to the SDA symbol table (DEFINE).
- Delete symbols not required from the SDA symbol table (UNDEFINE).
- Evaluate an expression in hexadecimal and decimal, interpreting its value as a symbol, a condition value, a page table entry (PTE), a processor status (PS) quadword, or date and time (EVALUATE).
- Examine the contents of memory locations, optionally interpreting them as assembler instructions, a PTE, a PS, or date and time (EXAMINE).
- Display device status as reflected in system data structures (SHOW DEVICE).
- Display the contents of the stored machine check frame (SHOW MACHINE_CHECK or CLUE MCHK) for selected HP computers.
- Format system data structures (FORMAT).
- Validate the integrity of the links in a queue (VALIDATE QUEUE).
- Display a summary of all processes on the system (SHOW SUMMARY).

- Show the hardware or software context of a process (SHOW PROCESS or CLUE PROCESS).
- Display the OpenVMS RMS data structures of a process (SHOW PROCESS with the /RMS qualifier).
- Display memory management data structures (SHOW POOL, SHOW PFN_DATA, SHOW PAGE_TABLE, or CLUE MEMORY).
- Display lock management data structures (SHOW RESOURCES or SHOW LOCKS).
- Display OpenVMS Cluster management data structures (SHOW CLUSTER, SHOW CONNECTIONS, SHOW RSPID, or SHOW PORTS).
- Display multiprocessor synchronization information (SHOW SPINLOCKS).
- Display the layout of the executive images (SHOW EXECUTIVE).
- Capture and archive a summary of dump file information in a list file (CLUE HISTORY).
- Copy the system dump file (COPY).
- Define keys to invoke SDA commands (DEFINE/KEY).
- Search memory for a given value (SEARCH).

Although SDA provides a great deal of information, it does not automatically analyze all the control blocks and data contained in memory. For this reason, in the event of system failure, it is extremely important that you save not only the output provided by SDA commands, but also a copy of the system dump file written at the time of the failure.

You can also invoke SDA to analyze a running system, using the DCL command ANALYZE/SYSTEM. Most SDA commands generate useful output when entered on a running system.

Caution

Although analyzing a running system may be instructive, you should undertake such an operation with caution. System context, process context, and a processor's hardware context can change during any given display.

In a multiprocessing environment, it is very possible that, during analysis, a process running SDA could be rescheduled to a different processor frequently. Therefore, avoid examining the hardware context of processors in a running system.

2.2. System Management and SDA

The system manager must ensure that the system writes a dump file whenever the system fails. The manager must also see that the dump file is large enough to contain all the information to be saved, and that the dump file is saved for analysis. The following sections describe these tasks.

2.2.1. Writing System Dumps

The operating system attempts to write information into the system dump file only if the system parameter DUMPBUG is set. (The DUMPBUG parameter is set by default. To examine and change its value, consult the *VSI OpenVMS System Manager's Manual, Volume 2: Tuning, Monitoring, and Complex Systems*.) If DUMPBUG is set and the operating system fails, the system manager has the following choices for writing system dumps:

- Have the system dump file written to either SYSDUMP.DMP (the system dump file) or to PAGEFILE.SYS (the primary system page file).
- Set the DUMPSTYLE system parameter to an even number (for dumps containing all physical memory) or to an odd number (for dumps containing only selected virtual addresses). See Section 2.2.1.1 for more information about the DUMPSTYLE parameter values.

2.2.1.1. Dump File Style

There are two types of dump files---a full memory dump (also known as a physical dump), and a dump of selected virtual addresses (also known as a selective dump). Both full and selective dumps may be produced in either compressed or uncompressed form. Compressed dumps save disk space and time taken to write the dump at the expense of a slight increase in time to access the dump with SDA. The SDA commands COPY/COMPRESS and COPY/DECOMPRESS can be used to convert an existing dump.

A dump can be written to the system disk, or to another disk set aside for dumps. When using a disk other than a system disk, the disk name is set in the console environment variable DUMP_DEV. This disk is also known as the "dump off system disk" (DOSD) disk.

When writing a system dump, information about the crash is displayed at the system console. This can be either minimal output (for example, bug check code, process name, and image name), or verbose output (for example, executive layout, stack and register contents).

In an OpenVMS Galaxy system, shared memory is dumped by default. It is sometimes necessary to disable the dumping of shared memory. For more information about shared memory, see *VSI OpenVMS Alpha Partitioning and Galaxy Guide*.

DUMPSTYLE, which specifies the method of writing system dumps, is a 32-bit mask. Table 2.1 shows how the bits are defined. Each bit can be set independently. The value of the SYSGEN parameter is the sum of the values of the bits that have been set. Remaining or undefined values are reserved to VSI.

Table 2.1. Definitions of Bits in DUMPSTYLE

Bit	Value	Description
0	1	0= Full dump. The entire contents of physical memory will be written to the dump file. 1= Selective dump. The contents of memory will be written to the dump file selectively to maximize the usefulness of the dump file while conserving disk space. (Only pages that are in use are written).
1	2	0= Minimal console output. This consists of the bugcheck code; the identity of the CPU, process, and image where the crash occurred; the system date and time; plus a series of dots indicating progress writing the dump. 1= Full console output. This includes the minimal output previously described plus stack and register contents, system layout, and additional progress information such as the names of processes as they are dumped.
2	4	0= Dump to system disk. The dump will be written to SYS$SYSDEVICE:[SYSn.SYSEXE]SYSDUMP.DMP, or in its absence, SYS$SYSDEVICE: [SYSn.SYSEXE]PAGEFILE.SYS. 1= Dump to alternate disk. The dump will be written to dump_dev:

Bit	Value	Description
		[SYSn.SYSEXE]SYSDUMP.DMP, where dump_dev is the value of the console environment variable DUMP_DEV.
3	8	0= Uncompressed dump. Pages are written directly to the dump file. 1= Compressed dump. Each page is compressed before it is written, providing a saving in space and in the time taken to write the dump, at the expense of a slight increase in time taken to access the dump.
4	16	0= Dump shared memory. 1= Do not dump shared memory.
5	32	0= Write all processes and global pages in a selective dump. 1= Write only key processes and global pages in a selective dump. This bit is ignored when writing a full dump (bit 0 = 0). This bit should be set only if the priority processes have been correctly set up, as described in *VSI OpenVMS System Manager's Manual, Volume 2: Tuning, Monitoring, and Complex Systems*.
6--31		Reserved to VSI.

The default setting for DUMPSTYLE is 9 (a compressed selective dump, including shared memory, written to the system disk). Unless a value for DUMPSTYLE is specified in MODPARAMS.DAT, AUTOGEN.COM will set DUMPSTYLE either to 1 (an uncompressed selective dump, including shared memory, written to the system disk) if there is less than 128 megabytes of memory on the system, or to 9 (a compressed selective dump, including shared memory, written to the system disk).

2.2.1.2. Comparison of Full and Selective Dumps

A full dump requires that all physical memory be written to the dump file. This ensures the presence of all the page table pages required for SDA to emulate translation of system virtual addresses. Any even-numbered value in the DUMPSTYLE system parameter generates a full dump.

In certain system configurations, it may be impossible to preserve the entire contents of memory in a disk file. For instance, a large memory system or a system with small disk capacity may not be able to supply enough disk space for a full memory dump. If the system dump file cannot accommodate all of memory, information essential to determining the cause of the system failure may be lost.

To preserve those portions of memory that contain information most useful in determining the causes of system failures, a system manager sets the value of the DUMPSTYLE system parameter to specify a dump of selected virtual address spaces. In a selective dump, related pages of virtual address space are written to the dump file as units called logical memory blocks (LMBs). For example, one LMB consists of the page tables for system space; another is the address space of a particular process. Those LMBs most likely to be useful in crash dump analysis are written first. Any odd-numbered value in the DUMPSTYLE system parameter generates a selective dump.

Table 2.2 compares full and selective style dumps.

Table 2.2. Comparison of Full and Selective Dumps

Item	Full	Selective
Available Information	Complete contents of physical memory in use, stored in order of increasing physical address.	System page table, global page table, system space memory, and process and control regions

Item	Full	Selective
		(plus global pages) for all saved processes.
Unavailable Information	Contents of paged-out memory at the time of the system failure.	Contents of paged-out memory at the time of the system failure, process and control regions of unsaved processes, and memory not mapped by a page table.
SDA Command Limitations	None.	The following commands are not useful for unsaved processes: SHOW PROCESS/CHANNELS, SHOW PROCESS/IMAGE, SHOW PROCESS/RMS, SHOW STACK, and SHOW SUMMARY/IMAGE.

2.2.1.3. Controlling the Size of Page Files and Dump Files

You can adjust the size of the system page file and dump file using AUTOGEN (the recommended method) or by using SYSGEN.

AUTOGEN automatically calculates the appropriate sizes for page and dump files. AUTOGEN invokes the System Generation utility (SYSGEN) to create or change the files. However, you can control sizes calculated by AUTOGEN by defining symbols in the MODPARAMS.DAT file. The file sizes specified in MODPARAMS.DAT are copied into the PARAMS.DAT file during AUTOGEN's GETDATA phase. AUTOGEN then makes appropriate adjustments in its calculations.

Although VSI recommends using AUTOGEN to create and modify page and dump file sizes, you can use SYSGEN to directly create and change the sizes of those files.

The sections that follow discuss how you can calculate the size of a dump file.

See the *VSI OpenVMS System Manager's Manual* for detailed information about using AUTOGEN and SYSGEN to create and modify page and dump file sizes.

2.2.1.4. Writing to the System Dump File

OpenVMS writes the contents of the error-log buffers, processor registers, and memory into the system dump file, overwriting its previous contents. If the system dump file is too small, OpenVMS cannot copy all memory to the file when a system failure occurs.

SYS$SYSTEM:SYSDUMP.DMP (SYS$SPECIFIC:[SYSEXE]SYSDUMP.DMP) is created during installation. To successfully store a crash dump, SYS$SYSTEM:SYSDUMP.DMP must be enlarged to hold all of memory (full dump) or all of system space and the key processes (selective dump).

To calculate the correct size for an uncompressed full dump to SYS$SYSTEM:SYSDUMP.DMP, use the following formula:

```
size-in-blocks(SYS$SYSTEM:SYSDUMP.DMP)
         = size-in-pages(physical-memory) * blocks-per-page
         + number-of-error-log-buffers * blocks-per-buffer
         + 10
```

Use the DCL command SHOW MEMORY to determine the total size of physical memory on your system. There is a variable number of error log buffers in any given system, depending on the setting of the ERRORLOGBUFF_S2 system parameter. The size of each buffer depends on the setting of the ERLBUFFERPAG_S2 parameter. (See the *VSI OpenVMS System Manager's Manual* for additional information about these parameters.)

2.2.1.5. Writing to a Dump File off the System Disk

OpenVMS allows you to write the system dump file to a device other than the system disk. This is useful in large memory systems and in clusters with common system disks where sufficient disk space, on one disk, is not always available to support customer dump file requirements. To perform this activity, the DUMPSTYLE system parameter must be correctly enabled to allow the bugcheck code to write the system dump file to an alternative device.

The requirements for writing the system dump file off the system disk are the following:

- The dump device directory structure must resemble the current system disk structure. The [SYSn.SYSEXE]SYSDUMP.DMP file will reside there, with the same boot time system root.

  You can use AUTOGEN to create this file. In the MODPARAMS.DAT file, the following symbol prompts AUTOGEN to create the file:

  ```
  DUMPFILE_DEVICE = $nnn$ddcuuuu
  ```

- The dump device cannot be part of a volume set or a member of a shadow set.
- You must set up DOSD for SDA CLUE as described in Chapter 5.
- The DUMP_DEV environment variable must exist on your system. You specify the dump device at the console prompt, using the following format:

  For Alpha

  >>> SET DUMP_DEV device-name[,...]

  For Integrity servers

  Shell> VMS_SET DUMP_DEV device-name[,...]

  On some CPU types, you can enter a list of devices. The list can include various alternate paths to the system disk and the dump disk.

  By specifying alternate paths in DUMP_DEV, a dump can still be written if the disk fails over to an alternate path while the system is running. When the system crashes, the bugcheck code can use the alternate path by referring to the contents of DUMP_DEV.

  When you enter a list of devices, however, the system disk must come last.

For information on how to write the system dump file to an alternative device to the system disk, see the *VSI OpenVMS System Manager's Manual, Volume 2: Tuning, Monitoring, and Complex Systems*.

2.2.1.6. Writing to the System Page File

If SYS$SYSTEM:SYSDUMP.DMP does not exist, and there is no DOSD device or dump file, the operating system writes the dump of physical memory into SYS$SYSTEM:PAGEFILE.SYS, the primary system page file, overwriting the contents of that file.

If the SAVEDUMP system parameter is set, the dump file is retained in PAGEFILE.SYS when the system is booted after a system failure. If the SAVEDUMP parameter is not set, which is the default, OpenVMS uses the entire page file for paging and any dump written to the page file is lost. (To examine or change the value of the SAVEDUMP parameter, consult the *VSI OpenVMS System Manager's Manual, Volume 2: Tuning, Monitoring, and Complex Systems*.)

To calculate the minimum size for a full memory dump to SYS$SYSTEM:PAGEFILE.SYS, use the following formula:

```
size-in-blocks(SYS$SYSTEM:PAGEFILE.SYS)
        = size-in-pages(physical-memory) * blocks-per-page
        + number-of-error-log-buffers  * blocks-per-buffer
        + 10
        + value of the system parameter RSRVPAGCNT * blocks-per-page
```

Note that this formula calculates the minimum size requirement for saving a physical dump in the system's page file. VSI recommends that the page file be a bit larger than this minimum to avoid hanging the system. Also note that you can only write the system dump into the primary page file (SYS $SYSTEM:PAGEFILE.SYS). Secondary page files cannot be used to save dump file information.

Note also that OpenVMS will not fill the page file completely when writing a system dump, since the system might hang when rebooting after a system crash. RSRVPAGCNT pages are kept unavailable for dumps. This applies to both full dumps and selective dumps.

Writing crash dumps to SYS$SYSTEM:PAGEFILE.SYS presumes that you will later free the space occupied by the dump for use by the pager. Otherwise, your system may hang during the startup procedure. To free this space, you can do one of the following:

- Include SDA commands that free dump space in the site-specific startup command procedure (described in Section 2.2.4).
- Use the SDA COPY command to copy the dump from SYS$SYSTEM:PAGEFILE.SYS to another file. Use the SDA COPY command instead of the DCL COPY command because the SDA COPY command only copies the blocks used by the dump and causes the pages occupied by the dump to be freed from the system's page file.
- If you do not need to copy the dump elsewhere, issue an ANALYZE/CRASH_DUMP/RELEASE command. When you issue this command, SDA immediately releases the pages to be used for system paging, effectively deleting the dump. Note that this command does not allow you to analyze the dump before deleting it.

2.2.2. Saving System Dumps

Every time the operating system writes information to the system dump file, it writes over whatever was previously stored in the file. The system writes information to the dump file whenever the system fails. For this reason, the system manager must save the contents of the file after a system failure has occurred.

The system manager can use the SDA COPY command or the DCL COPY command. Either command can be used in a site-specific startup procedure, but the SDA COPY command is preferred because it marks the dump file as copied. As mentioned earlier, this is particularly important if the dump was written into the page file, SYS$SYSTEM:PAGEFILE.SYS, because it releases those pages occupied by the dump to the pager. Another advantage of using the SDA COPY command is that this command copies only the saved number of blocks and not necessarily the whole allotted dump file. For instance, if the size of the SYSDUMP.DMP file is 100,000 blocks and the bugcheck wrote only 60,000 blocks to the dump file, then DCL COPY would create a file of 100,000 blocks. However, SDA COPY would generate a file of only 60,000 blocks.

Because system dump files are set to NOBACKUP, the Backup utility (BACKUP) does not copy them to tape unless you use the qualifier /IGNORE=NOBACKUP when invoking BACKUP. When you use the SDA COPY command to copy the system dump file to another file, OpenVMS does not set the new file to NOBACKUP.

As created during installation, the file SYS$SYSTEM:SYSDUMP.DMP is protected against world access. Because a dump file can contain privileged information, VSI recommends that the system manager does not change this default protection.

When a dump is being analyzed, it is useful to have data available that cannot be written to the dump file at the time of the system crash. This data includes the full file specification associated with a file identification, and, on OpenVMS Integrity servers, the unwind data for images activated in processes.

If the dump is being analyzed on the system where it was originally written, this data can be collected for use in the current SDA session by using the COLLECT command. If the dump is being copied for analysis elsewhere, the COPY/COLLECT command can be used to collect the data and append it to the copy being written. If the COPY/COLLECT command is used after a COLLECT command, the data already collected is appended to the dump copy.

By default, a copy of the original dump, as written at the time of the system crash, will include collection. You can use the COPY/NOCOLLECT command to override this. Conversely, a copy of a dump previously copied by SDA without collection (COPY/NOCOLLECT) will not include collection. You can use COPY/COLLECT to override this.

Copying a dump that already contains an appended collection will always include that collection.

For all file and unwind data to be collected successfully, all disks that were mounted at the time of the system crash should be remounted and accessible to the process running SDA. If SDA is invoked early during the startup to save the contents of the dump (for example, using CLUE$SITE_PROC, as described in Section 2.2.4), but disks are not mounted until a batch job is run, the COPY/NOCOLLECT command should be used in the CLUE$SITE_PROC command procedure. Once all disks are mounted, you can use a COPY/COLLECT command to save file and unwind data.

If the COPY and COLLECT operations cannot be done as a single step, a COLLECT/SAVE command will write the collection to a separate file that can be used later in conjunction with the dump file. A later COPY will combine the two files.

2.2.3. Partial Dump Copies

Because of the layout of a selective dump, it is often the case that only a small part of the dump is needed to investigate the cause of the system crash. The system manager must save the complete dump locally, as described in the previous section, but has to provide only the key sections of the dump to VSI Services for analysis. This can significantly reduce the time taken to copy the dump over the network. Such a copy is referred to as a Partial Dump Copy. It can only be used when a selective system dump (compressed or uncompressed) has been written, and is not available for full system dumps or for process dumps.

If you require information from a section of the dump that was not copied, it can be extracted from the saved local copy and submitted separately. The ANALYZE /CRASH_DUMP command accepts multiple input files from the same crash and treats them as a single dump.

For an explanation of key processes and key global pages, and the organization of a selective system dump, see the chapter Managing Page, Swap, and Dump Files in the *VSI OpenVMS System Manager's Manual, Volume 2: Tuning, Monitoring, and Complex Systems*.

2.2.3.1. Example - Use of Partial Dump Copies

The following steps describe a typical use of Partial Dump Copies:

1. Save the complete dump:

```
$ ANALYZE/CRASH SYS$SYSTEM:SYSDUMP.DMP

OpenVMS system dump analyzer
...analyzing an I64 compressed selective memory dump...

Dump taken on 22-SEP-2009 18:17:17.99 using version XC4I-J2I
SSRVEXCEPT, Unexpected system service exception

SDA> COPY SSRVEXCEPT.DMP
SDA> EXIT
```

2. Create a partial copy containing only the key sections of the dump:

```
$ ANALYZE/CRASH SSRVEXCEPT

OpenVMS system dump analyzer
...analyzing an I64 compressed selective memory dump...

Dump taken on 22-SEP-2009 18:17:17.99 using version XC4I-J2I
SSRVEXCEPT, Unexpected system service exception

SDA> COPY SSRVKEY /PARTIAL=KEY
SDA> EXIT
```

3. Provide the output of this copy, containing only the key sections, to VSI Services, where it can be analyzed as follows:

```
$ ANALYZE/CRASH SSRVKEY

OpenVMS system dump analyzer
...analyzing an I64 compressed selective memory dump...

Dump taken on 22-SEP-2009 18:17:17.99 using version XC4I-J2I
SSRVEXCEPT, Unexpected system service exception

SDA> SHOW CRASH
SDA> !
```

4. During analysis of the crash, VSI Services determines that the CLUSTER_SERVER process, not included in the partial dump copy, is required and requests that part of the dump. Extract the process from the saved complete copy, as follows:

```
$ ANALYZE/CRASH SSRVEXCEPT

OpenVMS system dump analyzer
...analyzing an I64 compressed selective memory dump...

Dump taken on 22-SEP-2009 18:17:17.99 using version XC4I-J2I
SSRVEXCEPT, Unexpected system service exception

SDA> COPY SSRVCSP /PARTIAL=PROCESS=NAME=CLUSTER_SERVER
SDA> EXIT
```

5. Provide the output of this copy to VSI Services for analysis, where it can be analyzed as follows:

```
$ ANALYZE/CRASH SSRVKEY,SSRVCSP

OpenVMS system dump analyzer
...analyzing an I64 compressed selective memory dump...

Dump taken on 22-SEP-2009 18:17:17.99 using version XC4I-J2I
SSRVEXCEPT, Unexpected system service exception

SDA> SHOW PROCESS CLUSTER_SERVER
SDA> ! etc.
```

2.2.3.2. Additional notes on Partial Dump Copies

This section provides additional notes on Partial Dump Copies.

- In Step 4 of the preceding example, the COPY command cannot be given as shown:

  ```
  SDA> COPY /PARTIAL=PROCESS=NAME=CLUSTER_SERVER SSRVCSP
  ```

  This is because SDA must treat the combined string "CLUSTER SERVER SSRVCSP" as the process name, since spaces are valid in a process name. Alternative formats that can be used are as follows:

  ```
  SDA> COPY /PARTIAL=PROCESS=NAME=CLUSTER_SERVER SSRVCSP
  SDA> COPY /PARTIAL=PROCESS=NAME=(CLUSTER_SERVER) SSRVCSP
  SDA> COPY /PARTIAL=(PROCESS=NAME=CLUSTER_SERVER) SSRVCSP
  ```

- In Step 5 of the preceding example, the input files cannot be specified as "SSRV*". In that case, SSRVCSP.DMP can be opened before SSRVKEY.DMP. The file that contains the section PT must be opened first.
- In a selective system dump, processes are dumped in two sections:
  - Process Page Table Space
  - Process Memory

  If a process is copied as part of a COPY /PARTIAL, the two sections are always copied together.
- In a selective system dump from an Alpha system with Resource Affinity Domains (RADs) enabled, there is a Replicated System Space section for each RAD other than the base RAD. If replicated system space is copied as part of a COPY /PARTIAL, all replicated system space sections are always copied together.
- See the description of the COPY command in Chapter 4 for a complete list of the possible section names.

2.2.4. Invoking SDA When Rebooting the System

When the system reboots after a system failure, SDA is automatically invoked by default. SDA archives information from the dump in a history file. In addition, a listing file with more detailed information about the system failure is created in the directory pointed to by the logical name CLUE$COLLECT. (Note that the default directory is SYS$ERRORLOG unless you redefine the logical name CLUE $COLLECT in the procedure SYS$MANAGER:SYLOGICALS.COM.) The file name is in the form CLUE$*node_ddmmyy_hhmm*.LIS where the timestamp (*hhmm*) corresponds to the system failure time and not the time when the file was created.

Directed by commands in a site-specific file, SDA can take additional steps to record information about the system failure. They include the following:

- Supplementing the contents of the list file containing the output of specific SDA commands.
- Copying the contents of the dump file to another file. This information is otherwise lost at the next system failure when the system saves information only about that failure.

If the logical name CLUE$SITE_PROC points to a valid and existing command file, it will be executed as part of the CLUE HISTORY command when you reboot. If used, this file should contain only valid SDA commands.

Generated by a set sequence of commands, the CLUE list file contains only an overview of the failure and is unlikely to provide enough information to determine the cause of the failure. VSI, therefore, recommends that you always copy the dump file.

The following example shows SDA commands that can make up your site-specific command file to produce a more complete SDA listing after each system failure, and to save a copy of the dump file:

```
!
! SDA command file, to be executed as part of the system
! bootstrap from within CLUE. Commands in this file can
! be used to save the dump file after a system bugcheck, and
! to execute any additional SDA commands.
!
! Note that the logical name DMP$ must have been defined
! within SYS$MANAGER:SYLOGICALS.COM
!
READ/EXEC                    ! read in the executive images' symbol tables
SHOW STACK                   ! display the stack
COPY DMP$:SAVEDUMP.DMP       ! copy and save dump file
!
```

The CLUE HISTORY command is executed first, followed by the SDA commands in this site-specific command file. See the reference section on CLUE HISTORY for details on the summary information that is generated and stored in the CLUE list file by the CLUE HISTORY command. Note that the SDA COPY command must be the last command in the command file. If the dump has been written to PAGEFILE.SYS, then the space used by the dump will be automatically returned for use for paging as soon as the COPY is complete and no more analysis is possible. You might need to include the /NOCOLLECT qualifier on the COPY command. See Section 2.2.2 for details.

To point to your site-specific file, add a line such as the following to the file SYS$MANAGER:SYLOGICALS.COM:

```
$ DEFINE/SYSTEM CLUE$SITE_PROC SYS$MANAGER:SAVEDUMP.COM
```

In this example, the site-specific file is named SAVEDUMP.COM.

The CLUE list file can be printed immediately or saved for later examination.

SDA is invoked and executes the specified commands only when the system boots for the first time after a system failure. If the system is booting for any other reason (such as a normal system shutdown and reboot), SDA exits.

If CLUE files occupy more space than the threshold allows (the default is 5000 blocks), the oldest files will be deleted until the threshold limit is reached. The threshold limit can be customized with the CLUE $MAX_BLOCK logical name.

To prevent the running of CLUE at system startup, define the logical CLUE$INHIBIT in the SYLOGICALS.COM file as TRUE in the system logical name table.

2.3. Analyzing a System Dump

SDA performs certain tasks before bringing a dump into memory, presenting its initial displays, and accepting command input. These tasks include the following:

- Verifying that the process invoking it is suitably privileged to read the dump file
- Using RMS to read in pages from the dump file
- Building the SDA symbol table from the files SDA$READ_DIR:SYS$BASE_IMAGE.EXE and SDA$READ_DIR:REQSYSDEF.STB
- Executing the commands in the SDA initialization file

For detailed information on investigating system failures, see Section 2.7.

2.3.1. Requirements

To analyze a dump file, your process must have read access both to the file that contains the dump and to copies of SDA$READ_DIR:SYS$BASE_IMAGE.EXE and SDA$READ_DIR:REQSYSDEF.STB (the required subset of the symbols in the file SYSDEF.STB). SDA reads these tables by default.

2.3.2. Invoking SDA

If your process can access the files listed in Section 2.3.1, you can issue the DCL command ANALYZE/CRASH_DUMP to invoke SDA. If you do not specify the name of a dump file in the command, and SYS$SYSTEM:SYSDUMP.DMP cannot be opened, SDA prompts you:

```
$ ANALYZE/CRASH_DUMP
_Dump File:
```

If any part of the file name is specified, the default file specification is as follows:

@@@@SYS$DISK:[default-dir]SYSDUMP.DMP

SYS$DISK and [default-dir] represent the disk and directory specified in your last SET DEFAULT command.

If you are rebooting after a system failure, SDA is automatically invoked. See Section 2.2.4.

2.3.3. Mapping the Contents of the Dump File

SDA first attempts to map the contents of memory as stored in the specified dump file. To do this, it must first locate the page tables for system space among its contents. The system page tables contain one entry for each page of system virtual address space.

- If SDA cannot find the system page tables in the dump file, it displays the following message:

  ```
  %SDA-E-SPTNOTFND, system page table not found in dump file
  ```

If that error message is displayed, you cannot analyze the crash dump, but must take steps to ensure that any subsequent dump can be analyzed. To do this, you must either adjust the DUMPSTYLE system parameter as discussed in Section 2.2.1.1 or increase the size of the dump file as indicated in Section 2.2.1.3.

- If SDA finds the system page tables in an incomplete dump, the following message is displayed:

```
%SDA-W-SHORTDUMP, dump file was n blocks too small when dump written;
                  analysis may not be possible
```

Under certain conditions, some memory locations might not be saved in the system dump file. Additionally, if a bugcheck occurs during system initialization, the contents of the register display may be unreliable. The symptom of such a bugcheck is a SHOW SUMMARY display that shows no processes or only the swapper process.

If you use an SDA command to access a virtual address that has no corresponding physical address, SDA generates the following error message:

```
%SDA-E-NOTINPHYS, 'location': virtual data not in physical memory
```

When analyzing a selective dump file, if you use an SDA command to access a virtual address that has a corresponding physical address not saved in the dump file, SDA generates one of the following error messages:

```
%SDA-E-MEMNOTSVD, memory not saved in the dump file

%SDA-E-NOREAD, unable to access location n
```

2.3.4. Building the SDA Symbol Table

After locating and reading the system dump file, SDA attempts to read the system symbol table file into the SDA symbol table. If SDA cannot find SDA$READ_DIR:SYS$BASE_IMAGE.EXE---or is given a file that is not a system symbol table in the /SYMBOL qualifier to the ANALYZE command---it displays a fatal error and exits. SDA also reads into its symbol table a subset of SDA$READ_DIR:SYSDEF.STB, called SDA$READ_DIR:REQSYSDEF.STB. This subset provides SDA with the information needed to access some of the data structures in the dump.

When SDA finishes building its symbol table, SDA displays a message identifying itself and the immediate cause of the system failure. In the following example, the cause of the system failure was the deallocation of a bad page file address.

```
OpenVMS Alpha System Dump Analyzer

Dump taken on 27-MAR-1993  11:22:33.92
BADPAGFILD, Bad page file address deallocated
```

2.3.5. Executing the SDA Initialization File (SDA$INIT)

After displaying the system failure summary, SDA executes the commands in the SDA initialization file, if you have established one. SDA refers to its initialization file by using the logical name SDA$INIT. If SDA cannot find the file defined as SDA$INIT, it searches for the file SYS$LOGIN:SDA.INIT.

This initialization file can contain SDA commands that read symbols into SDA's symbol table, define keys, establish a log of SDA commands and output, or perform other tasks. For instance, you may want to use an SDA initialization file to augment SDA's symbol table with definitions helpful in locating system code. If you issue the following command, SDA includes those symbols that define many of the system's data structures, including those in the I/O database:

```
READ SDA$READ_DIR:filename
```

You may also find it helpful to define those symbols that identify the modules in the images that make up the executive by issuing the following command:

```
READ/EXECUTIVE SDA$READ_DIR:
```

After SDA has executed the commands in the initialization file, it displays its prompt as follows:

```
SDA>
```

This prompt indicates that you can use SDA interactively and enter SDA commands.

An SDA initialization file may invoke a command procedure with the @ command. However, such command procedures cannot invoke other command procedures.

2.4. Analyzing a Running System

Occasionally, OpenVMS encounters an internal problem that hinders system performance without causing a system failure. By allowing you to examine the running system, SDA enables you to search for the solution without disturbing the operating system. For example, you may be able to use SDA to examine the stack and memory of a process that is stalled in a scheduler state, such as a miscellaneous wait (MWAIT) or a suspended (SUSP) state.

If your process has change-mode-to-kernel (CMKRNL) privilege, you can invoke SDA to examine the system. Use the following DCL command:

```
$ ANALYZE/SYSTEM
```

SDA attempts to load SDA$READ_DIR:SYS$BASE_IMAGE.EXE and SDA $READ_DIR:REQSYSDEF.STB. It then executes the contents of any existing SDA initialization file, as it does when invoked to analyze a crash dump (see Sections Section 2.3.4 and Section 2.3.5, respectively). SDA subsequently displays its identification message and prompt, as follows:

```
OpenVMS Alpha System Analyzer

SDA>
```

This prompt indicates that you can use SDA interactively and enter SDA commands. When analyzing a running system, SDA sets its process context to that of the process running SDA.

If you are analyzing a running system, consider the following:

- When used in this mode, SDA does not map the entire system, but instead retrieves only the information it needs to process each individual command. To update any given display, you must reissue the previous command.

  Caution

  When using SDA to analyze a running system, carefully interpret its displays. Because system states change frequently, it is possible that the information SDA displays may be inconsistent with the current state of the system.

- Certain SDA commands are illegal in this mode, such as SET CPU. Use of these commands results in the following error message:

```
%SDA-E-CMDNOTVLD, command not valid on the running system
```

- The SHOW CRASH command, although valid, does not display the contents of any of the processor's set of hardware registers.

2.5. SDA Context

When you invoke SDA to analyze either a crash dump or a running system, SDA establishes a default context for itself from which it interprets certain commands.

When you are analyzing a uniprocessor system, SDA's context is solely **process context**, which means SDA can interpret its process-specific commands in the context of either the process current on the uniprocessor or some other process in another scheduling state. When SDA is initially invoked to analyze a crash dump, SDA's process context defaults to that of the process that was current at the time of the system failure. When you invoke SDA to analyze a running system, SDA's process context defaults to that of the current process, that is, the one executing SDA. To change SDA's process context, issue any of the following commands:

- SET PROCESS process-name
- SET PROCESS/ADDRESS=pcb-address
- SET PROCESS/INDEX=nn
- SET PROCESS/NEXT
- SET PROCESS/SYSTEM
- SHOW PROCESS process-name
- SHOW PROCESS/ADDRESS=pcb-address
- SHOW PROCESS/INDEX=nn
- SHOW PROCESS/NEXT
- SHOW PROCESS/SYSTEM
- VALIDATE PROCESS/POOL process-name
- VALIDATE PROCESS/POOL/ADDRESS=pcb-address
- VALIDATE PROCESS/POOL/INDEX=nn
- VALIDATE PROCESS/POOL/NEXT
- VALIDATE PROCESS/POOL/SYSTEM

When you invoke SDA to analyze a crash dump from a multiprocessing system with more than one active CPU, SDA maintains a second dimension of context---its **CPU context**---that allows it to display certain processor-specific information. This information includes the reason for the bugcheck exception, the currently executing process, the current IPL, and the spinlocks owned by the processor. When you invoke SDA to analyze a multiprocessor's crash dump, its CPU context defaults to that of the processor that induced the system failure. When you are analyzing a running system, CPU context is not accessible to SDA. Therefore, the SET CPU command is not permitted.

You can change the SDA CPU context by using any of the following commands:

- SET CPU cpu-id
- SET CPU /FIRST
- SET CPU /NEXT
- SET CPU /PRIMARY
- SHOW CPU cpu-id
- SHOW CPU /FIRST
- SHOW CPU /NEXT
- SHOW CPU /PRIMARY
- SHOW CRASH
- SHOW MACHINE_CHECK cpu-id

Changing CPU context involves an implicit change in process context in either of the following ways:

- If there is a current process on the CPU made current, SDA process context is changed to that of that CPU's current process.
- If there is no current process on the CPU made current, SDA process context is undefined and no process-specific information is available until SDA process context is set to that of a specific process.

Changing process context requires a switch of CPU context as well. For instance, when you issue a SET PROCESS command, SDA automatically changes its CPU context to that of the CPU on which that process was most recently current. The following commands can have this effect:

- SET PROCESS process-name
- SET PROCESS/ADDRESS=pcb-address
- SET PROCESS/INDEX=nn
- SET PROCESS/NEXT
- SHOW PROCESS process-name
- SHOW PROCESS/ADDRESS=pcb-address
- SHOW PROCESS/INDEX=nn
- SHOW PROCESS/NEXT
- VALIDATE PROCESS/POOL process-name
- VALIDATE PROCESS/POOL/ADDRESS=pcb-address
- VALIDATE PROCESS/POOL/INDEX=nn
- VALIDATE PROCESS/POOL/NEXT

2.6. SDA Command Format

The following sections describe the format of SDA commands and the expressions you can use with SDA commands.

SDA uses a command format similar to that used by the DCL interpreter. Issue commands in the following format:

```
command-name[/qualifier...] [parameter][/qualifier...] [!comment]
```

The **command-name** is an SDA command. Each command tells the utility to perform a function. Commands can consist of one or more words, and can be abbreviated to the number of characters that make the command unique. For example, SH stands for SHOW.

The **parameter** is the target of the command. For example, SHOW PROCESS RUSKIN tells SDA to display the context of the process RUSKIN. The command EXAMINE 80104CD0;40 displays the contents of 40 bytes of memory, beginning with location 80104CD0.

When you supply part of a file specification as a parameter, SDA assumes default values for the omitted portions of the specification. The default device is SYS$DISK, the device specified in your most recent SET DEFAULT command. The default directory is the directory specified in the most recent SET DEFAULT command. See the *VSI OpenVMS DCL Dictionary* for a description of the DCL command SET DEFAULT.

The **qualifier** modifies the action of an SDA command. A qualifier is always preceded by a slash (/). Several qualifiers can follow a single parameter or command name, but each must be preceded by a slash. Qualifiers can be abbreviated to the shortest string of characters that uniquely identifies the qualifier.

The **comment** consists of text that describes the command; this comment is not actually part of the command. Comments are useful for documenting SDA command procedures. When executing a command, SDA ignores the exclamation point and all characters that follow it on the same line.

2.6.1. Using Expressions and Operators

You can use expressions as parameters for some SDA commands, such as SEARCH and EXAMINE. To create expressions, use any of the following elements:

- Numerals
- Radix operators
- Arithmetic and logical operators
- Precedence operators
- Symbols

Numerals are one possible component of an expression. The following sections describe the use of the other components.

2.6.1.1. Radix Operators

Radix operators determine which numeric base SDA uses to evaluate expressions. You can use one of the three radix operators to specify the radix of the numeric expression that follows the operator:

- ^X (hexadecimal)

- ^O (octal)
- ^D (decimal)

The default radix is hexadecimal. SDA displays hexadecimal numbers with leading zeros and decimal numbers with leading spaces.

2.6.1.2. Arithmetic and Logical Operators

There are two types of arithmetic and logical operators:

- **Unary operators** affect the value of the expression that follows them. (See Table 2.3.)
- **Binary operators** combine the operands that precede and follow them. (See Table 2.4.)

In evaluating expressions containing binary operators, SDA performs logical AND, OR, and XOR operations, and multiplication, division, and arithmetic shifting before addition and subtraction. Note that the SDA arithmetic operators perform integer arithmetic on 64-bit operands.

Table 2.3. SDA Unary Operators

Operator	Action
#	Performs a logical NOT of the expression.
+	Makes the value of the expression positive.
--	Makes the value of the expression negative.
@	Evaluates the following expression as an address, then uses the contents of that address as its value.
^Q	Specifies that the size of the field to be used as an address is a quadword when used with the unary operator @ 1.
^L	Specifies that the size of the field to be used as an address is a longword when used with the unary operator @ 1.
^W	Specifies that the size of the field to be used as an address is a word when used with the unary operator @ 1.
^B	Specifies that the size of the field to be used as an address is a byte when used with the unary operator @ 1.
^P	Specifies a physical address when used with the unary operator @. The command SET FETCH can be used to change the default FETCH size and/or access method. See the SET FETCH command description in Chapter 4 for more details and examples.
^V	Specifies a virtual address when used with the unary operator @ 1. The command SET FETCH can be used to change the default FETCH size and/or access method. See the SET FETCH command description in Chapter 4 for more details and examples.

Operator	Action
G	Adds FFFFFFFF 80000000 16 to the value of the expression 2. The unary operator G corresponds to the first virtual address in S0 system space. For example, the expression GD40 can be used to represent the address FFFFFFFF 80000D4016.
H	Adds 7FFE0000 16 to the value of the expression 3. The unary operator H corresponds to a convenient base address in P1 space (7FFE000016). You can therefore refer to an address such as 7FFE2A6416 as H2A64
I	Fills the leading digits of the following hexadecimal number with hex value of F. For example:

Table 2.4. SDA Binary Operators

Operator	Action
+	Addition
--	Subtraction
*	Multiplication
&	Logical AND
|	Logical OR
\	Logical XOR
/	Division. In division, SDA truncates the quotient to an integer, if necessary, and does not retain a remainder.
@	Arithmetic shifting

"."	Catenates two 32-bit values into a 64-bit value. For example:
	`SDA> eval fe.50000`
	`Hex = 000000FE00050000 Decimal = 1090922020864`

2.6.1.3. Precedence Operators

SDA uses parentheses as precedence operators. Expressions enclosed in parentheses are evaluated first. SDA evaluates nested parenthetical expressions from the innermost to the outermost pairs of parentheses.

2.6.1.4. SDA Symbols

An SDA **symbol** can represent several value types. It can represent a constant, a data address, a procedure or function descriptor address, or a routine address. Constants are usually offsets of a particular field in a data structure; however, they can also represent constant values such as the BUG $_*xxx* symbols.

Symbols are composed of up to 31 letters and numbers, and can include the dollar sign ($) and underscore (_) characters. When you invoke SDA, it reads in the global symbols from the symbols table section of SYS$BASE_IMAGE.EXE, and from REQSYSDEF.STB, a required subset of the symbols in the file SYSDEF.STB. You can add other symbols to SDA's symbol table by using the DEFINE and READ commands.

All address symbols identify memory locations. SDA generally does not distinguish among different types of address symbols. However, for a symbol identified as the name of a procedure descriptor, SDA takes an additional step of creating an associated symbol to name the code entry point address of the procedure. It forms the code entry point symbol name by appending _C to the name of the procedure descriptor.

Also, SDA substitutes the code entry point symbol name for the procedure descriptor symbol when you enter the following command:

```
SDA> EXAMINE/INSTRUCTION procedure-descriptor
```

For example, enter the following command:

```
SDA> EXAMINE/INSTRUCTION SCH$QAST
```

SDA displays the following information:

```
SCH$QAST_C:      SUBQ    SP,#X40,SP
```

Now enter the EXAMINE command but do not specify the /INSTRUCTION qualifier, as follows:

```
SDA> EXAMINE SCH$QAST
```

SDA displays the following information:

```
SCH$QAST:  0000002C.00003009   ".0..,..."
```

This display shows the contents of the first two longwords of the procedure descriptor.

Note that there are no routine address symbols on Alpha systems, except for those in MACRO-64 assembly language modules. Therefore, SDA creates a routine address symbol for every procedure descriptor it has in its symbol table. The new symbol name is the same as for the procedure descriptor except that it has an _C appended to the end of the name.

Sources for SDA Symbols

SDA obtains its information from the following:

- Images (.EXE files)
- Image symbol table files (.STB files)
- Object files

SDA also defines symbols to access registers and to access common data structures.

The only images with symbols are shareable images and executive images. These images contain only universal symbols, such as constants and addresses.

The image symbol table files are produced by the linker with the /SYMBOLS qualifier. These files normally contain only universal symbols, as do the executable images. However, if the SYMBOL_TABLE=GLOBALS linker option is specified, the .STB file also contains all global symbols defined in the image. See the *VSI OpenVMS Linker Utility Manual* for more information.

Object files can contain global constant values. An object file used with SDA typically contains symbol definitions for data structure fields. Such an object file can be generated by compiling a

MACRO-32 source module that invokes specific macros. The macros, which are typically defined in SYS$LIBRARY:LIB.MLB or STARLET.MLB, define symbols that correspond to data structure field offsets. The macro $UCBDEF, for example, defines offsets for fields within a unit control block (UCB). OpenVMS Alpha and Integrity servers provide several such object modules in SDA$READ_DIR, as listed in the table below. For compatibility with OpenVMS VAX, the modules' file types have been renamed to .STB.

Table 2.5. Modules Containing SDA Global Symbols and Data Structures

File	Contents
DCLDEF.STB	Symbols for the DCL interpreter
DECDTMDEF.STB	Symbols for transaction processing
GLXDEF.STB	Symbols for OpenVMS Galaxy data structures
IMGDEF.STB	Symbols for the image activator
IODEF.STB	I/O database structure symbols
NETDEF.STB	Symbols for DECnet data structures
REQSYSDEF.STB	Required symbols for SDA
RMSDEF.STB	Symbols that define RMS internal and user data structures and RMS$_ *xxx* completion codes
SCSDEF.STB	Symbols that define data structures for system communications services
SYSDEF.STB	Symbols that define system data structures, including the I/O database
TCPIP$NET_GLOBALS.STB 1	Data structure definitions for TCP/IP internet driver, execlet, and ACP data structures. Available only if TCP/IP has been installed.
TCPIP$NFS_GLOBALS.STB 1	Data structure definitions for TCP/IP NFS server. Available only if TCP/IP has been installed.
TCPIP$PROXY_GLOBALS.STB 1	Data structure definitions for TCP/IP proxy execlet
TCPIP$PWIP_GLOBALS.STB 1	Data structure definitions for TCP/IP PWIP driver, and ACP data structures. Available only if TCP/IP has been installed.
TCPIP$TN_GLOBALS.STB 1	Data structure definitions for TCP/IP TELNET/ RLOGIN server driver data structures. Available only if TCP/IP has been installed.

The following table lists symbols that SDA defines automatically on initialization.

Table 2.6. SDA Symbols Defined on Initialization

ASN	Address space number
AST	Both the asynchronous system trap status and enable registers: AST<3:0> = AST enable; AST<7:4> = AST status
BR0 through BR7	Branch registers (Integrity servers only)
CYCLE_COUNTER	Process cycle counter
ESP	Executive stack pointer

EBSP	Executive register stack pointer (Integrity servers only)
FEN	Floating-point enable
FP	Frame pointer (R29)
FP0 through FP31	Floating-point registers (Alpha only)
FP0 through FP127	Floating point registers (Integrity servers only)
FPCR	Floating-point control register (Alpha only)
FPSR	Floating-point status register (Integrity servers only)
GP	Global pointer (R1) (Integrity servers only)
G	FFFFFFFF.80000000 16, the base address of system space
H	00000000.7FFE0000 16, a base address in P1 space
I	FFFFFFFF.FFFFFFFF 16, also fills the leading digits of a hexadecimal number with the value of F
KSP	Kernel stack pointer
KBSP	Kernel register stack pointer (Integrity servers only)
PAL_RSVD	PAL reserved area in process HWPCB
PC	Program counter
PCC	Process cycle counter
PS	Processor status
PTBR	Page table base register
R0 through R31	Integer registers (Alpha only)
R0 through R127	Integer registers (Integrity servers only)
SCC	System cycle counter
SP	Current stack pointer of a process
SSP	Supervisor stack pointer
SBSP	Supervisor register stack pointer (Integrity servers only)
SYSPTBR	Page table base register for system space
USP	User stack pointer
UBSP	User register stack pointer (Integrity servers only)
VIRBND	Virtual Address Boundary for RADs (Alpha only)

After a SET CPU command is issued (for analyzing a crash dump only), the symbols defined in the table below are set for that CPU.

Table 2.7. SDA Symbols Defined by SET CPU Command

CPUDB	Address of CPU database
IPL	Interrupt priority level register

MCES	Machine check error summary register
PCBB	Process context block base register
PRBR	Processor base register (CPU database address)
RAD	Address of RAD database
SCBB	System control block base register
SISR	Software interrupt status register
VPTB	Virtual Page Table Base register

After a SET PROCESS command is issued, the symbols listed in the table below are defined for that process.

Table 2.8. SDA Symbols Defined by SET PROCESS Command

ARB	Address of access rights block
FRED	Address of floating-point register and execution data block
JIB	Address of job information block
KTB	Address of the kernel thread block
ORB	Address of object rights block
PCB	Address of process control block
PHD	Address of process header
PSB	Address of persona security block

Other SDA commands, such as SHOW DEVICE and SHOW CLUSTER, predefine additional symbols.

Symbols can include lowercase letters. Commands that manipulate symbols (such as DEFINE, SHOW SYMBOL, UNDEFINE) require these symbols to be enclosed within quotation marks ("*symbol*").

SDA Symbol Initialization

On initialization, SDA reads the universal symbols defined by SYS$BASE_IMAGE.EXE. For every procedure descriptor address symbol found, a routine address symbol is created (with _C appended to the symbol name).

SDA then reads the object file REQSYSDEF.STB. This file contains data structure definitions that are required for SDA to run correctly. It uses these symbols to access some of the data structures in the crash dump file or on the running system.

Finally, SDA initializes the process registers defined in Table 2.8 and executes a SET CPU command, defining the symbols as well.

Use of SDA Symbols

There are two major uses of the address type symbols. First, the EXAMINE command employs them to find the value of a known symbol. For example, EXAMINE CTL$GL_PCB finds the PCB for the current process. Then, certain SDA commands (such as EXAMINE, SHOW STACK, and FORMAT) use them to symbolize addresses when generating output.

When the code for one of these commands needs a symbol for an address, it calls the SDA symbolize routine. The symbolize routine tries to find the symbol in the symbol table whose address is closest to, but not greater than the requested address. This means, for any given address, the routine may return a symbol of the form symbol_name+offset. If, however, the offset is greater than 0FFF16, it fails to find a symbol for the address.

As a last resort, the symbolize routine checks to see if this address falls within a known memory range. Currently, the only known memory ranges are those used by the OpenVMS executive images and those used by active images in a process. SDA searches through the executive loaded image list (LDRIMG data structure) and activated image list (IMCB data structures) to see if the address falls within any of the image sections. If SDA does find a match, it returns one of the following types of symbols:

@@@@executive_image_name+offset activated_image_name+offset

The offset is the same as the image offset as defined in the map file.

The constants in the SDA symbol table are usually used to display a data structure with the FORMAT command. For example, the PHD offsets are defined in SYSDEF.STB; you can display all the fields of the PHD by entering the following commands:

```
SDA> READ SDA$READ_DIR:SYSDEF.STB

SDA> FORMAT/TYPE=PHD phd_address
```

Symbols and Address Resolution

In OpenVMS, executive and user images are loaded into dynamically assigned address space. To help you associate a particular virtual address with the image whose code has been loaded at that address, SDA provides several features:

- The SHOW EXECUTIVE command
- The symbolization of addresses, described in the previous section
- The READ command
- The SHOW PROCESS command with the /IMAGES qualifier
- The MAP command

The OpenVMS executive consists of two base images, SYS$BASE_IMAGE.EXE and SYS $PUBLIC_VECTORS.EXE, and a number of other separately loadable images. Some of these images are loaded on all systems, while others support features unique to particular system configurations. Executive images are mapped into system space during system initialization.

By default, a typical executive image is not mapped at contiguous virtual addresses. Instead, its nonpageable image sections are loaded into a reserved set of pages with other executive images' nonpageable sections. The pageable sections of a typical executive image are mapped contiguously into a different part of system space. An image mapped in this manner is said to be **sliced**. A particular system may have system parameters defined that disable executive image slicing altogether.

Each executive image is described by a data structure called a **loadable image data block** (LDRIMG). The LDRIMG specifies whether the image has been sliced. If the image is sliced, the LDRIMG indicates the beginning of each image section and the size of each section. All the LDRIMGs are linked together in a list that SDA scans to determine what images have been loaded and into what addresses they have been mapped. The SHOW EXECUTIVE command displays a list of all images that are included in the OpenVMS executive.

Each executive image is a shareable image whose universal symbols are defined in the SYS $BASE_IMAGE.EXE symbol vector. On initialization, SDA reads this symbol vector and adds its universal symbols to the SDA symbol table.

Executive image .STB files define additional symbols within an executive image that are not defined as universal symbols and thus are not in the SYS$BASE_IMAGE.EXE symbol vector (see *Sources for SDA Symbols Section 2.6.1.4 [26]* in this section). You can enter a READ/EXECUTIVE command to read symbols defined in all executive image .STB files into the SDA symbol table, or a READ/IMAGE filespec command to read the .STB for a specified image only.

To obtain a display of all images mapped within a process, execute a SHOW PROCESS/IMAGE command. See the description of the SHOW PROCESS command for additional information about displaying the hardware and software context of a process.

You can also identify the image name and offset that correspond to a specified address with the MAP command. With the information obtained from the MAP command, you can then examine the image map to locate the source module and program section offset corresponding to an address.

2.6.2. SDA Display Mode

Some SDA commands produce more output than will fit on one screen. In this situation, SDA enters **display mode**, and outputs the **screen overflow prompt** at the bottom of the screen:

```
Press RETURN for more.
SDA>
```

If the RETURN key is pressed, SDA will continue the output of the command it was processing. If an EXIT command is entered, SDA will leave display mode, abort the command it was processing and output a regular SDA prompt. If any other command is entered, SDA will leave display mode, abort the command it was processing, and begin processing the new command.

SDA will leave display mode once a continued command completes.

2.7. Investigating System Failures

This section discusses how the operating system handles internal errors, and suggests procedures that can help you determine the causes of these errors. It illustrates, through detailed analysis of a sample system failure, how SDA helps you find the causes of operating system problems.

For a complete description of the commands discussed in the sections that follow, refer to Chapter 4 and Chapter 5 of this document, where all the SDA and CLUE commands are presented in alphabetical order.

2.7.1. Procedure for Analyzing System Failures

When the operating system detects an internal error so severe that normal operation cannot continue, it signals a condition known as a fatal bugcheck and shuts itself down. A specific bugcheck code describes each fatal bugcheck.

To resolve the problem, you must find the reason for the bugcheck. Many failures are caused by errors in user-written device drivers or other privileged code not supplied by VSI. To identify and correct these errors, you need a listing of the code in question.

Occasionally, a system failure is the result of a hardware failure or an error in code supplied by VSI. A hardware failure requires the attention of VSI Services. To diagnose an error in code supplied by VSI, you need listings of that code, which are available from VSI.

Start the search for the error by analyzing the CLUE list file that was created by default when the system failed. This file contains an overview of the system failure, which can assist you in finding the line of code that signaled the bugcheck. CLUE CRASH displays the content of the program counter (PC) in the list file. The content of the PC is the address of the next instruction after the instruction that signaled the bugcheck.

However, some bugchecks are caused by unexpected exceptions. In such cases, the address of the instruction that *caused* the exception is more informative than the address of the instruction that signaled the bugcheck.

The address of the instruction that caused the exception is located on the stack. You can obtain this address either by using the SHOW STACK command to display the contents of the stack or by using the SHOW CRASH or CLUE CRASH command to display the system state at time of exception. See Section 2.7.2 for information on how to proceed for several types of bugchecks.

Once you have found the address of the instruction that caused the bugcheck or exception, find the module in which the failing instruction resides. Use the MAP command to determine whether the instruction is part of a device driver or another executive image. Alternatively, the SHOW EXECUTIVE command shows the location and size of each of the images that make up the OpenVMS executive.

If the instruction that caused the bugcheck is not part of a driver or executive image, examine the linker's map of the module or modules you are debugging to determine whether the instruction that caused the bugcheck is in your program.

To determine the general cause of the system failure, examine the code that signaled the bugcheck or the instruction that caused the exception.

2.7.2. Fatal Bugcheck Conditions

There are many possible conditions that can cause OpenVMS to issue a bugcheck. Normally, these occasions are rare. When they do occur, they are often fatal exceptions or illegal page faults occurring within privileged code. This section describes the symptoms of several common bugchecks. A discussion of other exceptions and condition handling in general appears in the *VSI OpenVMS Programming Concepts Manual*.

An exception is fatal when it occurs while either of the following conditions exists:

- The process is executing above IPL 2 (IPL$_ASTDEL).
- The process is executing in a privileged (kernel or executive) processor access mode and has not declared a condition handler to deal with the exception.

When the system fails, the operating system reports the approximate cause of the system failure on the console terminal. SDA displays a similar message when you issue a SHOW CRASH command. For instance, for a fatal exception, SDA can display one of these messages:

```
FATALEXCPT, Fatal executive or kernel mode exception
```

```
INVEXCEPTN, Exception while above ASTDEL
```

```
SSRVEXCEPT, Unexpected system service exception
```

```
UNXSIGNAL, Unexpected signal name in ACP
```

When a FATALEXCPT, INVEXCEPTN, SSRVEXCEPT, or UNXSIGNAL bugcheck occurs, two argument lists, known as the mechanism and signal arrays, are placed on the stack.

Section 2.7.2.1 to Section 2.7.2.6 describe these arrays and related data structures, and Section 2.7.2.7 shows example output from SDA for an SSRVEXCEPT bugcheck.

A page fault is illegal when it occurs while the interrupt priority level (IPL) is greater than 2 (IPL $_ASTDEL). When OpenVMS fails because of an illegal page fault, it displays the following message on the console terminal:

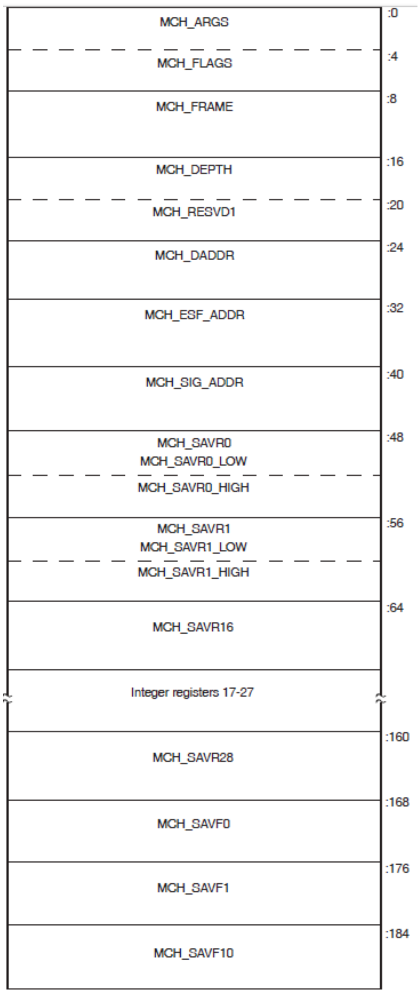
```
PGFIPLHI, Page fault with IPL too high
```

Section 2.7.2.8 describes the stack contents when an illegal page fault occurs.

2.7.2.1. Alpha Mechanism Array

The figure below illustrates the Alpha mechanism array, which is made up entirely of quadwords. The first quadword of this array indicates the number of quadwords in this array; this value is always 2C16. These quadwords are used by the procedures that search for a condition handler and report exceptions.

Figure 2.1. Alpha Mechanism Array



Symbolic offsets into the mechanism array are defined by using the SDA SHOW STACK command to identify the elements of the mechanism array on the stack using the symbols in the table below.

Table 2.9. Contents of the Alpha Mechanism Array

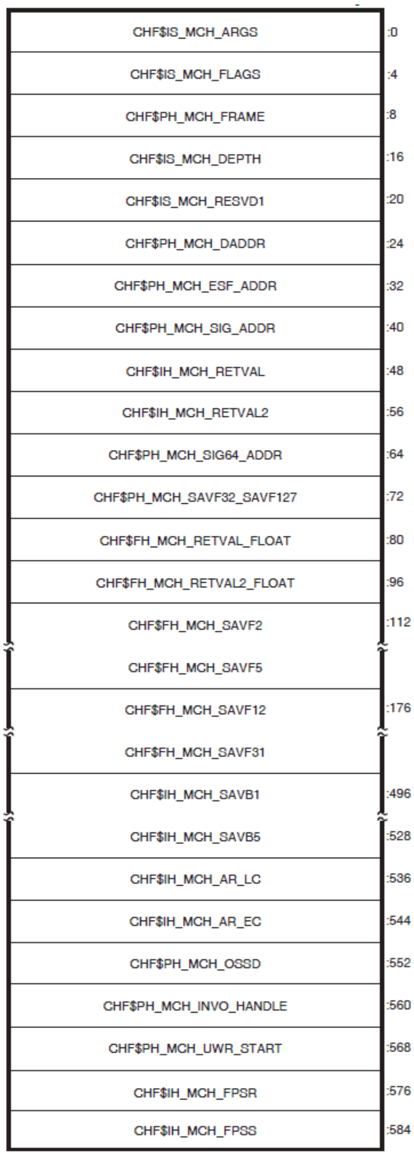
Offset	Meaning
CHF$IS_MCH_ARGS	Number of quadwords that follow. In a mechanism array, this value is always 2C 16.

Offset	Meaning
CHF$IS_MCH_FLAGS	Flag bits for related argument mechanism information.
CHF$PH_MCH_FRAME	Address of the FP (frame pointer) of the establisher's call frame.
CHF$IS_MCH_DEPTH	Depth of the OpenVMS search for a condition handler.
CHF$PH_MCH_DADDR	Address of the handler data quadword, if the exception handler data field is present.
CHF$PH_MCH_ESF_ADDR	Address of the exception stack frame (see Figure 2.5figure2-5).
CHF$PH_MCH_SIG_ADDR	Address of the signal array (see Figure 2.3).
CHF$IH_MCH_SAVRnn	Contents of the saved integer registers at the time of the exception. The following registers are saved: R0, R1, and R16 to R28 inclusive.
CHF$FH_MCH_SAVFnn	If the process was using floating point, contents of the saved floating-point registers at the time of the exception. The following registers are saved: F0, F1, and F10 to F30 inclusive.
CHF$PH_MCH_SIG64_ADDR	Address of the 64-bit signal array (see Figure 2.4).

2.7.2.2. Integrity server Mechanism Array

The figure below illustrates the Integrity server mechanism array, which is made up entirely of quadwords. The first quadword of this array indicates the number of quadwords in the array. This value is either 4916, if floating point registers F32 to F127 have not been saved, or 10916, if the floating point registers have been saved. These quadwords are used by the procedures that search for a condition handler and report exceptions.

Figure 2.2. Integrity server Mechanism Array



Symbolic offsets into the mechanism array are defined by using the SDA SHOW STACK command to identify the elements of the mechanism array on the stack using the symbols in the table below.

Table 2.10. Contents of the Integrity server Argument Mechanism Array

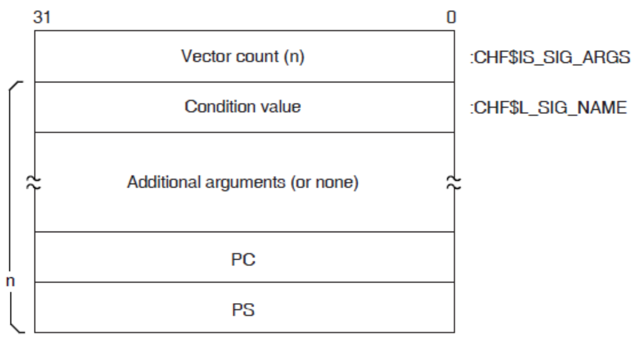
Field Name	Contents
CHF$IS_MCH_ARGS	Count of quadwords in this array starting from the next quadword, CHF$PH_MCH_FRAME (not counting the first quadword that contains this longword). This value is 73 if CHF $V_FPREGS2_VALID is clear, and 265 if CHF $V_FPREGS2_VALID is set.
CHF$IS_MCH_FLAGS	Flag bits for related argument-mechanism information.
CHF$PH_MCH_FRAME	Contains the Previous Stack Pointer, PSP, (the value of the SP at procedure entry) for the procedure context of the establisher.

Field Name	Contents
CHF$IS_MCH_DEPTH	Positive count of the number of procedure activation stack frames between the frame in which the exception occurred and the frame depth that established the handler being called.
CHF$PH_MCH_DADDR	Address of the handler data quadword (start of the Language Specific Data area, LSDA), if the exception handler data field is present in the unwind information block (as indicated by OSSD $V_HANDLER_DATA_VALID); otherwise, contains 0.
CHF$PH_MCH_ESF_ADDR	Address of the exception stack frame.
CHF$PH_MCH_SIG_ADDR	Address of the 32-bit form of signal array. This array is a 32-bit wide (longword) array. This is the same array that is passed to a handler as the signal argument vector.
CHF$IH_MCH_RETVAL	Contains a copy of R8 at the time of the exception.
CHF$IH_MCH_RETVAL2	Contains a copy of R9 at the time of the exception.
CHF$PH_MCH_SIG64_ADDR	Address of the 64-bit form of signal array. This array is a 64-bit wide (quadword) array.
CHF$FH_MCH_SAVF32_SAVF127	Address of the extension to the mechanism array that contains copies of F32 to F127 at the time of the exception.
CHF$FH_MCH_RETVAL_FLOAT	Contains a copy of F8 at the time of the exception.
CHF$FH_MCH_RETVAL2_FLOAT	Contains a copy of F9 at the time of the exception.
CHF$FH_MCH_SAVFnn	Contain copies of floating-point registers F2 to F5 and F12 to F31. Registers F6, F7 and F10, F11 are implicitly saved in the exception frame.
CHF$IH_MCH_SAVBnn	Contain copies of branch registers B1 to B5 at the time of the exception.
CHF$IH_MCH_AR_LC	Contains a copy of the Loop Count Register (AR65) at the time of the exception.
CHF$IH_MCH_AR_EC	Contains a copy of the Epilog Count Register (AR66) at the time of the exception.
CHF$PH_MCH_OSSD	Address of the operating-system specific data area.
CHF$PH_MCH_INVO_HANDLE	Contains the invocation handle of the procedure context of the establisher.
CHF$PH_MCH_UWR_START	Address of the unwind region.
CHF$IH_MCH_FPSR	Contains a copy of the hardware floating-point status register (AR.FPSR) at the time of the exception.
CHF$IH_MCH_FPSS	Contains a copy of the software floating-point status register (which supplements CHF $IH_MCH_FPSR) at the time of the exception.

2.7.2.3. Signal Array

The **signal array** appears somewhat further down the stack. This array comprises all longwords so that the structure is VAX compatible. A signal array describes the exception that occurred. It contains an argument count, the exception code, zero or more exception parameters, the PC, and the PS. Therefore, the size of a signal array can vary from exception to exception. Although there are several possible exception conditions, access violations are most common. the figure below shows the signal array for an access violation.

Figure 2.3. Signal Array



For access violations, the signal array is set up as follows:

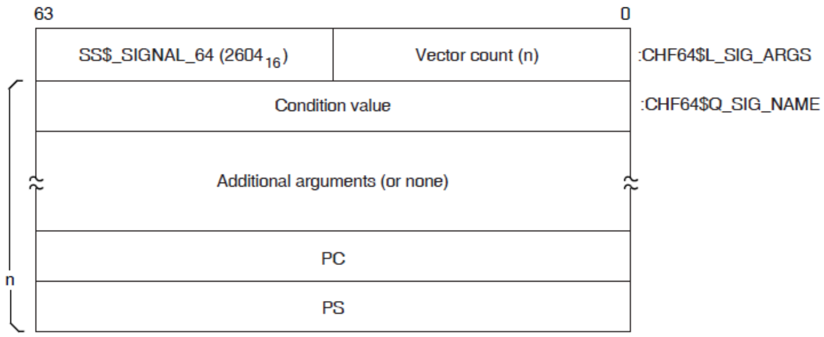
Table 2.11.

Value	Meaning
Vector list length	Number of longwords that follow. For access violations, this value is always 5.
Condition value	Exception code. The value 0C 16 represents an access violation. You can identify the exception code by using the SDA command EVALUATE/ CONDITION_VALUE or SHOW CRASH.
Additional arguments	These can include a reason mask and a virtual address. In the longword mask if bit 0 of the longword is set, the failing instruction (at the PC saved below) caused a length violation. If bit 1 is set, it referred to a location whose page table entry is in a "no access" page. Bit 2 indicates the type of access used by the failing instruction: it is set for write and modify operations and clear for read operations. The virtual address represents the low-order 32 bits of the virtual address that the failing instruction tried to reference.
PC	PC whose execution resulted in the exception.
PS	PS at the time of the exception.

2.7.2.4. 64-Bit Signal Array

The **64-bit signal array** also appears further down the stack. This array comprises all quadwords and is not VAX compatible. It contains the same data as the signal array, and Figure 2.4 shows the 64-bit signal array for an access violation. The SDA SHOW STACK command uses the CHF64$ symbols listed in the figure to identify the 64-bit signal array on the stack.

Figure 2.4. 64-Bit Signal Array



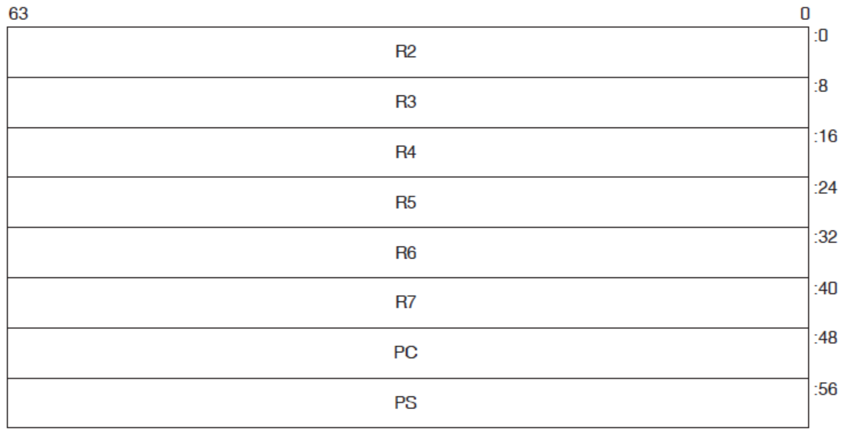
For access violations, the 64-bit signal array is set up as follows:

Value	Meaning
Vector list length	Number of quadwords that follow. For access violations, this value is always 5.
Condition value	Exception code. The value 0C 16 represents an access violation. You can identify the exception code by using the SDA command EVALUATE/ CONDITION_VALUE or SHOW CRASH.
Additional arguments	These can include a reason mask and a virtual address. In the quadword mask if bit 0 of the quadword is set, the failing instruction (at the PC saved below) caused a length violation. If bit 1 is set, it referred to a location whose page table entry is in a "no access" page. Bit 2 indicates the type of access used by the failing instruction: it is set for write and modify operations and clear for read operations.
PC	PC whose execution resulted in the exception.
PS	PS at the time of the exception.

2.7.2.5. Alpha Exception Stack Frame

The figure below illustrates the Alpha exception stack frame, which comprises all quadwords.

Figure 2.5. Alpha Exception Stack Frame



The values contained in the exception stack frame are defined as follows:

Table 2.12. Alpha Exception Stack Frame Values

Value	Contents
INTSTK$Q_R2	Contents of R2 at the time of the exception
INTSTK$Q_R3	Contents of R3 at the time of the exception
INTSTK$Q_R4	Contents of R4 at the time of the exception
INTSTK$Q_R5	Contents of R5 at the time of the exception
INTSTK$Q_R6	Contents of R6 at the time of the exception
INTSTK$Q_R7	Contents of R7 at the time of the exception
INTSTK$Q_PC	PC whose execution resulted in the exception
INTSTK$Q_PS	PS at the time of the exception (except high-order bits)

The SDA SHOW STACK command identifies the elements of the exception stack frame on the stack using these symbols.

2.7.2.6. Integrity server Exception Stack Frame

Two figures below illustrate the Integrity servers exception stack frame.

Figure 2.6. Integrity servers Exception Stack Frame

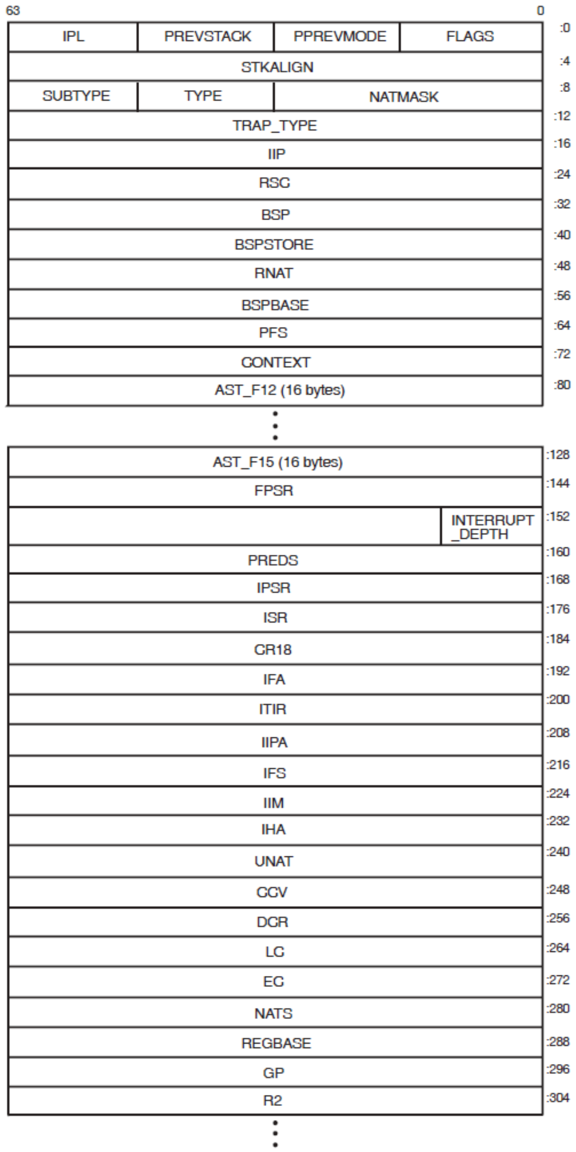
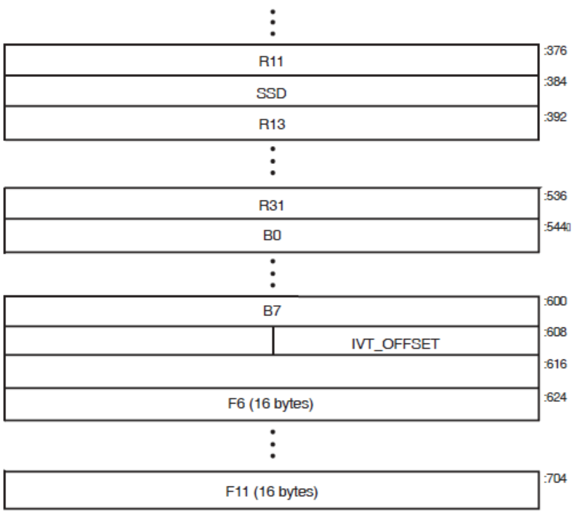


Figure 2.7. Integrity servers Exception Stack Frame (cont.)



The values contained in the exception stack frame are defined in the table below.

Table 2.13. Integrity servers Exception Stack Frame Values

Field	Use
INTSTK$B_FLAGS	Indicates if certain registers have been saved.
INTSTK$B_PPREVMODE	Save interrupted context's PREVMODE.
INTSTK$B_PREVSTACK	Indicates which mode of stack (register and memory) we return to.
INTSTK$B_IPL	SWIS IPL state
INTSTK$L_STKALIGN	How much allocated on this stack for exception frame.
INTSTK$W_NATMASK	Mask of bits 3-9 of the exception frame address.
INTSTK$B_TYPE	Standard VMS structure type.
INTSTK$B_SUBTYPE	Standard VMS structure subtype.
INTSTK$L_TRAP_TYPE	Trap type.
INTSTK$Q_IIP	Interruption Instruction Pointer (CR19).
INTSTK$Q_RSC	Register Stack Control register.
INTSTK$Q_BSP	Backing store pointer.
INTSTK$Q_BSPSTORE	User BSP store pointer for next spill.
INTSTK$Q_RNAT	RNAT register.
INTSTK$Q_BSPBASE	Base of backing store for the inner mode.
INTSTK$Q_PFS	Previous function state.
INTSTK$Q_CONTEXT	Bookkeeping data for exception processing.
INTSTK$Q_AST_F12 through INTSTK $Q_AST_F15	F12 to F15 - temporary FP registers; sometimes saved by AST.
INTSTK$Q_FPSR	Floating point status register.
INTSTK$B_INTERRUPT_DEPTH	Interrupt depth.
INTSTK$Q_PREDS	Predication registers.
INTSTK$Q_IPSR	Interruption Processor Status (CR16).
INTSTK$Q_ISR	Interruption Status Register (CR17).
INTSTK$Q_CR18	Reserved control register.
INTSTK$Q_IFA	Interruption Fault Address (CR20).
INTSTK$Q_ITIR	Interruption TLB Insertion Register (CR21).
INTSTK$Q_IIPA	Interruption immediate register (CR22).
INTSTK$Q_IFS	Interruption Function State (CR23).
INTSTK$Q_IIM	Interruption immediate (CR24).
INTSTK$Q_IHA	Interruption Hash Address (CR25).
INTSTK$Q_UNAT	User NAT collection register.
INTSTK$Q_CCV	CCV register.
INTSTK$Q_DCR	Default control register.

Field	Use
INTSTK$Q_LC	Loop counter.
INTSTK$Q_EC	Epilogue counter.
INTSTK$Q_NATS	NATs for registers saved in this structure.
INTSTK$Q_REGBASE	Used to index into registers.
INTSTK$Q_GP	r1 - Used as global pointer.
INTSTK$Q_R2	r2 - temporary register.
INTSTK$Q_R3	r3 - temporary register.
INTSTK$Q_R4 through R7	r4 through r7 - preserved registers (not saved by interrupt).
INTSTK$Q_R8	r8 - return value.
INTSTK$Q_R9	r9 - argument pointer.
INTSTK$Q_R10	r10 - temporary register.
INTSTK$Q_R11	r11 - temporary register.
INTSTK$Q_SSD	For future use.
INTSTK$Q_R13	r13 - Thread Pointer.
INTSTK$Q_R14 through R31	r14 through r31 - temporary registers.
INTSTK$Q_B0	Return pointer on kernel entry.
INTSTK$Q_B1 through B5	b1 through b5 - Preserved branch registers (not saved by interrupt).
INTSTK$Q_B6	b6 - temporary branch register.
INTSTK$Q_B7	b7 - temporary branch register.
INTSTK$L_IVT_OFFSET	Offset in IVT.
INTSTK$Q_F6 through F11	f6 through f11 - temporary FP registers.

2.7.2.7. SSRVEXCEPT Example

If OpenVMS encounters a fatal exception, you can find the code that signaled it by examining the PC in the signal array. Use the SHOW CRASH or CLUE CRASH command to display the PC and the instruction stream around the PC to locate the exception.

The following display shows the SDA output in response to the SHOW CRASH and SHOW STACK commands for an Alpha SSRVEXCEPT bugcheck. It illustrates the mechanism array, signal arrays, and the exception stack frame previously described.

Example 2.1. SHOW CRASH

```
OpenVMS (TM) Alpha system dump analyzer
...analyzing a selective memory dump...

Dump taken on 30-AUG-2000 13:13:46.83
SSRVEXCEPT, Unexpected system service exception

SDA>  SHOW CRASH
Time of system crash: 30-AUG-1996 13:13:46.83
```

```
Version of system: OpenVMS (TM) Alpha Operating System, Version V7.3

System Version Major ID/Minor ID: 3/0


System type: DEC 3000 Model 400

Crash CPU ID/Primary CPU ID:  00/00

Bitmask of CPUs active/available:  00000001/00000001


CPU bugcheck codes:
        CPU 00 -- SSRVEXCEPT, Unexpected system service exception

System State at Time of Exception
---------------------------------
Exception Frame:
----------------
        R2  = 00000000.00000003
        R3  = FFFFFFFF.80C63460  EXCEPTION_MON_NPRW+06A60
        R4  = FFFFFFFF.80D12740  PCB
        R5  = 00000000.000000C8
        R6  = 00000000.00030038
        R7  = 00000000.7FFA1FC0
        PC  = 00000000.00030078
        PS  = 00000000.00000003

         00000000.00030068:     STQ             R27,(SP)
         00000000.0003006C:     BIS             R31,SP,FP
         00000000.00030070:     STQ             R26,#X0010(SP)
         00000000.00030074:     LDA             R28,(R31)
   PC => 00000000.00030078:     LDL             R28,(R28)
         00000000.0003007C:     BEQ             R28,#X000007
         00000000.00030080:     LDQ             R26,#XFFE8(R27)
         00000000.00030084:     BIS             R31,R26,R0
         00000000.00030088:     BIS             R31,FP,SP

   PS =>
         MBZ SPAL      MBZ     IPL VMM MBZ CURMOD  INT PRVMOD
         0   00   00000000000 00  0    0   KERN    0   USER


Signal Array
------------
        Length = 00000005
        Type   = 0000000C
        Arg    = 00000000.00010000
        Arg    = 00000000.00000000
        Arg    = 00000000.00030078
        Arg    = 00000000.00000003
%SYSTEM-F-ACCVIO, access violation, reason mask=00, virtual
 address=0000000000000000,
   PC=0000000000030078, PS=00000003

Saved Scratch Registers in Mechanism Array
------------------------------------------
```

```
R0   = 00000000.00020000  R1   = 00000000.00000000  R16  =
 00000000.00020004
R17  = 00000000.00010050  R18  = FFFFFFFF.FFFFFFFF  R19  =
 00000000.00000000
R20  = 00000000.7FFA1F50  R21  = 00000000.00000000  R22  =
 00000000.00010050
R23  = 00000000.00000000  R24  = 00000000.00010051  R25  =
 00000000.00000000
R26  = FFFFFFFF.8010ACA4  R27  = 00000000.00010050  R28  =
 00000000.00000000

CPU 00 Processor crash information
----------------------------------


CPU 00 reason for Bugcheck: SSRVEXCEPT, Unexpected system service exception


Process currently executing on this CPU: SYSTEM


Current image file: $31$DKB0:[SYS0.][SYSMGR]X.EXE;1


Current IPL: 0  (decimal)


CPU database address:  80D0E000


CPUs Capabilities:    PRIMARY,QUORUM,RUN

General registers:

R0   = 00000000.00000000  R1   = 00000000.7FFA1EB8  R2   =
 FFFFFFFF.80D0E6C0
R3   = FFFFFFFF.80C63460  R4   = FFFFFFFF.80D12740  R5   =
 00000000.000000C8
R6   = 00000000.00030038  R7   = 00000000.7FFA1FC0  R8   =
 00000000.7FFAC208
R9   = 00000000.7FFAC410  R10  = 00000000.7FFAD238  R11  =
 00000000.7FFCE3E0
R12  = 00000000.00000000  R13  = FFFFFFFF.80C6EB60  R14  =
 00000000.00000000
R15  = 00000000.009A79FD  R16  = 00000000.000003C4  R17  =
 00000000.7FFA1D40
R18  = FFFFFFFF.80C05C38  R19  = 00000000.00000000  R20  =
 00000000.7FFA1F50
R21  = 00000000.00000000  R22  = 00000000.00000001  R23  =
 00000000.7FFF03C8
R24  = 00000000.7FFF0040  AI   = 00000000.00000003  RA   =
 FFFFFFFF.82A21080
PV   = FFFFFFFF.829CF010  R28  = FFFFFFFF.8004B6DC  FP   =
 00000000.7FFA1CA0
PC   = FFFFFFFF.82A210B4  PS   = 18000000.00000000
```

```
Processor Internal Registers:


ASN  = 00000000.0000002F                    ASTSR/ASTEN =
 0000000F
IPL  =          00000000  PCBB = 00000000.003FE080  PRBR =
 FFFFFFFF.80D0E000
PTBR = 00000000.00001136  SCBB = 00000000.000001DC  SISR =
 00000000.00000000
VPTB = FFFFFFFC.00000000  FPCR = 00000000.00000000  MCES =
 00000000.00000000

CPU 00 Processor crash information
----------------------------------


        KSP    = 00000000.7FFA1C98
        ESP    = 00000000.7FFA6000
        SSP    = 00000000.7FFAC100
        USP    = 00000000.7AFFBAD0

                No spinlocks currently owned by CPU 00
```

Example 2.2. SHOW STACK

```
SDA> SHOW STACK
Current Operating Stack (KERNEL):
                       00000000.7FFA1C78    18000000.00000000
                       00000000.7FFA1C80    00000000.7FFA1CA0
                       00000000.7FFA1C88    00000000.00000000
                       00000000.7FFA1C90    00000000.7FFA1D40
                SP =>  00000000.7FFA1C98    00000000.00000000
                       00000000.7FFA1CA0    FFFFFFFF.829CF010  EXE$EXCPTN
                       00000000.7FFA1CA8    FFFFFFFF.82A2059C
 EXCEPTION_MON_PRO+0259C
                       00000000.7FFA1CB0    00000000.00000000
                       00000000.7FFA1CB8    00000000.7FFA1CD0
                       00000000.7FFA1CC0    FFFFFFFF.829CEDA8  EXE
$SET_PAGES_READ_ONLY+00948
                       00000000.7FFA1CC8    00000000.00000000
                       00000000.7FFA1CD0    FFFFFFFF.829CEDA8  EXE
$SET_PAGES_READ_ONLY+00948
                       00000000.7FFA1CD8    00000000.00000000
                       00000000.7FFA1CE0    FFFFFFFF.82A1E930  EXE
$CONTSIGNAL_C+001D0
                       00000000.7FFA1CE8    00000000.7FFA1F40
                       00000000.7FFA1CF0    FFFFFFFF.80C63780  EXE$ACVIOLAT
                       00000000.7FFA1CF8    00000000.7FFA1EB8
                       00000000.7FFA1D00    00000000.7FFA1D40
                       00000000.7FFA1D08    00000000.7FFA1F00
                       00000000.7FFA1D10    00000000.7FFA1F40
                       00000000.7FFA1D18    00000000.00000000
                       00000000.7FFA1D20    00000000.00000000
                       00000000.7FFA1D28    00000000.00020000  SYS
$K_VERSION_04
                       00000000.7FFA1D30    00000005.00000250  BUG
$_NETRCVPKT
```

```
                       00000000.7FFA1D38    829CE050.000008F8  BUG
$_SEQ_NUM_OVF
CHF$IS_MCH_ARGS        00000000.7FFA1D40    00000000.0000002C
CHF$PH_MCH_FRAME       00000000.7FFA1D48    00000000.7AFFBAD0
CHF$IS_MCH_DEPTH       00000000.7FFA1D50    FFFFFFFF.FFFFFFFD
CHF$PH_MCH_DADDR       00000000.7FFA1D58    00000000.00000000
CHF$PH_MCH_ESF_ADDR    00000000.7FFA1D60    00000000.7FFA1F00
CHF$PH_MCH_SIG_ADDR    00000000.7FFA1D68    00000000.7FFA1EB8
CHF$IH_MCH_SAVR0       00000000.7FFA1D70    00000000.00020000  SYS
$K_VERSION_04
CHF$IH_MCH_SAVR1       00000000.7FFA1D78    00000000.00000000
CHF$IH_MCH_SAVR16      00000000.7FFA1D80    00000000.00020004  UCB
$M_LCL_VALID+00004
CHF$IH_MCH_SAVR17      00000000.7FFA1D88    00000000.00010050  SYS
$K_VERSION_16+00010
CHF$IH_MCH_SAVR18      00000000.7FFA1D90    FFFFFFFF.FFFFFFFF
CHF$IH_MCH_SAVR19      00000000.7FFA1D98    00000000.00000000
CHF$IH_MCH_SAVR20      00000000.7FFA1DA0    00000000.7FFA1F50
CHF$IH_MCH_SAVR21      00000000.7FFA1DA8    00000000.00000000
CHF$IH_MCH_SAVR22      00000000.7FFA1DB0    00000000.00010050  SYS
$K_VERSION_16+00010
CHF$IH_MCH_SAVR23      00000000.7FFA1DB8    00000000.00000000
CHF$IH_MCH_SAVR24      00000000.7FFA1DC0    00000000.00010051  SYS
$K_VERSION_16+00011
CHF$IH_MCH_SAVR25      00000000.7FFA1DC8    00000000.00000000
CHF$IH_MCH_SAVR26      00000000.7FFA1DD0    FFFFFFFF.8010ACA4  AMAC
$EMUL_CALL_NATIVE_C+000A4
CHF$IH_MCH_SAVR27      00000000.7FFA1DD8    00000000.00010050  SYS
$K_VERSION_16+00010
CHF$IH_MCH_SAVR28      00000000.7FFA1DE0    00000000.00000000
                       00000000.7FFA1DE8    00000000.00000000
                       00000000.7FFA1DF0    00000000.00000000
                       00000000.7FFA1DF8    00000000.00000000
                       00000000.7FFA1E00    00000000.00000000
                       00000000.7FFA1E08    00000000.00000000
                       00000000.7FFA1E10    00000000.00000000
                       00000000.7FFA1E18    00000000.00000000
                       00000000.7FFA1E20    00000000.00000000
                       00000000.7FFA1E28    00000000.00000000
                       00000000.7FFA1E30    00000000.00000000
                       00000000.7FFA1E38    00000000.00000000
                       00000000.7FFA1E40    00000000.00000000
                       00000000.7FFA1E48    00000000.00000000
                       00000000.7FFA1E50    00000000.00000000
                       00000000.7FFA1E58    00000000.00000000
                       00000000.7FFA1E60    00000000.00000000
                       00000000.7FFA1E68    00000000.00000000
                       00000000.7FFA1E70    00000000.00000000
                       00000000.7FFA1E78    00000000.00000000
                       00000000.7FFA1E80    00000000.00000000
                       00000000.7FFA1E88    00000000.00000000
                       00000000.7FFA1E90    00000000.00000000
                       00000000.7FFA1E98    00000000.00000000
CHF$PH_MCH_SIG64_ADDR  00000000.7FFA1EA0    00000000.7FFA1ED0
                       00000000.7FFA1EA8    00000000.00000000
                       00000000.7FFA1EB0    00000000.7FFA1F50
                       00000000.7FFA1EB8    0000000C.00000005
```

```
                       00000000.7FFA1EC0    00000000.00010000  SYS
$K_VERSION_07
                       00000000.7FFA1EC8    00000003.00030078  SYS
$K_VERSION_01+00078
CHF$L_SIG_ARGS         00000000.7FFA1ED0    00002604.00000005  UCB
$M_TEMPLATE+00604
CHF$L_SIG_ARG1         00000000.7FFA1ED8    00000000.0000000C
                       00000000.7FFA1EE0    00000000.00010000  SYS
$K_VERSION_07
                       00000000.7FFA1EE8    00000000.00000000
                       00000000.7FFA1EF0    00000000.00030078  SYS
$K_VERSION_01+00078
                       00000000.7FFA1EF8    00000000.00000003
INTSTK$Q_R2            00000000.7FFA1F00    00000000.00000003
INTSTK$Q_R3            00000000.7FFA1F08    FFFFFFFF.80C63460
 EXCEPTION_MON_NPRW+06A60
INTSTK$Q_R4            00000000.7FFA1F10    FFFFFFFF.80D12740  PCB
INTSTK$Q_R5            00000000.7FFA1F18    00000000.000000C8
INTSTK$Q_R6            00000000.7FFA1F20    00000000.00030038  SYS
$K_VERSION_01+00038
INTSTK$Q_R7            00000000.7FFA1F28    00000000.7FFA1FC0
INTSTK$Q_PC            00000000.7FFA1F30    00000000.00030078  SYS
$K_VERSION_01+00078
INTSTK$Q_PS            00000000.7FFA1F38    00000000.00000003
Prev SP (7FFA1F40) ==> 00000000.7FFA1F40    00000000.00010050  SYS
$K_VERSION_16+00010
                       00000000.7FFA1F48    00000000.00010000  SYS
$K_VERSION_07
                       00000000.7FFA1F50    FFFFFFFF.8010ACA4  AMAC
$EMUL_CALL_NATIVE_C+000A4
                       00000000.7FFA1F58    00000000.7FFA1F70
                       00000000.7FFA1F60    00000000.00000001
                       00000000.7FFA1F68    FFFFFFFF.800EE81C  RM_STD
$DIRCACHE_BLKAST_C+005AC
                       00000000.7FFA1F70    FFFFFFFF.80C6EBA0  SCH$CHSEP
+001E0
                       00000000.7FFA1F78    00000000.829CEDE8  EXE$SIGTORET
                       00000000.7FFA1F80    00010050.00000002  SYS
$K_VERSION_16+00010
                       00000000.7FFA1F88    00000000.00020000  SYS
$K_VERSION_04
                       00000000.7FFA1F90    00000000.00030000  SYS
$K_VERSION_01
                       00000000.7FFA1F98    FFFFFFFF.800A4D64
 EXCEPTION_MON_NPRO+00D64
                       00000000.7FFA1FA0    00000000.00000003
                       00000000.7FFA1FA8    FFFFFFFF.80D12740  PCB
                       00000000.7FFA1FB0    00000000.00010000  SYS
$K_VERSION_07
                       00000000.7FFA1FB8    00000000.7AFFBAD0
                       00000000.7FFA1FC0    00000000.7FFCF880  MMG
$IMGHDRBUF+00080
                       00000000.7FFA1FC8    00000000.7B0E9851
                       00000000.7FFA1FD0    00000000.7FFCF818  MMG
$IMGHDRBUF+00018
                       00000000.7FFA1FD8    00000000.7FFCF938  MMG
$IMGHDRBUF+00138
                       00000000.7FFA1FE0    00000000.7FFAC9F0
```

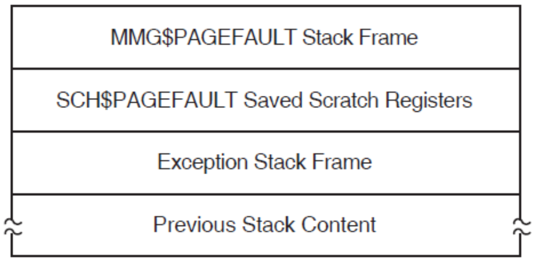
```
                         00000000.7FFA1FE8    00000000.7FFAC9F0
                         00000000.7FFA1FF0    FFFFFFFF.80000140  SYS
$PUBLIC_VECTORS_NPRO+00140
                         00000000.7FFA1FF8    00000000.0000001B


.
.
.
```

2.7.2.8. Illegal Page Faults

When an illegal page fault occurs, the stack appears as pictured in the figure below.

Figure 2.8. Stack Following an Illegal Page-Fault Error



The stack contents are as follows:

MMG$PAGEFAULT Stack Frame	Stack frame built at entry to MMG$PAGEFAULT, the page fault exception service routine. On Alpha, the frame includes the contents of the following registers at the time of the page fault: R3, R8, R11 to R15, R29 (frame pointer)
SCH$PAGEFAULT Saved Scratch Registers (Alpha only)	Contents of the following registers at the time of the page fault: R0, R1, R16 to R28
Exception Stack Frame	Exception stack frame ---see Figure 2.5, Figure 2.6 and Figure 2.7.
Previous Stack Content	Contents of the stack prior to the illegal page-fault error

When you analyze a dump caused by a PGFIPLHI bugcheck, the SHOW STACK command identifies the exception stack frame using the symbols shown in Table 2.12 or Table 2.13. The SHOW CRASH or CLUE CRASH command displays the instruction that caused the page fault and the instructions around it.

2.8. Page Protections and Access Rights

Page protections and access rights are different on Alpha and Integrity server systems. They are visible in output from the following commands:

- SHOW PAGE
- SHOW PROCESS/PAGE

- EXAMINE/PTE
- EVALUATE/PTE

Due to system differences, there is a need to distinguish "Write+Read+Execute" from "Write+Read" and to distinguish "Read+Execute" from "Read".

On an Alpha system, W=W+R+E and R=R+E but on an IA64 system, additional w and r indicators are introduced for non-execute cases.

On Alpha, page protection is described by 8 bits--- one Read bit for each mode, and one Write Bit. Therefore in the "Read" column, there might be KESU (read access in all modes) or K--- (read access in Kernel mode only) or NONE (no read access). Similarly in the "Writ" column. Not all combinations of the 8 bits are possible (for example, Write access for a mode implies Read access at that mode and both Read and Write access for all inner modes).

On Integrity servers, page protection is described by 5 bits, a combination of the Access Rights and Privilege Level fields. SDA interprets these with a single character to describe access in each mode, as shown in the table below.

Table 2.14. Integrity server Access Codes for Page Protections

Code	Meaning
r	Read
w	Read, Write
R	Read, Execute
W	Read, Write, Execute
X	Execute
K	Promote to Kernel
E	Promote to Executive
S	Promote to Supervisor
-	No access

For example WRRR means Kernel mode has Read+Write+Execute access; all other modes have Read +Execute access.

2.9. Inducing a System Failure

If the operating system is not performing well and you want to create a dump you can examine, you must induce a system failure. Occasionally, a device driver or other user-written, kernel-mode code can cause the system to execute a loop of code at a high priority, interfering with normal system operation. This loop can occur even though you have set a breakpoint in the code if the loop is encountered before the breakpoint. To gain control of the system in such circumstances, you must cause the system to fail and then reboot it.

If the system has suspended all noticeable activity and is hung, see the examples of causing system failures in Section 2.9.2.

If you are generating a system failure in response to a system hang, be sure to record the PC and PS as well as the contents of the integer registers at the time of the system halt.

2.9.1. Meeting Crash Dump Requirements

The following requirements must be met before the operating system can write a complete crash dump:

- You must not halt the system until the console dump messages have been printed in their entirety and the memory contents have been written to the crash dump file. Be sure to allow sufficient time for these events to take place or make sure that all disk activity has stopped before using the console to halt the system.
- There must be a crash dump file in SYS$SPECIFIC:[SYSEXE]: named either SYSDUMP.DMP or PAGEFILE.SYS.

  This dump file must be either large enough to hold the entire contents of memory (as discussed in Section 2.2.1.1) or, if the DUMPSTYLE system parameter is set, large enough to accommodate a subset or compressed dump (also discussed in Section 2.2.1.1).

  If SYSDUMP.DMP is not present, the operating system attempts to write crash dumps to PAGEFILE.SYS. In this case, the SAVEDUMP system parameter must be 1 (the default is 0).
- Alternatively, the system must be set up for DOSD. See Section 2.2.1.5, and the *VSI OpenVMS System Manager's Manual, Volume 2: Tuning, Monitoring, and Complex Systems* for details.
- The DUMPBUG system parameter must be 1 (the default is 1).

2.9.2. Procedure for Causing a System Failure

This section tells you how to enter the XDelta utility (XDELTA) to force a system failure.

Before you can use XDelta, it must be loaded at system startup. To load XDelta during system bootstrap, you must set bit 1 in the boot flags. See the *VSI OpenVMS Version 8.4 Upgrade and Installation Manual* for information about booting with the XDelta utility.

On Alpha, put the system in console mode by pressing Ctrl/P or the Halt push button. Enter the following commands at the console prompt to enter XDelta:

```
>>> DEPOSIT SIRR E
>>> CONTINUE
```

On Integrity servers, enter XDELTA by pressing Ctrl/P at the console.

Once you have entered XDelta, use any valid XDelta commands to examine register or memory locations, step through code, or force a system failure (by entering ;C under XDelta). See the *VSI OpenVMS Delta/XDelta Debugger Manual* for more information about using XDelta.

On Alpha, if you did not load XDelta, you can force a system crash by entering console commands that make the system incur an exception at high IPL. At the console prompt, enter commands to set the program counter (PC) to an invalid address and the PS to kernel mode at IPL 31 before continuing. This results in a forced INVEXCEPTN-type bugcheck. Some VSI Alpha computers employ the console command CRASH (which will force a system failure) while other systems require that you manually enter the commands.

Enter the following commands at the console prompt to force a system failure:

```
>>> DEPOSIT PC FFFFFFFFFFFFFF00
>>> DEPOSIT PS 1F00
```

```
>>> CONTINUE
```

For more information, refer to the hardware manuals that accompanied your Alpha computer.

On Integrity servers, pressing Ctrl/P when XDelta is not loaded causes the OpenVMS system to output the following:

```
Crash (y/n):
```

A response of Y forces a system crash; entering any other character lets the system continue processing.

Chapter 3. ANALYZE Usage

This chapter describes the format, usage, and qualifiers of the System Dump Analyzer (SDA) utility.

The System Dump Analyzer (SDA) utility helps determine the causes of system failures. This utility is also useful for examining the running system.

3.1. ANALYZE

ANALYZE

ANALYZE

Format

```
          /CRASH_DUMP  [ /COLLECTION=collection-filename     ] [filespec]
                       [ /LOG                                ]
                       [ /OVERRIDE                           ]
                       [ /RELEASE                            ]
                       [ /SHADOW_MEMBER [=device-name]       ]
                       [ /SYMBOL=system-symbol-table         ]
ANALYZE { /SSLOG       [qualifiers] (See SSLOG chapter.)             }
          /SYSTEM      [/SYMBOL=system-symbol-table]
```

Parameters

collection-file-name

Name of the file that contains the file ID translation data or unwind data to be used by SDA.

device-name

The device containing the system dump.

filespec

Name of the file(s) that contain the dump you want to analyze.

If **filespec** is not specified in an ANALYZE/CRASH_DUMP command, the default is the highest version of SYS$SYSTEM:SYSDUMP.DMP. If this file does not exist or cannot be opened, SDA prompts you for a file name. If any field of **filespec** is provided, the remaining fields default to the highest version of SYSDUMP.DMP in your default directory.

filespec can be a comma-separated list of files, including wildcards, where all the files contain Partial Dump Copies from the same original dump. See Section 2.2.3 for a description of Partial Dump Copies. The following restrictions apply when multiple files are specified:

- Files are opened in the order they are specified.

- The file that contains System Page Tables (section PT) must be the first file opened. This is the Primary dump file.
- If using a wildcard to specify file names, the primary dump file must be the first file to match the wildcard.
- The files specified must be part of the same original crash dump.
- If any section of the dump is found in multiple input files, SDA issues a warning, but continues.
- If the file or unwind data collection is in a separate file, it must have the same name and location as the primary dump file, with file type .COLLECT, or must be specified using the /COLLECTION qualifier.
- The files specified must either be all compressed or all uncompressed. They cannot be mixed.

You cannot specify **filespec** for ANALYZE/SYSTEM.

system-symbol-table

The system symbol table used by SDA.

Qualifiers

The /CRASH_DUMP and /SYSTEM qualifiers (described in this chapter) specify whether the object of an SDA session is a crash dump or a running system. Additional qualifiers used with these help to create the environment of an SDA session. The /SSLOG qualifier specifies that data be collected by the System Service Logging utility, which is documented in Chapter 14.

- /COLLECTION
- /LOG
- /CRASH_DUMP
- /OVERRIDE
- /RELEASE
- /SHADOW_MEMBER
- /SSLOG
- /SYMBOL
- /SYSTEM

The only additional qualifiers that can be used when invoking ANALYZE/SYSTEM are /LOG and /SYMBOL. See Chapter 14 for details of additional qualifiers that can be used when invoking ANALYZE/SSLOG. The following table shows which combinations of additional qualifiers can be used together when invoking ANALYZE/CRASH_DUMP:

	/OVERRIDE	/RELEASE	/SHADOW	/SYMBOL

/COLLECTION	No	No	Yes	yes
/OVERRIDE	--	No	Yes	See note
/RELEASE	--	--	No	See note
/SHADOW	--	--	--	Yes

Note

/LOG can be used with any valid combination of qualifiers. /SYMBOL is ignored if it is specified with /OVERRIDE or /RELEASE.

The qualifiers are described on the following pages.

Description

By default, the System Dump Analyzer is automatically invoked when you reboot the system after a system failure.

To analyze a system dump interactively, invoke SDA by issuing the following command:

```
$ ANALYZE/CRASH_DUMP filespec
```

If you do not specify **filespec**, and SYS$SYSTEM:SYSDUMP.DMP does not exist or cannot be opened, SDA prompts you for a file name.

To analyze a crash dump, your process must have the privileges necessary for reading the dump file. This usually requires system privilege (SYSPRV), but your system manager can, if necessary, allow less privileged processes to read the dump files. Your process needs change-mode-to-kernel (CMKRNL) privilege to release page file dump blocks, whether you use the /RELEASE qualifier or the SDA COPY command.

Invoke SDA to analyze a running system by issuing the following command:

```
$ANALYZE/SYSTEM
```

To examine a running system, your process must have change-mode-to-kernel (CMKRNL) privilege. Your process must also have the map-by-PFN privilege (PFNMAP) to access memory by physical address on a running system. You cannot specify **filespec** when using the /SYSTEM qualifier.

To send all output from SDA to a file, use the SDA command SET OUTPUT, specifying the name of the output file. The file produced is 132 columns wide and is formatted for output to a printer. To later redirect the output to your terminal, use the following command:

```
SDA> SET OUTPUT SYS$OUTPUT
```

To send a copy of all the commands you type and a copy of all the output those commands produce to a file, use the SDA command SET LOG, specifying the name of the log file. The file produced is 132 columns wide and is formatted for output to a printer.

To exit from SDA, use the EXIT command. Note that the EXIT command also causes SDA to exit from display mode. Thus, if SDA is in display mode, you must use the EXIT command twice: once to exit from display mode, and a second time to exit from SDA. See Section 2.6.2 for a description of display mode.

3.2. /COLLECTION

/COLLECTION

/COLLECTION — Valid for Alpha and Integrity server systems only. Indicates to SDA that the file ID translation data or unwind data is to be found in a separate file.

Format

/COLLECTION = collection-file-name

At least one field of the collection file name must be specified. Other fields default to the highest generation of the same filename and location as the dump file, with a file type of .COLLECT.

Description

SDA can provide additional information when analyzing a dump if a collection has been made of file identification translation data (on both Alpha and Integrity servers) and of unwind data (on Integrity servers only). This data is usually saved when the dump file is copied using the SDA COPY/COLLECT command, but it can be saved to a separate file using the COLLECT/SAVE command.

By default, COLLECT/SAVE creates a .COLLECT file with the same name and in the same directory as the dump file. A subsequent ANALYZE/CRASH_DUMP command automatically uses this file. If the collection file is in a different location or if the collection previously appended to the dump file is incomplete (for example, if a disk was not mounted at the time of the SDA COPY), you can use the /COLLECTION qualifier to specify an alternate collection file.

Example

```
$ ANALYZE/CRASH_DUMP SYS$SYSTEM:SYSDUMP.DMP
...
SDA> COLLECT/SAVE=SYS$LOGIN:NEWCOLL.COLLECT
SDA> EXIT
$ ANALYZE/CRASH_DUMP SYS$SYSTEM:SYSDUMP.DMP /COLLECTION=SYS$LOGIN:NEWCOLL
...
```

3.3. /CRASH_DUMP

/CRASH_DUMP

/CRASH_DUMP — Invokes SDA to analyze the specified dump file.

Format

/CRASH_DUMP [filespec]

Parameter

filespec

Name of the file that contains the dump you want to analyze. If no filespec is given on an ANALYZE/CRASH_DUMP command, the default is the highest version of SYS

$SYSTEM:SYSDUMP.DMP. If this file does not exist, SDA prompts you for a file name. If any field of filespec is given, the remaining fields default to the highest version of SYSDUMP.DMP in your default directory.

Description

See Section 2.3 for additional information on crash dump analysis. You cannot specify the /SYSTEM qualifier when you include the /CRASH_DUMP qualifier in the ANALYZE command.

Examples

```
$ ANALYZE/CRASH_DUMP SYS$SYSTEM:SYSDUMP.DMP
$ ANALYZE/CRASH SYS$SYSTEM
```

These commands invoke SDA to analyze the crash dump stored in SYS$SYSTEM:SYSDUMP.DMP.

```
$ ANALYZE/CRASH SYS$SYSTEM:PAGEFILE.SYS
```

This command invokes SDA to analyze a crash dump stored in the system page file.

3.4. /LOG

/LOG

/LOG — Causes SDA to display the names of the files opened because SDA initializes itself.

Format

/LOG

Parameters

None.

Description

SDA displays the names of the files opened because SDA initializes itself. Note that this does not affect the behavior of commands within SDA such as READ, but only files opened when SDA is initialized.

/LOG can be used on ANALYZE /CRASH_DUMP and ANALYZE /SYSTEM.

Examples

```
$ ANALYZE/CRASH_DUMP /LOG T*
%SDA-I-OPENED, opened USER$:[SYSMGR]T1.DMP;1 as dump file #1
%SDA-I-OPENED, opened SYS$COMMON:[SYS$LDR]SYS$BASE_IMAGE.EXE;1 as symbol
 file
%SDA-I-OPENED, opened USER$:[SYSMGR]T2.DMP;1 as dump file #2

OpenVMS system dump analyzer
...analyzing an I64 compressed selective memory dump...

%SDA-I-OPENED, opened SYS$COMMON:[SYS$LDR]REQSYSDEF.STB;1 as symbol file
Dump taken on 14-DEC-2009 17:16:31.35 using version XC6G-J2I
```

```
SSRVEXCEPT, Unexpected system service exception

$ SDA>
```

This example shows the use of the /LOG qualifier to identify the set of files being used by SDA.

3.5. /OVERRIDE

/OVERRIDE

/OVERRIDE — When used with the /CRASH_DUMP qualifier, invokes SDA to analyze only the structure of the specified dump file when a corruption or other problem prevents normal invocation of SDA with the ANALYZE/CRASH_DUMP command.

Format

`/CRASH_DUMP/OVERRIDE [filespec]`

Parameter

filespec

Name of the crash dump file to be analyzed. The default file specification is:

SYS$DISK:[default-dir]SYSDUMP.DMP

SYS$DISK and [default-dir] represent the disk and directory specified in your last SET DEFAULT command. If you do not specify filespec, and SYS$SYSTEM:SYSDUMP.DMP does not exist or cannot be opened, SDA prompts you for it.

Description

See Section 2.3 for additional information on crash dump analysis. Note that when SDA is invoked with /OVERRIDE, not all the commands in Section 2.3 can be used. Commands that can be used are as follows:

- Output control commands such as SET OUTPUT and SET LOG
- Dump file related commands such as SHOW DUMP and CLUE ERRLOG

Commands that cannot be used are as follows:

- Commands that access memory addresses within the dump file such as EXAMINE and SHOW SUMMARY

Also, the /RELEASE qualifier cannot be used when you include the /OVERRIDE qualifier in the ANALYZE/CRASH_DUMP command.

When /OVERRIDE is used, the SDA command prompt is SDA>>.

Example

```
$ ANALYZE/CRASH_DUMP/OVERRIDE SYS$SYSTEM:SYSDUMP.DMP
```

```
$ ANALYZE/CRASH/OVERRIDE SYS$SYSTEM
```

These commands invoke SDA to analyze the crash dump stored in SYS$SYSTEM:SYSDUMP.DMP.

3.6. /RELEASE

/RELEASE

/RELEASE — Invokes SDA to release those blocks in the specified system page file occupied by a crash dump. Requires CMKRNL (change-mode-to-kernel) privilege.

Format

`/CRASH_DUMP/RELEASE filespec`

Parameter

filespec

> Name of the system page file (SYS$SYSTEM:PAGEFILE.SYS). Because the default file specification is SYS$DISK:[default-dir]SYSDUMP.DMP, you must identify the page file explicitly. SYS$DISK and [default-dir] represent the disk and directory specified in your last DCL command SET DEFAULT.
>
> If you do not specify **filespec**, and SYS$SYSTEM:SYSDUMP.DMP does not exist or cannot be opened, SDA prompts you for it. Note that if you do not specify **filespec**, and SYS $SYSTEM:SYSDUMP.DMP exists and can be opened, SDA will report an error because this is not the primary page file.

Description

Use the /RELEASE qualifier to release from the system page file those blocks occupied by a crash dump. When invoked with the /RELEASE qualifier, SDA immediately deletes the dump from the page file and allows no opportunity to analyze its contents.

When you specify the /RELEASE qualifier in the ANALYZE command, do the following:

1. Use the /CRASH_DUMP qualifier.

2. Include the name of the system page file (SYS$SYSTEM:PAGEFILE.SYS) as the **filespec**.

If you do not specify the system page file or the specified page file does not contain a dump, SDA generates the following messages:

```
%SDA-E-BLKSNRLSD, no dump blocks in page file to release, or not page file
%SDA-E-NOTPAGFIL, specified file is not the page file
```

You cannot specify the /OVERRIDE or /SHADOW_MEMBER qualifier when you include the / RELEASE qualifier in the ANALYZE/CRASH_DUMP command.

Example

```
$ ANALYZE/CRASH_DUMP/RELEASE SYS$SYSTEM:PAGEFILE.SYS
```

```
$ ANALYZE/CRASH/RELEASE PAGEFILE.SYS
```

These commands invoke SDA to release to the page file those blocks in SYS$SYSTEM:PAGEFILE.SYS occupied by a crash dump.

3.7. /SHADOW_MEMBER

/SHADOW_MEMBER

/SHADOW_MEMBER — Valid for Alpha and Integrity server systems only. Specifies which member of a shadow set contains the system dump to be analyzed, or allows the user to determine what system dumps have been written to the members of the shadow set.

Format

`/CRASH_DUMP/SHADOW_MEMBER [filespec]`

Description

If the system disk is a shadow set, a system dump is written to only one member of the shadow set (usually the master member at the time the dump is written). By default, if the filespec translates to a file on a shadow set, SDA reads the dump only from the master member. If at analysis time, the master member is different from where the dump was written, the /SHADOW_MEMBER qualifier allows the user to choose the member from which the dump is to be read.

If the correct member is not known, the /SHADOW_MEMBER qualifier may be specified without a device name. SDA will display a one-line summary of the most recent dump written to each member and then prompt the user to determine which member to use. The prompt is:

```
Shadow set action?
```

The possible responses are:

Command	Effect
EXIT	Aborts the SDA session without analyzing a dump.
HELP	Displays simple help text. See Example 3 below.
USE <device_name>	Initiates analysis of the system dump located on the specified shadow set member.

The one-line summary for each member consists of the following fields:

- Member device name
- Bugcheck name
- Date and time of system crash
- Node name
- VMS Version
- Flags—none, one or more of: Bad_Checksum, ErrorLog_Dump, Not_Saved, Old_Dump

If there is no usable dump on a member, SDA output will an explanatory warning message followed by a line giving the member device name and the message "No system or error log dump found."

Note that SDA cannot distinguish a dump on a shadowed system disk from a dump copied to a shadowed data disk. SDA will therefore always read the dump from a single member of a host-based shadow set. (In an OpenVMS Cluster system with multiple shadowed system disks, one system's system disk will be a data disk on other systems.) This does not affect dumps being read directly from a DOSD disk, since DOSD disks cannot be members of a host-based shadow set.

Note

The /SHADOW_MEMBER qualifier is not useful if the system dump has been written to the primary page file on a shadowed system disk. You cannot specify /RELEASE with /SHADOW_MEMBER.

Examples

1.
```
$ ANALYZE/CRASH_DUMP DSA777:[SYS0.SYSEXE]SYSDUMP.DMP
%SDA-I-USEMASTER, accessing dump file via _$31$DKB200:, master member of
 shadow set _DSA777:
OpenVMS (TM) Alpha system dump analyzer
...analyzing a compressed selective memory dump...
Dump taken on 12-DEC-2001 08:23:07.80
SSRVEXCEPT, Unexpected system service exception
SDA>
```

   This command initiates dump analysis using the master member of the shadow set DSA777 (the default action).

2.
```
$ ANALYZE/CRASH_DUMP/SHADOW_MEMBER=DKB0 DSA777:[SYS0.SYSEXE]SYSDUMP.DMP
OpenVMS (TM) Alpha system dump analyzer
...analyzing a compressed selective memory dump...

Dump taken on 12-DEC-2001 08:23:07.80
SSRVEXCEPT, Unexpected system service exception

SDA>
```

   This command initiates dump analysis using member device 31DKB0 of the shadow set DSA777.

3.
```
$ ANALYZE/CRASH_DUMP/SHADOW_MEMBER DSA8888:[SYS1.SYSEXE]SYSDUMP.DMP
_$70$DKA303:     INVEXCEPTN           16-NOV-2001 00:00:25.74 MRVP2
 X96S-FT1
_$70$DKA202:     INCONSTATE           18-NOV-2001 02:08:45.05 MRVP2
 X96S-FT1

Shadow set action? HELP

Shadow set actions:

     EXIT                            exit SDA
     HELP                            this display
     USE <shadow_set_member>         proceed using specified shadow set
 member

Shadow set action? USE _$70$DKA303:
```

```
OpenVMS (TM) Alpha system dump analyzer
...analyzing a compressed selective memory dump...

%SDA-W-NOTSAVED, global pages not saved in the dump file
Dump taken on 16-NOV-2001 00:00:25.74
INVEXCEPTN, Exception while above ASTDEL

SDA> EXIT
```

This command displays the dumps to be found on the members of shadow set DSA8888:[SYS1.SYSEXE]SYSDUMP.DMP and then begins analysis of the dump written to device _70DKA303.

3.8. /SSLOG

/SSLOG

/SSLOG — Displays data collected by the System Service Logging Utility (SSLOG). For more information about this and associated commands, see Chapter 14, System Service Logging.

Format

/SSLOG

3.9. /SYMBOL

/SYMBOL

/SYMBOL — Specifies an alternate system symbol table for SDA to use.

Format

/SYMBOL = system-symbol-table

File specification of the OpenVMS Alpha SDA system symbol table required by SDA to analyze a system dump or running system. The specified **system-symbol-table** must contain those symbols required by SDA to find certain locations in the executive image.

If you do not specify the /SYMBOL qualifier, SDA uses SDA$READ_ DIR:SYS$BASE_IMAGE.EXE to load system symbols into the SDA symbol table. When you specify the /SYMBOL qualifier, SDA assumes the default disk and directory to be SYS$DISK:[ ], that is, the disk and directory specified in your last DCL command SET DEFAULT. If you specify a file for this parameter that is not a system symbol table, SDA exits with a fatal error.

Description

The /SYMBOL qualifier allows you to specify a system symbol table to load into the SDA symbol table. You can use the /SYMBOL qualifier whether you are analyzing a system dump or a running system. It is not normally necessary to use the /SYMBOL qualifier when analyzing the running system, since the default SYS$BASE_IMAGE.EXE is the one in use in the system. However if SDA$READ_DIR has been redefined during crash dump analysis, then the /SYMBOL qualifier can be used to ensure that the correct base image is found when analyzing the running system.

The /SYMBOL qualifier can be used with the /CRASH_DUMP and /SYSTEM qualifiers. It is ignored when /OVERRIDE or /RELEASE is specified.

Example

```
$ ANALYZE/CRASH_DUMP/SYMBOL=SDA$READ_DIR:SYS$BASE_IMAGE.EXE SYS$SYSTEM
```

This command invokes SDA to analyze the crash dump stored in SYS$SYSTEM:SYSDUMP.DMP, using the base image in SDA$READ_DIR.

3.10. /SYSTEM

/SYSTEM

/SYSTEM — Invokes SDA to analyze a running system. Requires CMKRNL (change-mode-to-kernel) privilege. Also requires PFNMAP (map-by-PFN) privilege to access memory by physical address.

Format

/SYSTEM

Parameters

None.

Description

See Section 2.4 for information on how to use SDA to analyze a running system. See Chapter 4 for information on SDA commands.

The only other qualifiers you can specify with /SYSTEM are /LOG and /SYMBOL.

Example

```
$ ANALYZE/SYSTEM

OpenVMS (TM) system analyzer

SDA>
```

This command invokes SDA to analyze the running system.

Chapter 4. SDA Commands

This chapter describes the SDA commands that you can use to analyze a system dump or a running system. SDA extension commands, such as CLUE and FLT are described in separate chapters.

4.1. @(Execute Command)

Causes SDA to execute SDA commands contained in a file. Use this command to execute a set of frequently used SDA commands.

Format

`@filespec`

Parameter

filespec

Name of a file that contains the SDA commands to be executed. The default file type is .COM.

Example

```
SDA>  @USUAL
```

The execute (@) command executes the following commands, as contained in a file named USUAL.COM:

```
SET OUTPUT LASTCRASH.LIS
SHOW CRASH
SHOW PROCESS
SHOW STACK
SHOW SUMMARY
```

This command procedure first makes the file LASTCRASH.LIS the destination for output generated by subsequent SDA commands. Next, the command procedure sends information to the file about the system failure and its context, including a description of the process executing at the time of the failure, the contents of the stack on which the failure occurred, and a list of the processes active on the system.

An EXIT command within a command procedure terminates the procedure at that point, as would an end-of-file.

Command procedures cannot be nested.

4.2. ATTACH

Switches control of your terminal from your current process to another process in your job (for example, one created with the SDA SPAWN command).

Format

`ATTACH [/PARENT] process-name`

Parameter

process-name

Name of the process to which you want to transfer control.

Qualifier

/PARENT

Transfers control of the terminal to the parent process of the current process. When you specify this qualifier, you cannot specify the process-name parameter.

Examples

```
SDA>  ATTACH/PARENT
```

This ATTACH command attaches the terminal to the parent process of the current process.

```
SDA>  ATTACH DUMPER
```

This ATTACH command attaches the terminal to a process named DUMPER in the same job as the current process.

4.3. COLLECT

Collect file identification to file name translation data on both OpenVMS Alpha and OpenVMS for Integrity servers, and process unwind data only on OpenVMS for Integrity servers.

Format

`COLLECT [qualifiers]`

Parameters

None.

Qualifiers

/LOG

Displays information on the progress of the COLLECT command, for example, the name of the process being scanned, or (on Integrity servers) the name of an image whose unwind data is being collected.

/SAVE [= file name]

Writes collection data to a separate file. By default, a file of type .COLLECT with the same name as the dump file will be created in the same directory as the dump file.

/UNDO

Removes all the file or unwind data from an earlier COLLECT command from SDA's memory. COLLECT/UNDO does not affect the file or unwind data already appended to the dump file being analyzed, or already written to a separate collection file.

Description

When a dump is being analyzed, it is useful to have data available that cannot be written to the dump file at the time of the system crash. This data includes the full file specification associated with a file identification. On OpenVMS for Integrity servers, it also includes the unwind data for images activated in processes.

If the dump is being analyzed on the system where it was originally written, this data can be collected for use in the current SDA session using the COLLECT command. If the dump is being copied for analysis elsewhere, the COPY/COLLECT command may be used to collect the data and append it to the copy being written. If the COPY/COLLECT command is used after a COLLECT command, the data already collected is appended to the dump copy.

For all file or unwind data to be collected successfully, all disks that were mounted at the time of the system crash should be remounted and accessible to the process running SDA.

If the COPY and the COLLECT cannot be done as a single step, a COLLECT/SAVE command writes the collection to a separate file that can be used later with the dump file. A later COPY will combine the two files.

Example

```
SDA> COLLECT
%SDA-W-DISKNOACC, no access to _$30$DKB100: for file and/or unwind data
%SDA-W-FILENOACC, no access to _$30$DKB0:(7709,1,0) for unwind data
-SYSTEM-W-NOSUCHFILE, no such file
```

In this example, the disk 30DKB100, which was mounted at the time the system crashed, is not available when file and/or unwind data is being collected. In addition, unwind data cannot be collected for the image with file identification (7709,1,0) on _30DKB0: since it no longer exists.

4.4. COPY

Copies the contents of the dump file to another file.

Format

`COPY [/qualifier...] output-filespec`

Parameter

output-filespec

Name of the device, directory, and file to which SDA copies the dump file. The default file specification is:

SYS$DISK:[default-dir]filename.DMP

SYS$DISK and [default-dir] represent the disk and directory specified in your last DCL command SET DEFAULT. You must specify a file name.

Qualifiers

/COLLECT

/NOCOLLECT

Causes SDA to collect (or not collect) file identification or unwind data from the current system and append it to the copy being created. For more details, see the Description section.

/COMPRESS

Causes SDA to compress dump data as it is writing a copy. If the dump being analyzed is already compressed, then SDA does a direct COPY, and issues an informational message indicating that it is ignoring the /COMPRESS qualifier.

/CONFIRM

Causes SDA to prompt for which processes to copy when performing a Partial Dump Copy. This qualifier can only be used when /PARTIAL=PROCESS=option is specified. For each possible process in the set, SDA prompts as follows, where the default response is No and only a single character response is needed otherwise:

```
Copy process "process-name"? (Y/[N]/A/Q):
```

Where the response:

```
YES   Includes the process in the copy.
NO    Excludes the process from the copy.
ALL   Includes the process and all remaining processes in the copy.
QUIT  Excludes the process and all remaining processes from the copy.
```

/DECOMPRESS

Causes SDA to decompress dump data as it is writing a copy. If the dump being analyzed is already decompressed, then SDA does a direct COPY, and issues an informational message indicating that it is ignoring the /DECOMPRESS qualifier.

/LOG

Displays information about the progress of the COPY command, for example, the name of the process being copied in a selective dump, or, in the case of COPY/COLLECT on Integrity servers, the name of an image whose unwind data is being appended to the dump copy.

/PARTIAL=(section,...)

Causes SDA to copy only the specified sections of the dump. The /PARTIAL qualifier can only be used with a selective system dump (compressed or uncompressed). It is not available for full system dumps or for process dumps. Also, the /PARTIAL qualifier cannot be combined with /COMPRESS, /DECOMPRESS, or /[NO]COLLECT. Such a copy must be performed as two separate COPY commands, and requires exiting from SDA and then re-invoking SDA on the intermediate copy.

See Section 2.2.3 for a description of Partial Dump Copies. For an explanation of key processes and key global pages, and the organization of a selective system dump, see the *VSI OpenVMS System Manager's Manual, Volume 2: Tuning, Monitoring, and Complex Systems*.

Multiple sections must be separated by commas. If only one section is given, the parentheses may be omitted. Possible sections are as follows:

PT	System Page Table Space
S0S1	32-bit System Space

S2	64-bit System Space	
REPLICATED_SYS	Replicated System Space (only applies to Alpha systems with RADs enabled)	
PROCESS=option	Process Space for one or more processes. Options are:	
	ALL	All processes. This is the default.
	KEY	All key processes.
	OTHER	All other (not key) processes.
	NAME=(list)	Specific named processes (see note below)
GLOBAL=option	Global Pages. Options are:	
	ALL	All global pages mapped by processes. This is the default.
	KEY	All global pages mapped by key processes.
	OTHER	All other (not key) global pages mapped by processes.
KEY	Equivalent to: PT, S0S1, S2, REPLICATED_SYS, PROCESS = KEY, GLOBAL = KEY	
OTHER	Equivalent to: PROCESS = OTHER, GLOBAL = OTHER	
SYSTEM	Equivalent to: PT, S0S1, S2, REPLICATED_SYS	

Note

If /PARTIAL=PROCESS=NAME=(list) is specified:

- Multiple process names must be separated by commas. If only one process name is given, the parentheses may be omitted.
- Process names can include "%" and "*" wildcards.
- The comparison of the given name to actual process names in the dump is performed case-blind, and trailing spaces and tabs are ignored.
- Process names can include characters, such as "," and "/". You can enclose the process name in quotes to include some of these special characters in the name you specify, or you can use the "%" wildcard instead of characters.

Description

Each time the system fails, the contents of memory and the hardware context of the current process (as directed by the DUMPSTYLE parameter) are copied into the file SYS$SYSTEM:SYSDUMP.DMP (or the page file), overwriting its contents. If you do not save this crash dump elsewhere, it will be overwritten the next time that the system fails.

The COPY command allows you to preserve a crash dump by copying its contents to another file. It is generally useful to invoke SDA during system initialization to execute the COPY command. This ensures that a copy of the dump file is made only after the system has failed. The preferred method for doing this, using the logical name CLUE$SITE_PROC, is described in Section 2.2.4.

The COPY command does not affect the contents of the file containing the dump being analyzed.

If you are using the page file (SYS$SYSTEM:PAGEFILE.SYS) as the dump file instead of SYSDUMP.DMP, successful completion of the COPY command will automatically cause the blocks of the page file containing the dump to be released, thus making them available for paging. Even if the copy operation succeeds, the release operation requires that your process have change-mode-to-kernel (CMKRNL) privilege. When the dump pages have been released from the page file, the dump information in these pages will be lost and SDA will immediately exit. You must perform subsequent analysis upon the copy of the dump created by the COPY command.

If you press Ctrl/T while using the COPY command, the system displays how much of the file has been copied.

When a dump is being analyzed, it is useful to have data available that cannot be written to the dump file at the time of the system crash. This data includes the full file specification associated with a file identification, and, on OpenVMS Integrity servers, the unwind data for images activated in processes.

If the dump is being analyzed on the system where it was originally written, this data can be collected for use in the current SDA session using the COLLECT command. If the dump is being copied for analysis elsewhere, the COPY/COLLECT command can be used to collect the data and append it to the copy being written. If the COPY/COLLECT command is used after a COLLECT command, the data already collected is appended to the dump copy.

By default, a copy of the original dump, as written at the time of the system crash, includes collection. You can use COPY/NOCOLLECT to override this default. Conversely, a copy of a dump previously copied by SDA without collection (COPY/NOCOLLECT) does not include collection. You can use COPY/COLLECT to override this setting.

When you copy a dump that already contains an appended collection, the copy will always include that collection.

For all file and unwind data to be collected successfully, all disks that were mounted at the time of the system crash should be remounted and be accessible to the process running SDA. If SDA is invoked early in the startup procedure to save the contents of the dump (for example, using CLUE$SITE_PROC as described in Section 2.2.4), but disks are not mounted until a batch job is run, you should use the COPY/NOCOLLECT command in the CLUE$SITE_PROC command procedure. Once all disks are mounted, you can use a COPY/COLLECT command to save file or unwind data.

If the COPY and the COLLECT procedures cannot be done as a single step, you can execute a COLLECT/SAVE command to write the collection to a separate file that can be used later in conjunction with the dump file. A later COPY operation can combine the two files.

Example

```
SDA>  COPY SYS$CRASH:SAVEDUMP
```

The COPY command copies the dump file into the file SYS$CRASH:SAVEDUMP.DMP.

4.5. DEFINE

Assigns a value to a symbol.

Format

`DEFINE [/qualifier...] symbol-name [=] expression`

Parameters

symbol-name

Name, containing from 1 to 31 alphanumeric characters, that identifies the symbol. Symbols that include lowercase letters must be enclosed in quotation marks ("symbol"). See Section 2.6.1.4 for a description of SDA symbol syntax and a list of default symbols.

expression

Definition of the symbol's value. See Section 2.6.1 for a discussion of the components of SDA expressions.

Qualifier

/FD

/PD

Defines a symbol as a function descriptor (FD) or procedure descriptor (PD). It also defines the routine address symbol corresponding to the defined symbol (the routine address symbol has the same name as the defined symbol, only with _C appended to the symbol name). See Section 2.6.1.4 for more information about symbols. /FD and /PD are completely interchangeable. SDA interprets them based on the architecture of the system or dump being analyzed.

Description

The DEFINE command causes SDA to evaluate an expression and then assign its value to a symbol. Both the DEFINE and EVALUATE commands perform computations to evaluate expressions. DEFINE adds symbols to the SDA symbol table but does not display the results of the computation. EVALUATE displays the result of the computation but does not add symbols to the SDA symbol table.

Examples

```
SDA>  DEFINE BEGIN = 80058E00
SDA>  DEFINE END = 80058E60
SDA>  EXAMINE BEGIN:END
```

In this example, DEFINE defines two addresses, called BEGIN and END. These symbols serve as reference points in memory, defining a range of memory locations for the EXAMINE command to inspect.

```
SDA>  DEFINE NEXT = @PC
SDA>  EXAMINE/INSTRUCTION NEXT
NEXT:   HALT
```

The symbol NEXT defines the address contained in the program counter, so that the symbol can be used in an EXAMINE/INSTRUCTION command.

```
SDA>  DEFINE VEC SCH$GL_PCBVEC
SDA>  EXAMINE VEC
SCH$GL_PCBVEC:  00000000.8060F2CC   "Ìò`....."
SDA>
```

After the value of global symbol SCH$GL_PCBVEC has been assigned to the symbol VEC, the symbol VEC is used to examine the memory location or value represented by the global symbol.

```
SDA>  DEFINE/PD VEC SCH$QAST
SDA>  EXAMINE VEC
SCH$QAST:  0000002C.00003008   ".0..,..."
SDA>  EXAMINE VEC_C
SCH$QAST_C:  B75E0008.43C8153E   ">.ÈC..^·"
SDA>
```

In this example, the DEFINE/PD command defines not only the symbol VEC, but also the corresponding routine address symbol (VEC_C).

4.6. DEFINE/KEY

Associates an SDA command with a terminal key. Once you have associated a command with a key, you can just press the defined key, followed by the Return key to issue the command. If you specify the /TERMINATE qualifier when you define the key, you do not have to press the Return key to issue the command.

Format

`DEFINE/KEY [/qualifier...] key-name command`

Parameters

key-name

Name of the key to be defined. You can define the following keys under SDA:

Key Name	Key Designation
PF1	LK201, VT100
PF2	LK201, VT100
PF3	LK201, VT100
PF4	LK201, VT100
KP0...KP9	Keypad 0--9
PERIOD	Keypad period
COMMA	Keypad comma
MINUS	Keypad minus
ENTER	Keypad ENTER
UP	Up arrow
DOWN	Down arrow
LEFT	Left arrow
RIGHT	Right arrow
E1	LK201 Find
E2	LK201 Insert Here
E3	LK201 Remove

Key Name	Key Designation
E4	LK201 Select
E5	LK201 Prev Screen
E6	LK201 Next Screen
HELP	LK201 Help
DO	LK201 Do
F7...F20	LK201 Function keys

command

SDA command to define a key. You must enclose the command in quotation marks (" ").

Qualifiers

/IF_STATE=state_list

/NOIF_STATE

Specifies a list of one or more states, one of which must be in effect for the key definition to work. The /NOIF_STATE qualifier has the same meaning as /IF_STATE=current_state. The state name is an alphanumeric string. States are established with the /SET_STATE qualifier. If you specify only one state name, you can omit the parentheses. By including several state names, you can define a key to have the same function in all the specified states.

/LOCK_STATE

/NOLOCK_STATE

Specifies that the state set by the /SET_STATE qualifier remains in effect until explicitly changed. By default, the /SET_STATE qualifier is in effect only for the next definable key you press or the next read-terminating character that you type. You can specify this qualifier only with the /SET_STATE qualifier.

The default is /NOLOCK_STATE.

/SET_STATE=state-name

/NOSET_STATE

Causes the key being defined to create a key state change instead of or in addition to issuing an SDA command. When you use the /SET_STATE qualifier, you supply the name of a key state to be used with the /IF_STATE qualifier in other key definitions.

For example, you can define the PF1 key as the GOLD key and use the /IF_STATE=GOLD qualifier to allow two definitions for the other keys, one in the GOLD state and one in the non-GOLD state. For more information on using the /IF_STATE qualifier, see the DEFINE/KEY command in the *VSI OpenVMS DCL Dictionary* or online help.

The default is /NOSET_STATE.

/TERMINATE

/NOTERMINATE

Causes the key definition to include termination of the command, which causes SDA to execute the command when the defined key is pressed. Therefore, you do not have to press the Return key after you press the defined key if you specify the /TERMINATE qualifier.

Description

The DEFINE/KEY command causes an SDA command to be associated with the specified key, in accordance with any of the specified qualifiers described previously.

If the symbol or key is already defined, SDA replaces the old definition with the new one. Symbols and keys remain defined until you exit from SDA.

Examples

```
SDA>  DEFINE/KEY PF1 "SHOW STACK"
SDA>  [PF1] SHOW STACK [RETURN]
Process stacks (on CPU 00)
-------------------------
Current operating stack (KERNEL):
    .
    .
    .
```

The DEFINE/KEY command defines PF1 as the SHOW STACK command. When you press the PF1 key, SDA displays the command and waits for you to press the Return key.

```
SDA>  DEFINE/KEY/TERMINATE PF1 "SHOW STACK"
SDA>  [PF1] SHOW STACK
Process stacks (on CPU 00)
-------------------------
Current operating stack (KERNEL):
       00000000.7FF95D00  00000000.0000000B
       00000000.7FF95D08  FFFFFFFF.804395C8  MMG$TBI_DATA_64+000B8
       00000000.7FF95D10  00000000.00000000
       00000000.7FF95D18  0000FE00.00007E04
SP =>  00000000.7FF95D20  00000000.00000800  IRP$M_EXTEND
       00000000.7FF95D28  00000001.000002F7  UCB$B_PI_FKB+0000B
       00000000.7FF95D30  FFFFFFFF.804395C8  MMG$TBI_DATA_64+000B8
       00000000.7FF95D38  00000002.00000000
    .
    .
    .
```

The DEFINE/KEY command defines PF1 as the SDA SHOW STACK command. The /TERMINATE qualifier causes SDA to execute the SHOW STACK command without waiting for you to press the Return key.

```
SDA>  DEFINE/KEY/SET_STATE="GREEN" PF1 ""
SDA>  DEFINE/KEY/TERMINATE/IF_STATE=GREEN PF3 "SHOW STACK"
SDA>  [PF1] [PF3] SHOW STACK
Process stacks (on CPU 00)
-------------------------
Current operating stack (KERNEL):
    .
    .
```

.

The first DEFINE/KEY command defines PF1 as a key that sets a command state GREEN. The trailing pair of quotation marks is required syntax, indicating that no command is to be executed when this key is pressed.

The second DEFINE command defines PF3 as the SHOW STACK command, but using the /IF_STATE qualifier makes the definition valid only when the command state is GREEN. Thus, you must press PF1 before pressing PF3 to issue the SHOW STACK command. The /TERMINATE qualifier causes the command to execute as soon as you press the PF3 key.

4.7. DUMP

Displays the contents of a range of memory formatted as a comma-separated variable (CSV) list, suitable for inclusion in a spreadsheet.

Format

`DUMP range`

`[/BYTE | /WORD | /LONGWORD (default) | /QUADWORD]`

`[/DECIMAL | /HEXADECIMAL (default)]`

`[/FORWARD (default) | /REVERSE]`

`[/RECORD_SIZE=size ] (default = 512)`

`[/INDEX_ARRAY [= {LONGWORD (default) | QUADWORD} ] ]`

`[/INITIAL_POSITION = {ADDRESS=address | RECORD=number } ]`

`[/COUNT = {ALL | records } ] (default = all records)`

`[/PHYSICAL]`

`[/BYTE | /WORD |/NOSUPPRESS]`

Parameter

range

The range of locations to be displayed. The range is specified in one of the following formats:

m:n	Range from address *m* to address *n* inclusive
m;n	Range from address *m* for *n* bytes

The length of the range must be an exact multiple of the data item size --- or of the index array size if /INDEX_ARRAY is specified.

Qualifiers

/BYTE

Outputs each data item as a byte.

/COUNT = [{ALL | records}]

Gives the number of records to be displayed. The default is to display all records.

/DECIMAL

Outputs data as decimal values.

/FORWARD

Causes SDA to display the records in the history buffer in ascending address order. This is the default.

/HEXADECIMAL

Outputs data as hexadecimal values. This is the default.

/INDEX_ARRAY [= {LONGWORD (default) | QUADWORD}]

Indicates to SDA that the range of addresses given is a vector of pointers to the records to be displayed. The vector can be a list of longwords (default) or quadwords. The size of the range must be an exact number of longwords or quadwords as appropriate.

/INITIAL_POSITION = {ADDRESS=address | RECORD=number}

Indicates to SDA which record is to be displayed first. The default is the lowest addressed record if /FORWARD is used, and the highest addressed record if /REVERSE is used. The initial position may be given as a record number within the range, or the address at which the record is located.

/LONGWORD

Outputs each data item as a longword. This is the default.

/NOSUPPRESS

Indicates that SDA should not suppress leading zeroes when displaying data in hexadecimal format.

/PHYSICAL

Indicates to SDA that all addresses (range and/or start position) are physical addresses. By default, virtual addresses are assumed.

/QUADWORD

Outputs each data item as a quadword.

/RECORD_SIZE=*size*

Indicates the size of each record within the history buffer, the default being 512 bytes. This size must exactly divide into the total size of the address range to be displayed, unless you specify /INDEX_ARRAY. If no record size is given, and the length of the range is not more than 512 bytes, a single record is output containing the range specified, with no record number field. The length of the range must be an exact multiple of the data item size --- or of the index array size if /INDEX_ARRAY is specified.

/REVERSE

Causes SDA to display the records in the history buffer in descending address order.

/WORD

Outputs each data item as a word.

Description

The DUMP command displays the contents of a range of memory formatted as a comma-separated variable (CSV) list, suitable for inclusion in a spreadsheet. It is intended for use with a history buffer containing records of information of which the most recently written entry is in the middle of the memory range.

Note

See SET OUTPUT/NOHEADER for related information.

Examples

1.
```
SDA> DUMP dump g;200/initial_position=record=5/record_size=20/reverse
05,A77B0010,A79B0008,6B9C4001,47FF041F,A03E0000,47DF041C,201F0016,083
04,A03E0000,47DF041C,201F0058,083,A77B0010,A79B0008,6B9C4001,47FF041F
03,A03E0000,47DF041C,201F0075,083,A03E0000,47DF041C,201F001B,083
02,A77B0010,A79B0008,6B9C4001,47FF041F,A03E0000,47DF041C,201F0074,083
01,43E05120,083,6BFA8001,47FF041F,A77B0010,A79B0008,6B9C4001,47FF041F
0,201F0104,6BFA8001,47FF041F,47FF041F,201F0001,6BFA8001,47FF041F,47FF041F
0F,A03E0000,47DF041C,201F0065,083,A03E0000,47DF041C,201F0006,083
0E,A03E0000,47DF041C,201F001C,083,A03E0000,47DF041C,201F001A,083
0D,A03E0000,47DF041C,201F0077,083,A03E0000,47DF041C,201F0057,083
0C,A03E0000,47DF041C,201F002B,083,A03E0000,47DF041C,201F003A,083
0B,A03E0000,47DF041C,201F007D,083,A77B0010,A79B0008,6B9C4001,47FF041F
0A,A03E0000,47DF041C,201F005A,083,A03E0000,47DF041C,201F0078,083
09,A03E0000,47DF041C,201F0002,082,A03E0000,47DF041C,201F0037,083
08,A03E0000,47DF041C,201F0035,083,A03E0000,47DF041C,201F007A,083
07,A03E0000,47DF041C,201F0019,083,A03E0000,47DF041C,201F0034,083
06,A77B0010,A79B0008,6B9C4001,47FF041F,A03E0000,47DF041C,201F0018,083
```

This example shows the dump of an area of memory treated as 16 records of 32 bytes each, beginning at record 5, and dumped in reverse order. Note the record number in the first field, and that the dump wraps to the end of the memory area after the first record has been output.

2.
```
SDA> EXAMINE SMP$GL_CPU_DATA;80
00000000 00000000 8FE26000 8FE14000 00000000 00000000 8FE02000 811FE000
   ...
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
   ...
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
   ...
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
   ...
SDA> DUMP SMP$GL_CPU_DATA;80/index_array/record_size=20/count=5
0,810C17C0,8EC7C180,026A09C0,02,0,FFFFFFFF,0,0
01,810C17C0,8EC7C400,026A09C0,02,0,FFFFFFFF,0,01
04,810C17C0,8EC7CB80,026A09C0,02,0,FFFFFFFF,0,04
```

This example shows the contents of the CPU database vector, then dumps the first 32 bytes of each CPU database entry. Only the first five entries in the array are requested, and those containing zero are ignored.

4.8. EVALUATE

Computes and displays the value of the specified expression in both hexadecimal and decimal. Alternative evaluations of the expression are available with the use of the qualifiers defined for this command.

Format

EVALUATE [{/CONDITION_VALUE | /FPSR | /IFS

| /ISR | /PFS | /PS | /PSR

| /PTE

| /[NO]SYMBOLS [=filter] | /TIME}] expression

Parameter

expression

SDA expression to be evaluated. Section 2.6.1 describes the components of SDA expressions.

Qualifiers

/CONDITION_VALUE

Displays the message that the $GETMSG system service obtains for the value of the expression.

/FPSR

(Integrity servers only) Evaluates the specified expression in the format of a floating-point status register.

/IFS

(Integrity servers only) Evaluates the specified expression in the format of an interruption function state.

/ISR

(Integrity servers only) Evaluates the specified expression in the format of an interruption status register.

/PFS

(Integrity servers only) Evaluates the specified expression in the format of a previous function state.

/PS

Evaluates the specified expression in the format of a processor status

/PSR

(Integrity servers only) Evaluates the specified expression in the format of a processor status register.

/PTE

Interprets and displays the expression as a page table entry (PTE). The individual fields of the PTE are separated and an overall description of the PTE's type is provided.

/SYMBOLS[=filter]

/NOSYMBOLS

The default behavior of the EVALUATE command is to display up to five symbols that are known to be equal to the evaluated expression. If /SYMBOLS is specified with no filter, all symbols are listed in alphabetical order. If /NOSYMBOLS is specified, only the hexadecimal and decimal values are displayed. If /SYMBOLS is specified with a filter, only symbols that match the filter are displayed. The filter is a string containing wildcards, such as PCB$*.

/TIME

Interprets and displays the expression as a 64-bit time value. Positive values are interpreted as absolute time; negative values are interpreted as delta time.

Description

If you do not specify a qualifier, the EVALUATE command interprets and displays the expression as hexadecimal and decimal values. In addition, if the expression is equal to the value of a symbol in the SDA symbol table, that symbol is displayed. If no symbol with this value is known, the next lower valued symbol is displayed with an appropriate offset unless the offset is extremely large. (See Section 2.6.1.4 for a description of how SDA displays symbols and offsets.) The DEFINE command adds symbols to the SDA symbol table but does not display the results of the computation. EVALUATE displays the result of the computation but does not add symbols to the SDA symbol table.

Examples

1.
```
SDA>  EVALUATE -1
Hex = FFFFFFFF.FFFFFFFF   Decimal = -1           I
```

   The EVALUATE command evaluates a numeric expression, displays the value of that expression in hexadecimal and decimal notation, and displays a symbol that has been defined to have an equivalent value.

2.
```
SDA>  EVALUATE 1
Hex = 00000000.00000001   Decimal = 1  CHF$M_CALEXT_CANCEL
                                                 CHF$M_FPREGS_VALID
                                                 CHF$V_CALEXT_LAST
                                                 IRP$M_BUFIO
                                                 IRP$M_CLN_READY
                                                    |
                                   (remaining symbols suppressed by default)
```

   The EVALUATE command evaluates a numeric expression and displays the value of that expression in hexadecimal and decimal notation. This example also shows the symbols that have the displayed value. A maximum of five symbols are displayed by default.

3.
```
SDA>  DEFINE TEN = A
SDA>  EVALUATE TEN
Hex = 00000000.0000000A   Decimal = 10  IRP$B_TYPE
```

```
                                                   IRP$S_FMOD
                                                   IRP$V_MBXIO
                                                   TEN
                                                   UCB$B_TYPE
                                                    |
                                  (remaining symbols suppressed by default)
```

This example shows the definition of a symbol named TEN. The EVALUATE command then shows the value of the symbol.

Note that A, the value assigned to the symbol by the DEFINE command, could be a symbol. When SDA evaluates a string that can be either a symbol or a hexadecimal numeral, it first searches its symbol table for a definition of the symbol. If SDA finds no definition for the string, it evaluates the string as a hexadecimal number.

4.
```
SDA>  EVALUATE (((TEN * 6) + (-1/4)) + 6)
Hex = 00000000.00000042      Decimal = 66
```

This example shows how SDA evaluates an expression of several terms, including symbols and rational fractions. SDA evaluates the symbol, substitutes its value in the expression, and then evaluates the expression. The fraction -1/4 is truncated to 0.

5.
```
SDA>  EVALUATE/CONDITION 80000018
%SYSTEM-W-EXQUOTA, exceeded quota
```

This example shows the output of an EVALUATE/CONDITION command.

6.
```
SDA>  EVALUATE/PFS 00000000.000013AF
         PPL    PEC    RRB.PR   RRB.FR   RRB.GR     SOR       SOL
    SOF
         0       0.       0.       0.       0.       0.    39. (32-70)
 47. (32-78)
```

This example shows the output of an EVALUATE/PFS command on an Integrity server system.

7.
```
SDA>  EVALUATE/PS  0B03
         MBZ  SPAL      MBZ     IPL VMM MBZ CURMOD  INT PRVMOD
         0    00   00000000000 0B   0   0   KERN    0   USER
```

In this EVALUATE/PS command on an Alpha system, SDA interprets the entered value 0B03 as though it were a processor status (PS) and displays the resulting field values.

8.
```
SDA> EVALUATE/PSR 00001410.0A026010
        RT  TB  LP  DB  SI  DI  PP  SP  DFH DFL DT  PK  I   IC  MFH MFL
 AC  BE
        1   0   1   0   0   0   0   0   0   0   1   0   1   1   0   1
 0   0
        IA  BN  ED  RI  SS  DD  DA  ID  IT  MC  IS  CPL
        0   1   0   2   0   0   0   0   1   0   0   0
```

This example shows the output of an EVALUATE/PSR command on an Integrity server system.

9.
```
SDA>  EVALUATE/PTE 0BCDFFEE
 3 3 2   2             2 1 1   1 1
 1 0 9   7             0 9 8   6 5                7 6   4 3     0
+-+-+---+-------------+-+-+---+-+---------------+-+---+-+-----+-+
|0|0| 0 |     005E    |0|1| 2 |1|      FF       |1| 3 |0|  7  |0|
+-+-+---+-------------+-+-+---+-+---------------+-+---+-+-----+-+
```

```
|                             00000000                             |
+------------------------------------------------------------------+
Global PTE:  Owner = S, Read Prot = KESU, Write Prot = KESU, CPY = 0
             GPT Index  = 00000000
```

The EVALUATE/PTE command displays the expression 0BCDFFEE as a page table entry (PTE) and labels the fields. It also describes the status of the page. For more information on interpreting information in this output, see Section 2.8.

10.
```
SDA> EVALUATE/TIME 009A9A4C.843DBA9F
10-OCT-1996 15:59:44.02
```

This example shows the use of the EVALUATE/TIME command.

11.
```
SDA>  EVALUATE 2F0/SYMBOL=PCB*
Hex = 00000000.000002F0   Decimal = 752        PCB$L_INITIAL_KTB
                                               PCB$L_PCB
```

This example shows the use of the symbol filter. Only those symbols whose value is 2F0 and whose names begin with PCB are displayed.

4.9. EXAMINE

Displays either the contents of a location or of a range of locations in physical memory, or the contents of a register. Use location parameters to display specific locations or use qualifiers to display the entire process and system regions of memory.

Format

EXAMINE [location [/PHYSICAL] | /ALL | /P0 | /P1 | /SYSTEM]

[/CONDITION_VALUE | /FPSR | /IFS | /ISR | /PFS

| /PS | /PSL | /PSR | /PTE | /TIME | /[NO]FD | /[NO]PD]

[/NOSUPPRESS]

[/INSTRUCTION]

Parameter

location

Location in memory to be examined. A location can be represented by any valid SDA expression. (See Section 2.6.1 for additional information about expressions.) To examine a range of locations, use the following syntax:

m:n	Range of locations to be examined, from *m* to *n*
m;n	Range of locations to be examined, starting at *m* and continuing for *n* bytes

The default location that SDA uses is initially 0 in the program region (P0) of the process that was executing at the time the system failed (if you are examining a crash dump) or your process (if you are examining the running system). Subsequent uses of the EXAMINE command with no parameter specified increase the last address examined by eight. Use of the /INSTRUCTION qualifier increases the default address by four (for Alpha) or 16 (for Integrity server). To examine memory locations of other processes, you must use the SET PROCESS command.

Qualifiers

/ALL

Examines all the locations in the program, and control regions and system space, displaying the contents of memory in hexadecimal longwords and ASCII characters. Do not specify parameters when you use this qualifier.

/CONDITION_VALUE

Examines the specified longword, displaying the message that the $GETMSG system service obtains for the value in the longword.

/FD

/NOFD

See the description of /PD.

/FPSR

(Integrity servers only) Examines the specified expression in the format of a floating-point status register.

/IFS

(Integrity servers only) Examines the specified expression in the format of an interruption function state.

/INSTRUCTION

Translates the specified range of memory locations into assembly instruction format. Each symbol in the EXAMINE expression that is defined as a procedure descriptor is replaced with the code entry point address of that procedure, unless you also specify the /NOPD qualifier. For Integrity servers only, SDA always displays entire bundles of instructions, not individual slots.

/ISR

(Integrity servers only) Examines the specified expression in the format of an interruption status register.

/NOSUPPRESS

Inhibits the suppression of zeros when displaying memory with one of the following qualifiers: /ALL, /P0, /P1, /SYSTEM, or when a range is specified.

/P0

Displays the entire program region for the default process. Do not specify parameters when you use this qualifier.

/P1

Displays the entire control region for the default process. Do not specify parameters when you use this qualifier.

/PD

/NOPD

Functionally equivalent to /FD and /NOFD.

Causes the EXAMINE command to treat the location specified in the EXAMINE command as a function descriptor (FD) or procedure descriptor (PD), depending on the architecture of the system or dump being analyzed. /PD can also be used to qualify symbols.

You can use the /PD and /NOPD qualifiers with the /INSTRUCTION qualifier to override treating symbols as function or procedure descriptors. Placing the qualifier right after a symbol overrides how the symbol is treated. /PD forces it to be a procedure descriptor, and /NOPD forces it to not be a procedure descriptor.

If you place the /PD qualifier right after the /INSTRUCTION qualifier, SDA treats the calculated value as a function or procedure descriptor. /NOPD has the opposite effect.

In the following examples, TEST_ROUTINE is a PD symbol. Its value is 500 and the code address in this procedure descriptor is 1000. The first example displays instructions starting at 520.

```
EXAMINE/INSTRUCTION TEST_ROUTINE/NOPD+20
```

The next example fetches code address from TEST_ROUTINE PD, adds 20 and displays instructions at that address. In other words, it displays code starting at location 1020.

```
EXAMINE/INSTRUCTION TEST_ROUTINE+20
```

The final example treats the address TEST_ROUTINE+20 as a procedure descriptor, so it fetches the code address out of a procedure descriptor at address 520. It then uses that address to display instructions.

```
EXAMINE/INSTRUCTION/PD TEST_ROUTINE/NOPD+20
```

/PFS

(Integrity servers only) Examines the specified expression in the format of a previous function state.

/PHYSICAL

Examines physical addresses. You cannot use the /PHYSICAL qualifier in combination with the /P0, /P1, or /SYSTEM qualifiers.

/PS

/PSL

Examines the specified quadword, displaying its contents in the format of a processor status. This qualifier must precede any parameters used in the command line.

/PSR

(Integrity servers only) Examines the specified expression in the format of a processor status register.

/PTE

Interprets and displays the specified quadword as a page table entry (PTE). The display separates individual fields of the PTE and provides an overall description of the PTE's type.

/SYSTEM

Displays portions of the writable system region. Do not specify parameters when you use this qualifier.

/TIME

Examines the specified quadword, displaying its contents in the format of a system-date-and-time quadword.

Description

The following sections describe how to use the EXAMINE command.

Examining Locations

When you use the EXAMINE command to look at a location, SDA displays the location in symbolic notation (symbolic name plus offset), if possible, and its contents in hexadecimal and ASCII formats:

```
SDA> EXAMINE G6605C0
806605C0:  64646464.64646464  "dddddddd"
```

If the ASCII character that corresponds to the value contained in a byte is not printable, SDA displays a period (.). If the specified location does not exist in memory, SDA displays this message:

```
%SDA-E-NOTINPHYS, address : virtual data not in physical memory
```

To examine a range of locations, you can designate starting and ending locations separated by a colon. For example:

```
SDA> EXAMINE G40:G200
```

Alternatively, you can specify a location and a length, in bytes, separated by a semicolon. For example:

```
SDA> EXAMINE G400;16
```

When used to display the contents of a range of locations, the EXAMINE command displays six or ten columns of information. Ten columns are used if the terminal width is 132 or greater, or if a SET OUTPUT has been entered; six columns are used otherwise. An explanation of the columns is as follows:

- Each of the first four or eight columns represents a longword of memory, the contents of which are displayed in hexadecimal format.
- The fifth or ninth column lists the ASCII value of each byte in each longword displayed in the previous four or eight columns.
- The sixth or tenth column contains the address of the first, or rightmost, longword in each line. This address is also the address of the first, or leftmost, character in the ASCII representation of the longwords. Thus, you read the hexadecimal dump display from right to left, and the ASCII display from left to right.

If a series of virtual addresses does not exist in physical memory, SDA displays a message specifying the range of addresses that were not translated.

If a range of virtual locations contains only zeros, SDA displays this message:

```
Zeros suppressed from 'loc1' to 'loc2'
```

Decoding Locations

You can translate the contents of memory locations into instruction format by using the /INSTRUCTION qualifier. This qualifier causes SDA to display the location in symbolic notation (if possible) and its contents in instruction format. The operands of decoded instructions are also displayed in symbolic notation. The location must be longword aligned (for Alpha) or octaword aligned (for Integrity servers).

Examining Memory Regions

You can display an entire region of virtual memory by using one or more of the qualifiers /ALL, /SYSTEM, /P0, and /P1 with the EXAMINE command.

Other Uses

Other uses of the EXAMINE command appear in the following examples.

Note

When examining individual locations, addresses are usually symbolized, as described previously. If the SET SYMBOLIZE OFF command is issued, addresses are not symbolized. See the SET SYMBOLIZE command for further details.

Examples

1.
```
SDA> EXAMINE/PFS 7FF43C10
        PPL     PEC     RRB.PR   RRB.FR   RRB.GR     SOF        SOL
   SOF
        0       0.       0.       0.       0.       0.     23. (32-54)
 31. (32-62)
```

   This example shows the display produced by the EXAMINE/PFS command. Headings refer to previous privilege level (PPL), previous epilog count (PEC), Register Rename Base (RRB) for Predicate (PR), Floating (FR), and General (GR) Registers, Size of Rotating (SOR) or Local (SOL) portion of the stack frame or Size of the Stack Frame (SOF). For more information, see the *Intel IA-64 Architecture Software Developer's Manual*.

2.
```
SDA> EXAMINE/PS 7FF95E78
        MBZ SPAL      MBZ     IPL VMM MBZ CURMOD INT PRVMOD
        0   00   00000000000 08  0   0   KERN   0   EXEC
```

   This example shows the display produced by the EXAMINE/PS command.

3.
```
SDA> EXAMINE/PSR 7FF43C78
        RT  TB  LP  DB  SI  DI  PP  SP  DFH DFL DT  PK  I   IC  MFH MFL
 AC  BE
        1   0   1   0   0   0   0   0   1   0   1   0   1   1   0   1
 0   0
        IA  BN  ED  RI  SS  DD  DA  ID  IT  MC  IS  CPL
        0   1   0   1   0   0   0   0   1   0   0   0
```

   This example shows the display produced by the EXAMINE/PSR command

4.
```
SDA> EXAMINE/PTE @^QMMG$GQ_L1_BASE
 3 3 2   2             2 1 1   1 1
 1 0 9   7             0 9 8   6 5               7 6   4 3     0
+-+-+---+-------------+-+-+---+-+---------------+-+---+-+-----+-+
```

```
|0|1| 0 |     0000    |0|0| 0 |0|      11       |0| 0 |0|  4  |1|
+-+-+---+-------------+-+-+---+-+---------------+-+---+-+-----+-+
|                            00007090                           |
+---------------------------------------------------------------+
Valid PTE: Owner = K, Read Prot = K---, Write Prot = K---
           Fault on = -E--, ASM = 00, Granularity Hint = 00 (8KB)
           CPY = 00, PFN = 00007090
```

The EXAMINE/PTE command displays and formats the level 1 page table entry at FFFFFEFD.BF6FC000. For more information on interpreting this display, see Section 2.8.

5.
```
SDA> EXAMINE/CONDITION_VALUE R0
%SYSTEM-F-NOPRIV, insufficient privilege or object protection violation
```

This example shows the text associated with the condition code in R0.

6.
```
SDA> EXAMINE/TIME EXE$GQ_SYSTIME
12-DEC-2001 08:23:07.80
```

This example displays the current system as an ASCII absolute time.

4.10. EXIT

Exits from an SDA display or exits from the SDA utility.

Format

EXIT

Parameters

None.

Qualifiers

None.

Description

If SDA is displaying information on a video display terminal---and if that information extends beyond one screen---SDA enters display mode and displays a **screen overflow prompt** at the bottom of the screen:

```
Press RETURN for more.
SDA>
```

If you want to discontinue the current display at this point, enter the EXIT command. If you want SDA to execute another command, enter that command. SDA discontinues the display as if you entered EXIT, and then executes the command you entered.

When the SDA> prompt is not immediately preceded by the screen overflow prompt, entering EXIT causes your process to cease executing the SDA utility. When issued within a command procedure (either the SDA initialization file or a command procedure invoked with the execute (@) command), EXIT causes SDA to terminate execution of the procedure and return to the SDA prompt.

See Section 2.6.2 for a description of SDA display mode.

4.11. FORMAT

Displays a formatted list of the contents of a block of memory.

Format

`FORMAT [/TYPE=block-type] location [/NOSYMBOLIZE][/PAGE][/PHYSICAL] [/POSITIV`

Parameters

location

Location of the beginning of the data block. The location can be given as any valid SDA expression.

Qualifiers

/NOSYMBOLIZE

If /NOSYMBOLIZE is specified, no attempt is made to symbolize the contents of any field in a structure. This is useful if the loaded execlet or activated image lists are corrupted, since symbolization relies on these lists.

/PAGE

If the output of the formatted structure does not fit on one screen, SDA enters display mode. (For information on this topic, see Section 2.6.2.) By default, SDA displays the formatted structure without screen overflow prompts.

/PHYSICAL

Specifies that the location given is a physical address.

/POSITIVE

Symbols that describe negative offsets from the start of the structure are ignored. By default, all symbols for the block type are processed

/TYPE=block-type

Forces SDA to characterize and format a data block at **location** as the specified type of data structure. The /TYPE qualifier thus overrides the default behavior of the FORMAT command in determining the type and/or subtype of a data block, as described in the Description section. The *block-type* can be the symbolic prefix of any data structure defined by the operating system.

Description

The FORMAT command performs the following actions:

- Characterizes a range of locations as a system data
- Assigns, if possible, a symbol to each item of data within the block
- Displays all the data within the block, up to a quadword per line
- Whenever successive quadword fields with no symbolic name containing the same value occur, only the first occurrence is output. Ellipses replace all subsequent occurrences.

Most OpenVMS control blocks include two bytes that indicate the block type and/or subtype at offsets 0A16 and 0B16, respectively. The type and/or subtype associate the block with a set of symbols that have a common prefix. Each symbol's name describes a field within the block, and the value of the symbol represents the offset of the field within the block.

If the type and/or subtype bytes contain a valid block type/subtype combination, SDA retrieves the symbols associated with that type of block (see $DYNDEF) and uses their values to format the block.

For a given block type, all associated symbols have the following form:

```
<block_type>$<field>_<name>
```

where field is one of the following:

```
B  Byte
W  Word
L  Longword
Q  Quadword
O  Octaword
A  Address
C  Constant
G  Global Longword
P  Pointer
R  Structure (variable size)
T  Counted ASCII string (up to 31 characters)
```

If SDA cannot find the symbols associated with the block type specified in the block-type byte or by the /TYPE qualifier, it issues the following message:

```
%SDA-E-NOSYMBOLS, no <block type> symbols found to format this block
```

If you receive this message, you may want to read additional symbols into the SDA symbol table and retry the FORMAT command. Many symbols that define OpenVMS data structures are contained within SDA$READ_DIR:SYSDEF.STB. Thus, you would issue the following command:

```
SDA> READ SDA$READ_DIR:SYSDEF.STB
```

If SDA issues the same message again, try reading additional symbols. Section 2.5 lists additional modules provided by the OpenVMS operating system. Alternatively, you can create your own object modules with the MACRO-32 Compiler for OpenVMS. See the READ command description for instructions on creating such an object module.

Certain OpenVMS data structures do not contain a block type and/or subtype. If bytes contain information other than a block type/subtype---or do not contain a valid block type/subtype--- SDA either formats the block in a totally inappropriate way, based on the contents of offsets 0A16 and 0B16, or displays the following message:

```
%SDA-E-INVBLKTYP, invalid block type in specified block
```

To format such a block, you must reissue the FORMAT command, using the /TYPE qualifier to designate a *block-type*.

The FORMAT command produces a three-column display containing the following information:

- The first column shows the virtual address of each item within the block.
- The second column lists each symbolic name associated with a location within the block.
- The third column shows the contents of each item in hexadecimal format, including symbolization if a suitable symbol exists.

Examples

1.
```
SDA> READ SYSDEF
SDA> format  81475D00
FFFFFFFF.81475D00   UCB$L_FQFL           8104EA58           EXE
$GL_FKWAITFL+00078
                    UCB$L_MB_MSGQFL
                    UCB$L_RQFL
                    UCB$W_MB_SEED
                    UCB$W_UNIT_SEED
FFFFFFFF.81475D04   UCB$L_FQBL           81412038
                    UCB$L_MB_MSGQBL
                    UCB$L_RQBL
FFFFFFFF.81475D08   UCB$W_SIZE                       0380
FFFFFFFF.81475D0A   UCB$B_TYPE                     10
FFFFFFFF.81475D0B   UCB$B_FLCK                   3A
FFFFFFFF.81475D0C   UCB$L_ASTQFL         81223888           SYS$DKDRIVER
+19A88
                    UCB$L_FPC
                    UCB$L_MB_W_AST
                    UCB$T_PARTNER
   .
   .
   .
```

In this example on an OpenVMS Alpha system, the READ command loads the symbols from SDA $READ_DIR:SYSDEF.STB into SDA's symbol table. The FORMAT command displays the data structure that begins at 81475D0016, a unit control block (UCB). If a field has more than one symbolic name, all such names are displayed. Thus, the field that starts at 81475D0C16 has four designations: UCBL_ASTQFL, UCBL_FPC, UCB$L_MB_W_AST, and UCB$T_PARTNER.

The contents of each field appear to the right of the symbolic name of the field. Thus, the contents of UCB$L_FQBL are 8104EA5816

2.
```
SDA> read sysdef
SDA> read/exec
SDA> format 84191D00
FFFFFFFF.84191D00   SPL$L_OWN_CPU                     00000000
FFFFFFFF.84191D04   SPL$L_OWN_CNT             FFFFFFFF
FFFFFFFF.84191D08   SPL$W_SIZE                            0100
FFFFFFFF.84191D0A   SPL$B_TYPE                          4F
FFFFFFFF.84191D0B   SPL$B_SUBTYPE                     01
FFFFFFFF.84191D0C   SPL$L_SPINLOCK            00000000
FFFFFFFF.84191D10   SPL$L_RANK                        00000000
FFFFFFFF.84191D14   SPL$B_IPL                      1F
                    SPL$L_IPL
FFFFFFFF.84191D15                             000000
FFFFFFFF.84191D18   SPL$L_RLS_PC                      00000000
FFFFFFFF.84191D1C   SPL$L_BUSY_WAITS          00000000
FFFFFFFF.84191D20   SPL$L_WAIT_CPUS                   00000000
FFFFFFFF.84191D24   SPL$L_WAIT_PC             00000000
FFFFFFFF.84191D28   SPL$Q_SPINS               00000000.00000000
FFFFFFFF.84191D30   SPL$Q_ACQ_COUNT           00000000.00008E08
FFFFFFFF.84191D38   SPL$L_TIMO_INT                    000186A0    UCB
$M_FLOPPY_MEDIA+006A0
FFFFFFFF.84191D3C   SPL$PS_SHARE_ARRAY        00000000
FFFFFFFF.84191D40   SPL$PS_SHARE_LINK                 00000000
```

```
FFFFFFFF.84191D44   SPL$T_NAME                 ""
FFFFFFFF.84191D45                              000000
FFFFFFFF.84191D48                              00000000.00000000
FFFFFFFF.84191D50   SPL$Q_RELEASE_COUNT        00000000.00008E08
FFFFFFFF.84191D58   SPL$Q_HISTORY_BITMASK      00000000.00000000
FFFFFFFF.84191D60   SPL$Q_ABUSE_THRESHOLD      00000000.00000000
FFFFFFFF.84191D68   SPL$Q_FLAGS                00000000.00000000
FFFFFFFF.84191D70                              00000000.00000000
       ...                                            ...
FFFFFFFF.84191D80   SPL$Q_ABUSE_BITMASK        00000000.00000000
FFFFFFFF.84191D88                              00000000.00000000
       ...                                            ...
FFFFFFFF.84191DB8                                       00000000
FFFFFFFF.84191DBC   SPL$L_VEC_INX              00000010
FFFFFFFF.84191DC0   SPL$L_OWN_PC_VEC                    8016B7A0    ERL
$WAKE_C+00370
FFFFFFFF.84191DC4                              8016BF50             ERL
$WAKE_C+00B20
FFFFFFFF.84191DC8                              8016BF50.8016B7A0
       ...                                            ...
FFFFFFFF.84191DD8                              8016B8C0.8016B7A0
FFFFFFFF.84191DE0                              000231E0.00022C20
FFFFFFFF.84191DE8                              00023BF0.000238D0
FFFFFFFF.84191DF0                              000231E0.00022C20

FFFFFFFF.84191DF8                              00023BF0.000238D0
                    SPL$C_LENGTH
   .
   .
   .
```

In this example on an OpenVMS Integrity server system, the READ command loads the symbols from SYSDEF and the loaded executive images into SDA's symbol table. The FORMAT command displays the data structure that begins at 84191D0016, a spinlock control block (SPL). If a field has more than one symbolic name, all such names are displayed. Thus, the field that starts at 84191D1416 has two designations: SPL$B_IPL and SPL$L_IPL.

The contents of each field appear to the right of the symbolic name of the field. Thus, the contents of SPL$B_IPL is 1F16.

4.12. HELP

Displays information about the SDA utility, its operation, and the format of its commands.

Format

HELP [topic-name]

Parameters

topic-name

Topic for which you need information. A topic can be an SDA command name such as ATTACH or COPY, the name of an SDA extension such as CLUE or FLT, or a keyword such as Extensions or Process_Context.

If you enter HELP with no topic name, a list of all topics is displayed.

Qualifiers

None.

Description

The HELP command displays brief descriptions of SDA commands and concepts on the terminal screen (or sends these descriptions to the file designated in a SET OUTPUT command). You can request additional information by specifying the name of a topic in response to the Topic? prompt.

If you do not specify a parameter in the HELP command, it lists the features of SDA and those commands and topics for which you can request help, as follows:

Examples

1.
```
SDA> HELP
HELP


     The System Dump Analyzer (SDA) allows you to inspect the contents
     of memory as saved in the dump taken at crash time or as exists
     in a running system. You can use SDA interactively or in batch
     mode. You can send the output from SDA to a listing file. You can
     use SDA to perform the following operations:

                     Assign a value to a symbol
                     Examine memory of any process
                     Format instructions and blocks of data
                     Display device data structures
                     Display memory management data structures
                     Display a summary of all processes on the system
                     Display the SDA symbol table
                     Copy the system dump file
                     Read global symbols from any object module
                     Search memory for a given value
                     Send output to a file or device

     For help on performing these functions, use the HELP command and
     specify a topic.

     Format

       HELP  [topic-name]



  Additional information available:

     .
     .
     .


Topic?
```

4.13. MAP

Transforms an address into an offset in a particular image.

Format

`MAP address`

Parameters

address

Address to be identified.

Qualifiers

None.

Description

The MAP command identifies the image name and offset corresponding to an address. With this information, you can examine the image map to locate the source module and program section offset corresponding to an address.

If the address is in system space, MAP searches for the specified address in executive images first. It then checks activated images in process space to search those images installed using the /RESIDENT qualifier of the Install utility. Finally, it checks all image-resident sections in system space. If the address is in process space, MAP searches the activated images for the process.

If the address cannot be found, MAP displays the following message:

```
%SDA-E-NOTINIMAGE, Address not within a system/installed image
```

On Integrity servers, the MAP command can also provide additional data for addresses in system space. If the address is determined to be in a code section of an executive loaded image or a resident shareable image, and if the image file is accessible and was linked using /TRACEBACK, the traceback data is used to obtain and display the module name and routine name information.

Examples

1.
```
SDA> MAP G90308
Image                                Base      End       Image Offset
SYS$VM
Nonpaged read only                   80090000  800ABA00  00000308
```

   Examining the image map identified by this MAP command (SYS$VM.MAP) shows that image offset 308 falls within psect EXEC$HI_USE_PAGEABLE_CODE because the psect goes from offset 0 to offset 45D3:

   .
   .
   .

```
EXEC$HI_USE_PAGEABLE_CODE       00000000 000045D3 000045D4 ( 17876.) 2
 **  5...
                 SYSCREDEL      00000000 0000149B 0000149C (  5276.) 2
 **  5
                 SYSCRMPSC      000014A0 000045D3 00003134 ( 12596.) 2
 **  5

EXEC$NONPAGED_CODE              000045E0 0001B8B3 000172D4 ( 94932.) 2
 **  5...
                 EXECUTE_FAULT  000045E0 0000483B 0000025C (   604.) 2
 **  5
                 IOLOCK         00004840 000052E7 00000AA8 (  2728.) 2
 **  5
                 LOCK_SYSTEM_PAGES
    .
    .
    .
```

Specifically, image offset 308 is located within source module SYSCREDEL. Therefore, to locate the corresponding code, you would look in SYSCREDEL for offset 308 in psect EXEC $HI_USE_PAGEABLE_CODE.

2.
```
SDA> MAP G550000
Image                             Base         End       Image Offset
SYS$DKDRIVER                      80548000     80558000  00008000
```

In this example, the MAP command identifies the address as an offset into an executive image that is not sliced. The base and end addresses are the boundaries of the image.

3.
```
SDA> MAP G550034
Image                             Base         End       Image Offset
SYS$DUDRIVER
      Nonpaged read/write         80550000     80551400  00008034
```

In this example, the MAP command identifies the address as an offset into an executive image that is sliced. The base and end addresses are the boundaries of the image section that contains the address of interest.

4.
```
SDA> MAP GF0040
Image Resident Section            Base         End       Image Offset
MAILSHR                           800F0000     80119000  00000040
```

The MAP command identifies the address as an offset into an image-resident section residing in system space.

5.
```
SDA> MAP 12000
Activated Image                   Base         End       Image Offset
MAIL                              00010000     000809FF  00002000
```

The MAP command identifies the address as an offset into an activated image residing in process-private space.

6.
```
SDA> MAP B2340
Compressed Data Section           Base         End       Image Offset
LIBRTL                            000B2000     000B6400  00080340
```

The MAP command identifies the address as being within a compressed data section. When an image is installed with the Install utility using the /RESIDENT qualifier, the code sections are mapped in system space. The data sections are compressed into process-private space to reduce null pages or holes in the address space left by the absence of the code section. The SHOW PROCESS/ IMAGE=ALL display shows how the data has been compressed; the MAP command searches this information to map an address in a compressed data section to an offset in an image.

7.
```
SDA> MAP 7FC06000
Shareable Address Data Section          Base      End       Image Offset
LIBRTL                                  7FC06000  7FC16800  00090000
```

The MAP command identifies the address as an offset into a shareable address data section residing in P1 space.

8.
```
SDA> MAP 7FC26000
Read-Write Data Section                 Base      End       Image Offset
LIBRTL                                  7FC26000  7FC27000  000B0000
```

The MAP command identifies the address as an offset into a read-write data section residing in P1 space.

9.
```
SDA> MAP 7FC36000
Shareable Read-Only Data Section        Base      End       Image Offset
LIBRTL                                  7FC36000  7FC3F600  000C0000
```

The MAP command identifies the address as an offset into a shareable read-only data section residing in P1 space.

10.
```
SDA> MAP 7FC56000
Demand Zero Data Section                Base      End       Image Offset
LIBRTL                                  7FC56000  7FC57000  000E0000
```

The MAP command identifies the address as an offset into a demand zero data section residing in P1 space.

11.
```
SDA> MAP FFFFFFFF.8042FE00
Image                                Base                End
 Image Offset
EXCEPTION_MON
    Code                       FFFFFFFF.8041FE00 FFFFFFFF.804E3DFF
 00000000.00028000

    Module:     IPF_DECODE + 00005380
    Routine:    process_i_unit + 00000840
```

This example shows the additional module and routine offset information that is displayed for system space code sections.

4.14. MODIFY DUMP

Allows a given byte, word, longword, or quadword in the dump file to be modified.

Format

MODIFY DUMP value {/BLOCK=n/OFFSET=n | /NEXT}

{/BYTE | /WORD | /LONGWORD (d) | /QUADWORD}

`[/CONFIRM=n]`

Parameters

value

New value deposited in the specified location in the dump file.

Qualifiers

/BLOCK=n

Indicates block number to be modified. Required unless the /NEXT qualifier is given.

/OFFSET=n

Indicates byte offset within block to be modified. Required unless the /NEXT qualifier is given.

/NEXT

Indicates that the byte or bytes immediately following the location altered by the previous MODIFY DUMP command are to be modified. Used instead of the /BLOCK=*n* and /OFFSET=*n* qualifiers.

/BYTE

Indicates that only a single byte is to be replaced

/WORD

Indicates that a word is to be replaced.

/LONGWORD

Indicates that a longword is to be replaced. This is the default.

/QUADWORD

Indicates that a quadword is to be replaced.

/CONFIRM=n

Checks existing contents of location to be modified.

Description

The MODIFY DUMP command is used on a dump file that cannot be analyzed without specifying the /OVERRIDE qualifier on the ANALYZE/CRASH_DUMP command. You can use the MODIFY DUMP command to correct the problem that prevents normal analysis of a dump file. You can only use the MODIFY DUMP command when you have invoked SDA with the ANALYZE/CRASH_DUMP/OVERRIDE command.

Important

This command is not intended for general use. It is provided for the benefit of VSI support personnel when investigating crash dumps that cannot be analyzed in other ways.

If the block being modified is part of either the dump header, the error log buffers, or the compression map, the changes made are not seen when you issue the appropriate SHOW DUMP command, unless you first exit from SDA and then reissue the ANALYZE/CRASH_DUMP command.

The MODIFY DUMP command sets a bit in the dump header to indicate that the dump has been modified. Subsequent ANALYZE/CRASH_DUMP commands issued to that file produce the following warning message:

```
%SDA-W-DUMPMOD, dump has been modified
```

Examples

1. ```
   SDA>> MODIFY DUMP/BLOCK=10/OFFSET=100/WORD FF
   ```

   This example shows the dump file modified with the word at offset 100 in block 00000010 replaced by 00FF.

2. ```
   SDA>> MODIFY DUMP/BLOCK=10/OFFSET=100/WORD 0/CONFIRM=EE
   %SDA-E-NOMATCH, expected value does not match value in dump; dump not
    updated
   ```

   This example shows what happens when the actual word value of 00FF at offset 100 in block 00000010 does not match the given value of 00EE.

3. ```
   SDA>> MODIFY DUMP/BLOCK=10/OFFSET=100/WORD 0/CONFIRM=FF
   ```

   This example shows the dump file modified with a word value of 00FF at offset 100 in block 00000010 replaced by 0000

4.15. READ

Loads the global symbols contained in the specified file into the SDA symbol table.

Format

READ {/EXECUTIVE [directory spec]

| /FORCE filespec [/RELOCATE =expression | /SYMVA=expression]

| /IMAGE filespec

| filespec}

[/[NO]LOG]

Parameters

directory-spec

Name of the directory containing the loadable images of the executive. This parameter defaults to SDA$READ_DIR, which is a search list of SYS$LOADABLE_IMAGES, SYS$LIBRARY, and SYS$SYSTEM.
   ```

filespec

Name of the device, directory, and file from which you want to read global symbols. The **filespec** defaults to SYS$DISK:[default-dir]filename.type, where SYS$DISK and [default-dir] represent the disk and directory specified in your last DCL command SET DEFAULT. If no type has been given in **filespec**, SDA first tries .STB and then .EXE.

If no device or directory is given in the file specification, and the file specification is not found in SYS$DISK:[default_dir], then SDA attempts to open the file SDA$READ_DIR:filename.type. If no type has been given in **filespec**, SDA first tries .STB and then .EXE.

If the file name is the same as that of an execlet or image, but the symbols in the file are not those of the execlet or image, then you must use the /FORCE qualifier, and optionally /RELOCATE and /SYMVA qualifiers, to tell SDA how to interpret the symbols in the file.

The READ command accepts quoted filenames for access to images on ODS-5 disks with lowercase or compound characters in their names.

Qualifiers

/EXECUTIVE directory-spec

Reads into the SDA symbol table all global symbols and global entry points defined within all loadable images that make up the executive. For all the execlets in the system, SDA reads the .STB or .EXE files in the requested directory.

/FORCE filespec

Forces SDA to read the symbols file, regardless of what other information or qualifiers are specified. If you do not specify the /FORCE qualifier, SDA may not read the symbols file if the specified **filespec** matches the image name in either the executive loaded images or the current processes activated image list, and one of the following conditions is true:

- The image has a symbols vector (is a shareable image), and a symbols vector was not specified with the /SYMVA or /IMAGE qualifier.
- The image is sliced, and slicing information was not provided with the /IMAGE qualifier.
- The shareable or executive image is not loaded at the same address it was linked at, and the relocation information was not provided with either the /IMAGE or /RELOCATE qualifier.

The use of /FORCE [/SYMVA=*addr*][/RELOCATE=*addr*] **filespec** is a variant of the /IMAGE qualifier and avoids fixing up the symbols to match an image of the same name.

/IMAGE filespec

Searches the executive loaded image list and the current process activated image list for the image specified by filespec. If the image is found, the symbols are read in using the image symbol vector (if there is one) and either slicing or relocation information.

This is the preferred way to read in the .STB files produced by the linker. These .STB files contain all universal symbols, unless SYMBOL_TABLE=GLOBAL is in the linker options file, in which case the .STB file contains all universal and global symbols.

/LOG

/NOLOG (D)

The /LOG qualifier causes SDA to output the %SDA-I-READSYM message for each symbol table file it reads. By default, these messages are suppressed. You can specify /LOG and /NOLOG with any other combination of parameters and qualifiers.

/RELOCATE=*expression*

Changes the relative addresses of the symbols to absolute addresses by adding the value of **expression** to the value of each symbol in the symbol table file to be read. This qualifier changes those addresses to absolute addresses in the address space into which the dump is mapped.

The relocation only applies to symbols with the relocate flag set. All universal symbols must be found in the symbol vector for the image. All constants are read in without any relocation.

If the image is sliced (image sections are placed in memory at different relative offsets than how the image is linked), then the /RELOCATE qualifier does not work. SDA compares the file name used as a parameter to the READ command against all the image names in the executive loaded image list and the current processes activated image list. If a match is found, and that image contains a symbol vector, an error results. At this point you can either use the /FORCE qualifier or the /IMAGE qualifier to override the error.

/SYMVA=*expression*

Informs SDA whether the absolute symbol vector address is for a shareable image (SYS $PUBLIC_VECTORS.EXE) or base system image (SYS$BASE_IMAGE.EXE). All symbols found in the file with the universal flag are found by referencing the symbol vector (that is, the symbol value is a symbol vector offset).

Description

The READ command symbolically identifies locations in memory and the definitions used by SDA for which the default files (SDA$READ_DIR:SYS$BASE_IMAGE.EXE and SDA $READ_DIR:REQSYSDEF.STB) provide no definition. In other words, the required global symbols are located in modules and symbol tables that have been compiled and/or linked separately from the executive. SDA extracts no local symbols from the files.

The file specified in the READ command can be the output of a compiler or assembler (for example, an .OBJ file).

Note

The READ command can read both OpenVMS Alpha and OpenVMS Integrity servers format files. Do not use READ to read files that contain symbols specific to another architecture, as this might change the behavior of other SDA commands for the current architecture.

Most often the file is provided in SYS$LOADABLE_IMAGES. Many SDA applications, for instance, need to load the definitions of system data structures by issuing a READ command specifying SYSDEF.STB. Others require the definitions of specific global entry points within the executive image.

The files in SYS$LOADABLE_IMAGES define global locations within executive images, including those listed in the table below. The actual list of executive images used varies, depending on platform type, devices, and the settings of several system parameters.

Table 4.1. Modules Defining Global Locations Within Executive Images

File	Contents
ACME.EXE	$ACM system service
CNX$DEBUG.EXE	Connection Manager trace routines
DDIF$RMS_EXTENSION.EXE	Support for Digital Document Interchange Format (DDIF) file operations
ERRORLOG.STB	Error-logging routines and system services
EXCEPTION.STB	Bugcheck and exception-handling routines and those system services that declare condition and exit handlers. Variations of these files also exist, for example, where the file name ends in "_MON." System parameters such as SYSTEM_CHECK determine which image is loaded.
EXEC_INIT.STB	Initialization code
F11BXQP.STB	File system support
FC$GLOGALS.STB	Fibrechannel symbols
IMAGE_MANAGEMENT.STB	Image activator and the related system services
IO_ROUTINES.STB	$QIO system service, related system services (for example, $CANCEL and $ASSIGN), and supporting routines. Variations of these files also exist, for example, where the file name ends in "_MON." System parameters such as SYSTEM_CHECK determine which image is loaded.
LAT$RATING.EXE	CPU load-balancing routines for LAT
LCK$DEBUG.EXE	Lock manager trace routines
LMF$GROUP_TABLE.EXE	Data structures for licensed product groups. Alpha only.
LOCKING.STB	Lock management routines and system services
LOGICAL_NAMES.STB	Logical name routines and system services
MESSAGE_ROUTINES.STB	System message routines and system services (including $SNDJBC and $GETTIM)
MSCP.EXE	Disk MSCP server
MULTIPATH.STB	Fibrechannel multipath support routinesю Variations of these files also exist, for example, where the file name ends in "_MON." System parameters such as SYSTEM_CHECK determine which image is loaded.
NET$CSMACD.EXE	CSMA/CD LAN management module
NET$FDDI.EXE	FDDI LAN management module
NT_EXTENSION.EXE	NT extensions for persona system services
PROCESS_MANAGEMENT.STB	Scheduler, report system event, and supporting routines and system services. Variations of these files also exist, for example, where the file name

File	Contents
	ends in "_MON." System parameters such as SYSTEM_CHECK determine which image is loaded.
RECOVERY_UNIT_SERVICES.STB	Recovery unit system services
RMS.EXE	Global symbols and entry points for RMS
SECURITY.STB	Security management routines and system services. Variations of these files also exist, for example, where the file name ends in "_MON." System parameters such as SYSTEM_CHECK determine which image is loaded.
SHELL *xx*K.STB	Process shell
SPL$DEBUG.EXE	Spinlock trace routines
SSPI.EXE	Security Support Provider Interface
SYS$ *xx*DRIVER.EXE	Run-time device drivers
SYS$ACPI.EXE	Advanced Configuration and Power Interface routines. Integrity servers only.
SYS$ATMWORKS351.EXE	PCI-ATM driver
SYS$CLUSTER.EXE	OpenVMS Cluster support routines
SYS$CPU_ROUTINES_ *xxxx*.EXE	Processor-specific data and initialization routines. Alpha only.
SYS$EW1000A.EXE	Gigabit Ethernet driver
SYS$EW5700.EXE	Gigabit Ethernet driver. Integrity servers only.
SYS$GALAXY.STB	OpenVMS Galaxy support routines
SYS$HWP *nnnn*.EXE	PCI support routines. Integrity servers only.
SYS$IPC_SERVICES.EXE	Interprocess communication for DECdtm and Batch/Print
SYS$IPI *nnnn*.EXE	PCI support routines. Integrity servers only.
SYS$LAN.EXE	Common LAN routines
SYS$LAN_ATM.EXE	LAN routines for ATM
SYS$LAN_ATM4.EXE	LAN routines for ATM (ForeThought)
SYS$LAN_CSMACD.EXE	LAN routines for CSMA/CD
SYS$LAN_FDDI.EXE	LAN routines for FDDI
SYS$LAN_TR.EXE	LAN routines for Token Ring
SYS$MME_SERVICES.STB	Media Management Extensions
SYS$NETWORK_SERVICES.EXE	DECnet support
SYS$NTA.STB	NT affinity routines and services
SYS$ *xxxx*_SUPPORT.EXE	Processor-specific data and initialization routines. Integrity servers only.
SYS$PUBLIC_VECTORS.EXE	System service vector base image. This file is located in SYS$LIBRARY.
SYS$SCS.EXE	System Communication Services

File	Contents
SYS$TRANSACTION_SERVICES.EXE	DECdtm services
SYS$UTC_SERVICES.EXE	Universal Coordinated Time services
SYS$VCC.STB	Virtual I/O cache. Variations of these files also exist, for example, where the file name ends in "_MON." System parameters such as SYSTEM_CHECK determine which image is loaded. Alpha only.
SYS$VM.STB	System pager and swapper, along with their supporting routines, and management system services
SYS$XFCACHE.STB	Extented File Cache. Variations of these files also exist, for example, where the file name ends in "_MON." System parameters such as SYSTEM_CHECK determine which image is loaded.
SYSDEVICE.STB	Mailbox driver and null driver
SYSGETSYI.STB	Get System Information system service ($GETSYI)
SYSLDR_DYN.STB	Dynamic executive image loader
SYSLICENSE.STB	Licensing system service ($LICENSE)
SYSTEM_DEBUG.EXE	XDelta and SCD routines
SYSTEM_PRIMITIVES.STB	Miscellaneous basic system routines, including those that allocate system memory, maintain system time, create fork processes, and control mutex acquisition. Variations of these files also exist, for example, where the file name ends in "_MON." System parameters such as SYSTEM_CHECK determine which image is loaded.
SYSTEM_SYNCHRONIZATION.STB	Routines that enforce synchronization. Variations of these files also exist, for example, where the file name ends in "_MON." System parameters such as SYSTEM_CHECK determine which image is loaded.
TCPIP$BGDRIVER.STB	TCP/IP internet driver. Available only if TCP/IP has been installed.
TCPIP$INETACP.STB	TCP/IP internet ACP Available only if TCP/IP has been installed.
TCPIP$INETDRIVER.STB	TCP/IP internet driver. Available only if TCP/IP has been installed.
TCPIP$INTERNET_SERVICES.STB	TCP/IP internet execlet
TCPIP$NFS_SERVICES.STB	Symbols for the TCP/IP NFS server. Available only if TCP/IP has been installed.
TCPIP$PROXY_SERVICES.STB	Symbols for the TCP/IP proxy execlet. Available only if TCP/IP has been installed.

File	Contents
TCPIP$PWIPACP.STB	TCP/IP PWIP ACP. Available only if TCP/IP has been installed.
TCPIP$PWIPDRIVER.STB	TCP/IP PWIP driver. Available only if TCP/IP has been installed.
TCPIP$TNDRIVER.STB	TCP/IP TELNET/RLOGIN server driver. Available only if TCP/IP has been installed.
TMSCP.EXE	Tape MSCP server
VMS_EXTENSION.EXE	VMS extensions for persona system services

SDA can also read symbols from an image .EXE or .STB produced by the linker. The STB and EXE files only contain universal symbols. The STB file, however, can be forced to have global symbols for the image if you use the SYMBOL_TABLE=GLOBAL option in the linker options file.

A number of ready-built symbol table files ship with OpenVMS. They can be found in the directory SYS$LOADABLE_IMAGES, and all have names of the form xyzDEF.STB. Of these files, SDA automatically reads REQSYSDEF.STB on activation. You can add the symbols in the other files to SDA's symbol table using the READ command. Table 2.5 lists the files that OpenVMS provides in SYS $LOADABLE_IMAGES that define data structure offsets.

The following MACRO program, GLOBALS.MAR, shows how to obtain symbols in addition to those in SYS$BASE_IMAGE.EXE, other executive images listed in Table 4.1, and the symbol table files that are listed in Table 2.5:

```
.TITLE GLOBALS
; n.b. on following lines GLOBAL must be capitalized
$PHDDEF GLOBAL          ; Process header definitions
$DDBDEF GLOBAL          ; Device data block
$UCBDEF GLOBAL          ; Unit control block
$VCBDEF GLOBAL          ; Volume control block
$ACBDEF GLOBAL          ; AST control block
$IRPDEF GLOBAL          ; I/O request packet
; more can be inserted here
.END
```

Use the following command to generate an object module file containing the globals defined in the program:

```
$MACRO GLOBALS+SYS$LIBRARY:LIB/LIBRARY /OBJECT=GLOBALS.STB
```

Examples

1. ```
   SDA>  READ SDA$READ_DIR:SYSDEF.STB/LOG
   %SDA-I-READSYM, 10010 symbols read from SYS$COMMON:[SYSEXE]SYSDEF.STB;1
   ```

   The READ command causes SDA to add all the global symbols in SDA$READ_DIR:SYSDEF.STB to the SDA symbol table. Such symbols are useful when you are formatting an I/O data structure, such as a unit control block or an I/O request packet.

2. ```
   SDA> SHOW STACK
   Process stacks (on CPU 00)
   --------------------------
   Current operating stack (KERNEL):
   ```

```
        00000000.7FF95CD0  FFFFFFFF.80430CE0  SCH$STATE_TO_COM+00040
        00000000.7FF95CD8  00000000.00000000
        00000000.7FF95CE0  FFFFFFFF.81E9CB04  LNM$SEARCH_ONE_C+000E4
        00000000.7FF95CE8  FFFFFFFF.8007A988  PROCESS_MANAGEMENT_NPRO
+0E988
   SP =>00000000.7FF95CF0  00000000.00000000
        00000000.7FF95CF8  00000000.006080C1
        00000000.7FF95D00  FFFFFFFF.80501FDC
        00000000.7FF95D08  FFFFFFFF.81A5B720
   .
   .
   .

SDA>  READ/IMAGE SYS$LOADABLE_IMAGES:PROCESS_MANAGEMENT/LOG
%SDA-I-READSYM, 767 symbols read from SYS$COMMON:[SYS
$LDR]PROCESS_MANAGEMENT.STB;1
SDA>  SHOW STACK
Process stacks (on CPU 00)
--------------------------
Current operating stack (KERNEL):

        00000000.7FF95CD0  FFFFFFFF.80430CE0  SCH$FIND_NEXT_PROC
        00000000.7FF95CD8  00000000.00000000
        00000000.7FF95CE0  FFFFFFFF.81E9CB04  LNM$SEARCH_ONE_C+000E4
        00000000.7FF95CE8  FFFFFFFF.8007A988  SCH$INTERRUPT+00068
   SP =>00000000.7FF95CF0  00000000.00000000
        00000000.7FF95CF8  00000000.006080C1
        00000000.7FF95D00  FFFFFFFF.80501FDC
        00000000.7FF95D08  FFFFFFFF.81A5B720
   .
   .
   .
```

The initial SHOW STACK command contains an address that SDA resolves into an offset from the PROCESS_MANAGEMENT executive image. The READ command loads the corresponding symbols into the SDA symbol table such that the reissue of the SHOW STACK command subsequently identifies the same location as an offset within a specific process management routine.

4.16. REPEAT

Repeats execution of the last command issued. On terminal devices, the KP0 key performs the same function as the REPEAT command with no parameter or qualifier.

Format

REPEAT [count | /UNTIL=condition]

Parameter

count

Number of times the previous command is to be repeated. The default is a single repeat.

Qualifier

/UNTIL=condition

Defines a condition that terminates the REPEAT command. By default, there is no terminating condition.

Description

The REPEAT command is useful for stepping through a linked list of data structures, or for examining a sequence of memory locations. When used with ANALYZE/SYSTEM, it allows the changing state of a system location or data structure to be monitored.

You can also use the REPEAT command to provide a convenient method of either displaying a series of data structures in a linked list or examining a sequence of locations. For example:

```
FORMAT @IOC$GL_DEVLIST   ! Start at first DDB in system
FORMAT @.                ! Skip to next entry in list
<KP0>                    ! Repeat FORMAT @. command
.
.
.
```

Examples

1.
```
SDA> SPAWN CREATE SDATEMP.COM
SEARCH  0:3FFFFFFF   12345678
SET PROCESS/NEXT
^Z
SDA>  SET PROCESS NULL
SDA>  @SDATEMP
SDA>  REPEAT/UNTIL = BADPROC
```

   This example demonstrates how to search the address space of each process in a system or dump a given pattern.

2.
```
SDA> SPAWN CREATE SDATEMP2.COM
FORMAT CPUDB
SET CPU /NEXT
^Z
SDA>  READ SYSDEF
SDA>  SET CPU /FIRST
SDA>  @SDATEMP2
SDA>  REPEAT/UNTIL = BADCPU
```

   This example demonstrates how to format the CPU database for every CPU in a dump.

3.
```
SDA> SHOW CALL_FRAME
Call Frame Information
----------------------
        Stack Frame Procedure Descriptor
Flags:  Base Register = FP, Jacket, Native
        Procedure Entry: FFFFFFFF.80080CE0            MMG$RETRANGE_C
+00180
        Return address on stack = FFFFFFFF.8004CF30  EXCEPTION_NPRO
+00F30
```

```
Registers saved on stack
------------------------
7FF95E80 FFFFFFFF.FFFFFFFD  Saved R2
7FF95E88 FFFFFFFF.8042DBC0  Saved R3      EXCEPTION_NPRW+03DC0
7FF95E90 FFFFFFFF.80537240  Saved R4
7FF95E98 00000000.00000000  Saved R5
7FF95EA0 FFFFFFFF.80030960  Saved R6      MMG$IMGRESET_C+00200
7FF95EA8 00000000.7FF95EC0  Saved R7
7FF95EB0 FFFFFFFF.80420E68  Saved R13     MMG$ULKGBLWSL E
7FF95EB8 00000000.7FF95F70  Saved R29
.
.
.
SDA> SHOW CALL_FRAME/NEXT_FRAME

Call Frame Information
----------------------
        Stack Frame Procedure Descriptor
Flags:  Base Register = FP, Jacket, Native
        Procedure Entry: FFFFFFFF.80F018D0
 IMAGE_MANAGEMENT_PRO+078D0
        Return address on stack = FFFFFFFF.8004CF30     EXCEPTION_NPRO
+00F30

Registers saved on stack
------------------------
7FF95F90 FFFFFFFF.FFFFFFFB  Saved R2
7FF95F98 FFFFFFFF.8042DBC0  Saved R3      EXCEPTION_ NPRW+03DC0
7FF95FA0 00000000.00000000  Saved R5
7FF95FA8 00000000.7FF95FC0  Saved R7
7FF95FB0 FFFFFFFF.80EF8D20  Saved R13     ERL$DEVINF O+00C20
7FF95FB8 00000000.7FFA0450  Saved R29
.
.
.
SDA> REPEAT
Call Frame Information
----------------------
        Stack Frame Procedure Descriptor
Flags:  Base Register = FP, Jacket, Native
        Procedure Entry: FFFFFFFF.80F016A0
 IMAGE_MANAGEMENT_PRO+076A0
        Return address on stack = 00000000.7FF2451C

Registers saved on stack
------------------------
7FFA0470 00000000.7FEEA890  Saved R13
7FFA0478 00000000.7FFA0480  Saved R29
.
.
.
```

The first SHOW CALL_FRAME displays the call frame indicated by the current FP value. Because the /NEXT_FRAME qualifier to the instruction displays the call frame indicated by the saved frame in the current call frame, you can use the REPEAT command to repeat the SHOW CALL_FRAME/NEXT_FRAME command and follow a chain of call frames.

4.17. SEARCH

Scans a range of memory locations for all occurrences of a specified value or string.

Format

`SEARCH [/qualifier] range [=] {expression | string}`

Parameters

range

Location in memory to be searched. A location can be represented by any valid SDA expression. To search a range of locations, use the following syntax:

m:n	Range of locations to be searched, from *m* to *n*
m;n	Range of locations to be searched, starting at *m* and continuing for *n* bytes

You must use either an equals sign or a blank to separate **range** from **expression** or **string**.

expression

Value for which SDA is to search. SDA evaluates the expression and searches the specified range of memory for the resulting value. For a description of SDA expressions, see Section 2.6.1.

string

Character sequence for which SDA is to search. If all characters in the sequence are printable characters, the string is enclosed in quotes, for example, "My_String". If the character sequence contains non-printable characters, it must be specified as a comma-separated list composed of quoted strings and hexadecimal numbers; for example,("My_String",0C00,"More") would specify a search for"My_String<NUL><FF>More". Each hexadecimal number can be no more than 8 digits (4 bytes) in length. Non-printable sequences of more than 4 bytes must be split into multiple hexadecimal numbers. The maximum length of a search string is 127 bytes. Note that the quote character itself cannot be included in a quoted string and must be specified as a hexadecimal number.

Qualifiers

/IGNORE_CASE

Specifies that searches for strings are not to be case-specific. (By default, searches look for an exact match.) This qualifier is ignored for value searches.

/LENGTH={*QUADWORD* | *LONGWORD* | *WORD* | *BYTE*}

Specifies the size of the expression value that the SEARCH command uses for matching. If you do not specify the /LENGTH qualifier, the SEARCH command uses a longword length by default. This qualifier is ignored for string searches.

/MASK=*n*

Allows the SEARCH command finer granularity in its matches. It compares only the given bits of a byte, word, longword, or quadword. To compare bits when matching, you set the bits in the mask;

to ignore bits when matching, you clear the bits in the mask. This qualifier is ignored for string searches.

/PHYSICAL

Specifies that the addresses used to define the range of locations to be searched are physical addresses.

/STEPS = {QUADWORD | LONGWORD | WORD | BYTE | value}

Specifies the step factor of the search through the specified memory **range**. After the SEARCH command has performed the comparison between the value of **expression** or the given **string** and memory location, it adds the specified step factor to the address of the memory location. The resulting location is the next location to undergo the comparison. If you do not specify the /STEPS qualifier, the SEARCH command uses a step factor of a longword for value searches, and a step factor of a byte for string searches.

Description

SEARCH displays each location as each value or string is found. If you press Ctrl/T while using the SEARCH command, the system displays how far the search has progressed. The progress display is always output to the terminal even if a SET OUTPUT <file> command has previously been entered.

Examples

1.
```
SDA> SEARCH GB81F0;500 B41B0000
Searching from FFFFFFFF.800B81F0 to FFFFFFFF.800B86EF in LONGWORD steps
 for B41B0000...
Match at FFFFFFFF.800B86E4    B41B0000
```

This SEARCH command finds the value B41B0000 in the longword at FFFFFFFF.800B86E4.

2.
```
SDA> SEARCH 80000000;200/STEPS=BYTE 82
Searching from FFFFFFFF.80000000 to FFFFFFFF.800001FF in BYTE steps for
 00000082...
Match at FFFFFFFF.8000012C    00000082
```

This SEARCH command finds the value 00000082 in the longword at FFFFFFFF.8000012C.

3.
```
SDA> SEARCH/LENGTH=WORD 80000000;100 10
Match at FFFFFFFF.80000030    0010
Match at FFFFFFFF.80000040    0010
Match at FFFFFFFF.80000090    0010
Match at FFFFFFFF.800000A0    0010
Match at FFFFFFFF.800000C0    0010
5 matches found
```

This SEARCH command finds the value 0010 in the words at FFFFFFFF.80000030, FFFFFFFF.80000040, FFFFFFFF.80000090, FFFFFFFF.800000A0, FFFFFFFF.800000C0.

4.
```
SDA> SEARCH/MASK=FF000000 80000000;40 20000000
Searching from FFFFFFFF.80000000 to FFFFFFFF.8000003F in LONGWORD steps
 for 20000000...
(Using search mask of FF000000)
Match at FFFFFFFF.80000000    201F0104
Match at FFFFFFFF.80000010    201F0001
```

```
2 matches found
```

This SEARCH command finds the value 20 in the upper byte of the longwords at FFFFFFFF.80000000 and FFFFFFFF.80000010, regardless of the contents of the lower 3 bytes.

5.
```
SDA> SEARCH g:i ("test",01020304,"this",05060708,"again")
 Searching from FFFFFFFF.80000000 to FFFFFFFF.FFFFFFFF in byte steps for
 "test....this....again"...
 (74,65,73,74,04,03,02,01,74,68 ,69,73,08,07,06,05,61,67,61,69,6E)
 No matches found
```

This example combines quoted strings and hexadecimal values to form a character sequence to be used in a search. Note the order in which the bytes within each hexadecimal number are inserted into the search sequence: the least significant byte of the hexadecimal number is the first byte added to the search sequence.

4.18. SET CPU

When analyzing a system dump, selects a processor to become the current CPU for SDA. When invoked under ANALYZE/SYSTEM, SET CPU lists the database address for the specified CPU before exiting with the message: `%SDA-E-CMDNOTVLD command not valid on the running system`

Format

SET CPU {cpu-id | /FIRST | /NEXT | /PRIMARY } [/NOLOG]

Parameter

cpu-id

Numeric value indicating the identity of the processor to be made the current CPU. If you specify the **cpu-id** of a processor that was not active at the time of the system failure, SDA displays the following message:

```
%SDA-E-CPUNOTVLD, CPU not booted or CPU number out of range
```

Qualifiers

/FIRST

The lowest numbered CPU (not necessarily the primary CPU) is set as the current CPU.

/NEXT

The next higher numbered CPU is set as the current CPU. SDA skips CPUs not in the configuration at the time of the system failure. If there are no further CPUs, SDA returns an error.

/NOLOG

Use the /NOLOG qualifier to inhibit output of the database address for the CPU being set.

/PRIMARY

The primary CPU is set as the current CPU.

Description

When you invoke SDA to examine a system dump, the current CPU context for SDA defaults to that of the processor that caused the system to fail. When analyzing a system failure from a multiprocessing system, you may find it useful to examine the context of another processor in the configuration.

The SET CPU command changes the current CPU context for SDA to that of the processor indicated by **cpu-id**. The CPU specified by this command becomes the current CPU for SDA until you either exit from SDA or change the CPU context for SDA by issuing one of the following commands:

SET CPU **cpu-id**

SET CPU /FIRST

SET CPU /NEXT

SET CPU /PRIMARY

SHOW CPU **cpu-id**

SHOW CPU /FIRST

SHOW CPU /NEXT

SHOW CPU /PRIMARY

SHOW CRASH

SHOW MACHINE_CHECK **cpu-id**

Changing CPU context can cause an implicit change in process context under the following circumstances:

- If there is a current process on the CPU made current, SDA changes its process context to that of that CPU's current process.
- If there is no current process on the CPU made current, the SDA process context is undefined and no process-specific information is available until you set the SDA process context to that of a specific process.

The following commands also change the CPU context for SDA to that of the CPU on which the process was most recently current:

SET PROCESS **process-name**

SET PROCESS/ADDRESS=**pcb-address**

SET PROCESS/INDEX=**nn**

SET PROCESS/NEXT

SHOW PROCESS **process-name**

SHOW PROCESS/ADDRESS=**pcb-address**

SHOW PROCESS/INDEX=**nn**

SHOW PROCESS/NEXT

VALIDATE PROCESS/POOL **process-name**

VALIDATE PROCESS/POOL/ADDRESS=**pcb-address**

VALIDATE PROCESS/POOL/INDEX=**nn**

VALIDATE PROCESS/POOL/NEXT

See Section 2.5 for further discussion of the way in which SDA maintains its context information.

See the description of the REPEAT command for an example of the use of SET CPU/NEXT command.

4.19. SET ERASE_SCREEN

Enables or disables the automatic clearing of the screen before each new page of SDA output.

Format

SET ERASE_SCREEN {ON | OFF}

Parameters

ON

Enables the screen to be erased before SDA outputs a new heading. This setting is the default.

OFF

Disables the erasing of the screen.

Description

SDA's usual behavior is to erase the screen and then show the data. By setting the OFF parameter, the clear screen action is replaced by a blank line. This action does not affect what is written to a file when the SET LOG or SET OUTPUT commands are used.

Examples

1. `SDA>  SET ERASE_SCREEN ON`

   The clear screen action is now enabled.

2. `SDA> SET ERASE_SCREEN OFF`

   The clear screen action is disabled.

4.20. SET FETCH

Sets the default size and access method of address data used when SDA evaluates an expression that includes the @ unary operator.

Format

SET FETCH [{QUADWORD | LONGWORD | WORD | BYTE}]

[, {PHYSICAL | VIRTUAL}]

Parameters

QUADWORD

Sets the default size to 8 bytes.

LONGWORD

Sets the default size to 4 bytes.

WORD

Sets the default size to 2 bytes.

BYTE

Sets the default size to 1 byte.

PHYSICAL

Sets the default access method to physical addresses.

VIRTUAL

Sets the default access method to virtual addresses.

You can specify only one parameter out of each group. If you are changing both size and access method, separate the two parameters by spaces or a comma. Include a comma only if you are specifying a parameter from both groups. See Example 6.

Qualifiers

None.

Description

Sets the default size and/or default access method of address data used by the @ unary operator in commands such as EXAMINE and EVALUATE. SDA uses the current default size unless it is overridden by the ^Q, ^L, ^W, or ^B qualifier on the @ unary operator in an expression. SDA uses the current default access method unless it is overridden by the ^P or ^V qualifier on the @ unary operator in an expression.

Examples

1. ```
SDA> EXAMINE MMG$GQ_SHARED_VA_PTES
MMG$GQ_SHARED_VA_PTES: FFFFFFFD.FF7FE000   ".`a....."
```

   This example shows the location's contents of a 64-bit virtual address.

2. ```
SDA> SET FETCH LONG
SDA> EXAMINE @MMG$GQ_SHARED_VA_PTES
%SDA-E-NOTINPHYS, FFFFFFFF.FF7FE000 : virtual data not in physical
 memory
```

This example shows a failure because the SET FETCH LONG causes SDA to assume that it should take the lower 32 bits of the location's contents as a longword value, sign-extend them, and use that value as an address.

3.
```
SDA> EXAMINE @^QMMG$GQ_SHARED_VA_PTES
FFFFFFFD.FF7FE000:  000001D0.40001119   "...@..."
```

This example shows the correct results by overriding the SET FETCH LONG with the ^Q qualifier on the @ operator. SDA takes the full 64 bits of the location's contents and uses that value as an address.

4.
```
SDA> SET FETCH QUAD
SDA> EXAMINE @MMG$GQ_SHARED_VA_PTES
FFFFFFFD.FF7FE000:  000001D0.40001119   "...@..."
```

This example shows the correct results by changing the default fetch size to a quadword.

5.
```
SDA> SET FETCH PHYSICAL
SDA> EXAMINE /PHYSICAL @0
```

This command uses the contents of the physical location 0 as the physical address of the location to be examined.

6.
```
SDA> SET FETCH QUADWORD, PHYSICAL
```

This command sets the default fetch size and default access method at the same time.

4.21. SET LOG

Initiates or discontinues the recording of an SDA session in a text file.

Format

`SET [NO]LOG filespec`

Parameter

filespec

Name of the file in which you want SDA to log your commands and their output. The default **filespec** is SYS$DISK:[*default_dir]filename*.LOG, where SYS$DISK and [*default-dir*] represent the disk and directory specified in your last DCL command SET DEFAULT. If you specify SET LOG without a filename or specify SET NOLOG, SDA stops recording the session and directs all output to SYS$OUTPUT.

Qualifier

None.

Description

The SET LOG command echoes the commands and output of an SDA session to a log file. The SET NOLOG command terminates this behavior.

The following differences exist between the SET LOG command and the SET OUTPUT command:

- When logging is in effect, your commands and their results are still displayed on your terminal. The SET OUTPUT command causes the displays to be redirected to the output file and they no longer appear on the screen.
- If an SDA command requires that you press Return to produce successive screens of display, the log file produced by SET LOG will record only those screens that are actually displayed. SET OUTPUT, however, sends the entire output of any SDA commands to its listing file.
- The SET LOG command produces a log file with a default file type of .LOG; the SET OUTPUT command produces a listing file whose default file type is .LIS.
- The SET OUTPUT command can generate a table of contents, each item of which refers to a display written to its listing file. SET OUTPUT also produces running heads for each page of output. The SET LOG command does not produce these items in its log file.

If you use the SET OUTPUT command to redirect output to a listing file, a SET LOG command to direct the same output to a log file is ineffective until output is restored to the terminal.

4.22. SET OUTPUT

Redirects output from SDA to the specified file or device.

Format

`SET OUTPUT [/[NO]INDEX | /[NO]HEADER | /PERMANENT | /SINGLE_COMMAND] filespec`

Parameter

filespec

Name of the file to which SDA is to send the output generated by its commands. The default **filespec** is SYS$DISK:[*default_dir*] *filename*.LIS, where SYS$DISK and [*default-dir*] represent the disk and directory specified in your last DCL command SET DEFAULT. You must specify a file name except when /PERMANENT is specified.

Qualifiers

/INDEX

/NOINDEX

The /INDEX qualifier causes SDA to include an index page at the beginning of the output file. This is the default unless you specify /NOHEADER or modify the default with a SET OUTPUT/PERMANENT command. The /NOINDEX qualifier causes SDA to omit the index page from the output file.

/HEADER

/NOHEADER

The /HEADER qualifier causes SDA to include a heading at the top of each page of the output file. This is the default unless you modify it with a SET OUTPUT/PERMANENT command. The /NOHEADER qualifier causes SDA to omit the page headings. Use of /NOHEADER implies /NOINDEX.

/PERMANENT

Modifies the defaults for /[NO]HEADER and /[NO]INDEX. Specify either or both qualifiers with or without a NO prefix to set new defaults. Setting the default to /NOHEADER implies a default of /NOINDEX. The new defaults remain in effect until another SET OUTPUT/PERMANENT command is entered or the SDA session is ended.

You cannot combine /PERMANENT and /SINGLE_COMMAND in one command, and you cannot provide a filespec with /PERMANENT.

/SINGLE_COMMAND

Indicates to SDA that the output for a single command is to be written to the specified file and that subsequent output should be written to the terminal. /SINGLE_COMMAND cannot be combined with /PERMANENT.

Description

When you use the SET OUTPUT command to send the SDA output to a file or device, SDA continues displaying the SDA commands that you enter but sends the output generated by those commands to the file or device you specify. (See the description of the SET LOG command for a list of differences between the SET LOG and SET OUTPUT commands.)

When you finish directing SDA commands to an output file and want to return to interactive display, issue the following command:

```
SDA> SET OUTPUT SYS$OUTPUT
```

You do not need this command when you specify the /SINGLE_COMMAND qualifier on the original SET OUTPUT command.

If you use the SET OUTPUT command to send the SDA output to a listing file and do not specify /NOINDEX or /NOHEADER, SDA builds a table of contents that identifies the displays you selected and places the table of contents at the beginning of the output file. The SET OUTPUT command formats the output into pages and produces a running head at the top of each page, unless you specify /NOHEADER.

If the table of contents does not fit on a single index page at the beginning of the listing file, SDA will insert additional index pages as necessary. These are inserted into the listing file immediately preceding the pages that are listed in each index page. Each index page includes the page number for the adjacent index pages.

Note

See the description of the DUMP command for use of SET OUTPUT/NOHEADER.

4.23. SET PROCESS

Selects a process to become the SDA current process.

Format

```
SET PROCESS {/ADDRESS=pcb-address | process-name | /ID=nn | /INDEX=nn | /NEXT
```

Parameter

process-name

Name of the process to become the SDA current process. The process-name can contain up to 15 uppercase letters, numerals, the underscore (_), dollar sign ($), colon (:), and some other printable characters. If it contains any other characters (including lowercase letters), you may need to enclose the process-name in quotation marks (" ").

Qualifiers

/ADDRESS = *pcb-address*

Specifies the process control block (PCB) address of a process in order to display information about the process.

/ID=*nn*

/INDEX=*nn*

Specifies the process for which information is to be displayed either by its index into the system's list of software process control blocks (PCBs), or by its process identification. /ID and /INDEX are functionally equivalent. You can supply the following values for *nn*:

- The process index itself.
- The process identification (PID) or extended PID longword, from which SDA extracts the correct index. The PID or extended PID of any thread of a process with multiple kernel threads may be specified. Any thread-specific data displayed by further commands will be for the given thread.

To obtain these values for any given process, issue the SDA command SHOW SUMMARY/ THREADS. The /ID=nn and /INDEX=nn qualifiers can be used interchangeably.

/NEXT

Causes SDA to locate the next valid process in the process list and select that process. If there are no further valid processes in the process list, SDA returns an error.

/SYSTEM

Specifies the new current process by the system process control block (PCB). The system PCB and process header (PHD) parallel the data structures that describe processes. They contain the system working set list, global section table, and other systemwide data.

Description

When you issue an SDA command such as EXAMINE, SDA displays the contents of memory locations in its current process. To display any information about another process, you must change the current process with the SET PROCESS command.

When you invoke SDA to analyze a crash dump, the process context defaults to that of the process that was current at the time of the system failure. If the failure occurred on a multiprocessing system, SDA sets the CPU context to that of the processor that caused the system to fail. The process context is set to that of the process that was current on that processor.

When you invoke SDA to analyze a running system, its process context defaults to that of the current process, that is, the one executing SDA.

The SET PROCESS command changes the current SDA process context to that of the process indicated by **process-name**, *pcb-address*, or /INDEX=*nn*. The process specified by this command becomes the current process for SDA until you either exit from SDA or change SDA process context by issuing one of the following commands:

SET PROCESS **process-name**

SET PROCESS/ADDRESS=*pcb-address*

SET PROCESS/INDEX=*nn*

SET PROCESS/NEXT

SET PROCESS/SYSTEM

SHOW PROCESS **process-name**

SHOW PROCESS/ADDRESS=*pcb-address*

SHOW PROCESS/INDEX=*nn*

SHOW PROCESS/NEXT

SHOW PROCESS/SYSTEM

VALIDATE PROCESS/POOL **process-name**

VALIDATE PROCESS/POOL/ADDRESS=*pcb-address*

VALIDATE PROCESS/POOL/INDEX=*nn*

VALIDATE PROCESS/POOL/NEXT

VALIDATE PROCESS/POOL/SYSTEM

When you analyze a crash dump from a multiprocessing system, changing process context causes a switch of CPU context as well. When you issue a SET PROCESS command, SDA automatically changes its CPU context to that of the CPU on which that process was most recently current.

The following commands will also switch process context when analyzing a system dump, if there was a current process on the target CPU at the time of the crash:

SET CPU **cpu-id**

SET CPU /FIRST

SET CPU /NEXT

SET CPU /PRIMARY

SHOW CPU **cpu-id**

SHOW CPU /FIRST

SHOW CPU /NEXT

SHOW CPU /PRIMARY

SHOW CRASH

SHOW MACHINE_CHECK **cpu-id**

See Section 2.5 for further discussion of the way in which SDA maintains its context information.

Examples

1.
```
SDA> SET PROCESS/ADDRESS=80D772C0
SDA> SHOW PROCESS
Process index: 0012   Name: ERRFMT   Extended PID: 00000052
-----------------------------------------------------------
Process status:  02040001   RES,PHDRES,INTER
        status2: 00000001   QUANTUM_RESCHED

PCB address              80D772CO    JIB address              80556600
PHD address              80477200    Swapfile disk address    01000F01
KTB vector address       80D775AC    HWPCB address            81260080
Callback vector address  00000000    Termination mailbox          0000
Master internal PID      00010004    Subprocess count                0
Creator extended PID     00000000    Creator internal PID     00000000
Previous CPU Id          00000000    Current CPU Id           00000000
Previous ASNSEQ  0000000000000001    Previous ASN     000000000000002E
Initial process priority        4    Delete pending count            0
# open files allowed left     100    Direct I/O count/limit
 150/150
UIC                [00001,000004]    Buffered I/O count/limit
 149/150
Abs time of last event   0069D34E    BUFIO byte count/limit
 99424/99808
ASTs remaining                247    # of threads                    1
Swapped copy of LEFC0    00000000    Timer entries allowed left     63
Swapped copy of LEFC1    00000000    Active page table count         4
Global cluster 2 pointer 00000000    Process WS page count          32
Global cluster 3 pointer 00000000    Global WS page count           31
```

   The SET PROCESS command switches SDA's current process context to the process whose PCB is at address 80D772C0. The SHOW PROCESS command shows that the process is ERRFMT, and displays information from its PCB and job information block (JIB).

   See the description of the REPEAT command for an example of the use of the SET PROCESS/NEXT command.

4.24. SET RMS

Changes the options shown by the SHOW PROCESS/RMS command.

Format

`SET RMS = (option[,...])`

Parameter

option

Data structure or other information to be displayed by the SHOW PROCESS/RMS command. The table below lists those keywords that can be used as options.

Table 4.2. SET RMS Command Keywords for Displaying Process RMS Information

Keyword	**Meaning**
[NO]ALL[: **ifi**] 1	All control blocks (default)
[NO]ASB	Asynchronous save block
[NO]BDB	Buffer descriptor block
[NO]BDBSUM	BDB summary page
[NO]BLB	Buffer lock block
[NO]BLBSUM	Buffer lock summary page
[NO]CCB	Channel control block
[NO]DRC	Directory cache
[NO]FAB	File access block
[NO]FCB	File control block
NO]FSB	File statistics block
[NO]FWA	File work area
[NO]GBD	Global buffer descriptor
[NO]GBDSUM	GBD summary page
[NO]GBH	Global buffer header
[NO]GBHSH	Global buffer hash table
[NO]GBSB	Global buffer synchronization block
[NO]IDX	Index descriptor
[NO]IFAB[: **ifi**] 1	Internal FAB. The optional parameter ifi is an internal file identifier. The default ifi (ALL) is all the files the current process has opened.
[NO]IFB[: **ifi**] 1	Internal FAB
[NO]IRAB	Internal RAB
[NO]IRB	Internal RAB
[NO]JFB	Journaling file block
[NO]KLTB	Key-less-than block
[NO]NAM	Name block
[NO]NWA	Network work area
[NO]PIO	Image I/O (NOPIO), the default, or process I/O (PIO)

Keyword	Meaning
[NO]RAB	Record access block
[NO]RLB	Record lock block
[NO]RU	Recovery unit structures, including the recovery unit block (RUB), recovery unit stream block (RUSB), and recovery unit file block (RUFB)
[NO]SFSB	Shared file synchronization block
[NO]WCB	Window control block
[NO]XAB	Extended attribute block
[NO]*	Current list of options displayed by the SHOW RMS command

The default **option** is **(ALL,NOPIO)**, which designates that the SHOW PROCESS/RMS command display all structures for all files related to the process image I/O.

If only a single option is specified, you can omit the parentheses. You can add a given data structure to those displayed by ensuring that the list of keywords begins with the asterisk (*) symbol. You can delete a given data structure from the current display by preceding its keyword with NO.

Qualifier

None.

Description

The SET RMS command determines the data structures to be displayed by the SHOW PROCESS/RMS command. (See the examples included in the discussion of the SHOW PROCESS command for information provided by various displays.) You can examine the options that are currently selected by issuing a SHOW RMS command.

Examples

1.
```
SDA>  SHOW RMS
RMS Display Options:
 IFB,IRB,IDX,BDB,BDBSUM,ASB,CCB,WCB,FCB,FAB,RAB,NAM,XAB,RLB,
BLB,BLBSUM,GBD,GBH,FWA,GBDSUM,JFB,NWA,RU,DRC,SFSB,GBSB

Display RMS structures for all IFI values.

SDA>  SET RMS=IFB
SDA>  SHOW RMS

RMS Display Options:  IFB

Display RMS structures for all IFI values.
```

   The first SHOW RMS command shows the default selection of data structures that are displayed in response to a SHOW PROCESS/RMS command. The SET RMS command selects only the IFB to be displayed by subsequent SET/PROCESS commands.

2.
```
SDA>  SET RMS=(*,BLB,BLBSUM,RLB)
SDA>  SHOW RMS
```

```
RMS Display Options:  IFB,RLB,BLB,BLBSUM

Display RMS structures for all IFI values.
```

The SET RMS command adds the BLB, BLBSUM, and RLB to the list of data structures currently displayed by the SHOW PROCESS/RMS command.

3. ```
   SDA>  SET RMS=(*,NORLB,IFB:05)
   SDA>  SHOW RMS

   RMS Display Options:  IFB,BLB,BLBSUM
   Display RMS structures only for IFI=5.
   ```

   The SET RMS command removes the RLB from those data structures displayed by the SHOW PROCESS/RMS command and causes only information about the file with the ifi of 5 to be displayed.

4. ```
   SDA> SET RMS=(*,PIO)
   ```

   The SET RMS command indicates that the data structures designated for display by SHOW PROCESS/RMS be associated with process-permanent I/O instead of image I/O.

4.25. SET SIGN_EXTEND

Enables or disables the sign extension of 32-bit addresses.

Format

SET SIGN_EXTEND {ON | OFF}

Parameters

ON

Enables automatic sign extension of 32-bit addresses with bit 31 set. This is the default.

OFF

Disables automatic sign extension of 32-bit addresses with bit 31 set.

Qualifiers

None.

Description

The 32-bit S0/S1 addresses need to be sign-extended to access 64-bit S0/S1 space. To do this, specify explicitly sign-extended addresses, or set the sign-extend command to **ON**, which is the default.

However, to access addresses in P2 space, addresses must not be sign-extended. To do this, specify a zero in front of the address, or set the sign-extend command to **OFF**.

Examples

1. ```
   SDA> SET SIGN_EXTEND ON
   ```
   ```

```
SDA>  examine 80400000
FFFFFFFF.80400000: 23DEFF90.4A607621
```

This shows the SET SIGN_EXTEND command as ON.

2.
```
SDA> SET SIGN_EXTEND OFF
SDA>  EXAMINE 80400000
%SDA-E-NOTINPHYS, 00000000.80400000: virtual data not in physical memory
```

This shows the SET SIGN_EXTEND command as OFF.

4.26. SET SYMBOLIZE

Enables or disables symbolization of addresses in the display from an EXAMINE command.

Format

SET SYMBOLIZE {ON | OFF}

Parameters

ON

Enables symbolization of addresses.

OFF

Disables symbolization of addresses.

Qualifier

None.

Examples

1.
```
SDA> SET SYMBOLIZE ON
        SDA> examine g1234
        SYS$PUBLIC_VECTORS+01234:  47DF041C   "..ßG"
```

2.
```
SDA> SET SYMBOLIZE OFF
        SDA> examine g1234
        FFFFFFFF.80001234:  47DF041C   "..ßG"
```

These examples show the effect of enabling (default) or disabling symbolization of addresses.

4.27. SHOW ACPI (Integrity servers only)

Displays the contents of Advanced Configuration and Power Interface (ACPI) tables and namespace structures.

Format

SHOW ACPI {/NAMESPACE |/TABLE} [/ADDRESS = *address* | /ALL | /CHILDREN] [ident

Parameter

ident

The name of the table or the namespace structure to be displayed. If an ident is given, /ADDRESS cannot be specified.

Qualifiers

/ADDRESS = *address*

The physical address of the table entry or virtual address of a namespace structure to be displayed. If /ADDRESS is used, no ident may be specified.

/ALL

Specifies that detailed information on each entity is to be displayed. By default, only a brief summary of each entity is given, except when a specific table is displayed.

/CHILDREN

Specifies that all the child namespace structures for a specified namespace entry are to be displayed. /CHILDREN cannot be used with /TABLES.

/NAMESPACE

Specifies that ACPI namespace structures are to be displayed. Either /NAMESPACE or /TABLES must be specified.

/TABLES

Specifies that ACPI tables are to be displayed. Either /NAMESPACE or /TABLES must be specified.

Description

The SHOW ACPI command displays the Advanced Configuration and Power Interface (ACPI) Tables and Namespace structures, either as a one line summary for each entity or in detail. The amount of detail varies for each structure. The structures most interesting to OpenVMS are formatted; others are output as a hexadecimal dump.

Examples

1.
```
SDA> SHOW ACPI /TABLES
ACPI Tables
-----------
                                                              OEM        ASL
Signature   Physical Address     Length     OEM Id    Table Id   Vendor Id
   Rev
---------   -----------------   --------   ------    --------   ---------
   ---
RSDP        00000000.3FB2E000   00000028   HP        -          -
   02
XSDT        00000000.3FB2E02C   0000007C   HP        zx2000     HP
   01
```

```
FACP        00000000.3FB373E0   000000F4   HP       zx2000     HP
   03
SPCR        00000000.3FB37518   00000050   HP       zx2000     HP
   01
DBGP        00000000.3FB37568   00000034   HP       zx2000     HP
   01
APIC        00000000.3FB37628   00000084   HP       zx2000     HP
   01
SPMI        00000000.3FB375A0   00000050   HP       zx2000     HP
   04
CPEP        00000000.3FB375F0   00000034   HP       zx2000     HP
   01
SSDT        00000000.3FB33870   00000A14   HP       zx2000     INTL
   01
SSDT        00000000.3FB34290   000022E2   HP       zx2000     INTL
   01
SSDT        00000000.3FB36580   00000342   HP       zx2000     INTL
   01
SSDT        00000000.3FB368D0   00000A16   HP       zx2000     INTL
   01
SSDT        00000000.3FB372F0   000000EB   HP       zx2000     INTL
   01
FACS        00000000.3FB374D8   00000040   -        -          -
   01
DSDT        00000000.3FB2E0E0   00005781   HP       zx2000     INTL
   01
HCDP        00000000.3FB2C000   00000088   HP       zx1        HP
   00
```

This example shows the default display for the ACPI tables.

2.
```
SDA> SHOW ACPI /TABLES RSDP

ACPI Tables
-----------
RSDP

      Physical Address:      00000000.3FB2E000   Length:
  00000028
     OEM Identification:                "HP"   XSDT PA:
 00000000.3FB2E02C
    Revision:                            02
```

This example shows the contents of the Root System Description Pointer (RSDP) table.

3.
```
SDA> SHOW ACPI /NAMESPACE
ACPI Namespace
--------------
      Node              ACPI      Owner   Object           Operand
     Address            Name       Id      Type            Object
    Flags
----------------- ---------------- -- --------------- -----------------
 -----------
FFFFFFFF.88253028 \___             00 Device          FFFFFFFF.89523158
 End_Of_Peer_List Subtree_Has_Ini
FFFFFFFF.89521BD8   _GPE           00 Local_Scope     00000000.00000000
FFFFFFFF.89523F58     _L14         01 Method          FFFFFFFF.89523F98
 End_Of_Peer_List
```

```
FFFFFFFF.89521C18   _PR_           00 Local_Scope     00000000.00000000
FFFFFFFF.89521C58   _SB_           00 Device          00000000.00000000
 Subtree_Has_Ini
FFFFFFFF.89529098     SBA0         01 Device          00000000.00000000
 Subtree_Has_Ini
FFFFFFFF.895290D8       _HID       01 Method          FFFFFFFF.89529118
FFFFFFFF.89529198       _CID       01 Integer         FFFFFFFF.8952AD18
```

This example shows the default display for the ACPI namespace structures.

4.
```
SDA> SHOW ACPI/NAMESPACE/CHILDREN _GPE
ACPI Namespace
--------------
      Node              ACPI       Owner   Object            Operand
     Address            Name        Id      Type             Object
   Flags
----------------- ---------------- -- --------------- -----------------
 -----------
FFFFFFFF.89521BD8 \_GPE            00 Local_Scope     00000000.00000000
FFFFFFFF.89523F58 \_GPE._L14       01 Method          FFFFFFFF.89523F98
 End_Of_Peer_List
```

This example shows the summary display for the _GPE (General Purpose Event) package in the ACPI namespace, plus its child node.

4.28. SHOW ADDRESS

Displays the page table related information about a memory address.

Format

`SHOW ADDRESS address [/PHYSICAL]`

Parameter

address

The requested address.

Qualifier

/PHYSICAL

Indicates that a physical address has been given. The SHOW ADDRESS command displays the virtual address that maps to the given physical address.

Description

The SHOW ADDRESS command displays the region of memory that contains the memory address. It also shows all the page table entries (PTEs) that map the page and can show the range of addresses mapped by the given address if it is the address of a PTE. If the virtual address is in physical memory, the corresponding physical address is displayed.

When the /PHYSICAL qualifier is given, the SHOW ADDRESS command displays the virtual address that maps to the given physical address. This provides you with a way to use SDA commands that do not have a /PHYSICAL qualifier when only the physical address of a memory location is known.

Examples

1.
```
SDA> SHOW ADDRESS 80000000
FFFFFFFF.80000000 is an S0/S1 address
Mapped by Level-3 PTE at: FFFFFFFD.FFE00000
Mapped by Level-2 PTE at: FFFFFFFD.FF7FF800
Mapped by Level-1 PTE at: FFFFFFFD.FF7FDFF8
Mapped by Selfmap PTE at: FFFFFFFD.FF7FDFF0
Also mapped in SPT window at: FFFFFFFF.FFDF0000
Mapped to physical address 00000000.00400000
```

   The SHOW ADDRESS command in this example shows where the address 80000000 is mapped at different page table entry levels.

2.
```
SDA> SHOW ADDRESS 0
00000000.00000000 is a P0 address
Mapped by Level-3 PTE at: FFFFFFFC.00000000
Mapped by Level-2 PTE at: FFFFFFFD.FF000000
Mapped by Level-1 PTE at: FFFFFFFD.FF7FC000
Mapped by Selfmap PTE at: FFFFFFFD.FF7FDFF0
Not mapped to a physical address
```

   The SHOW ADDRESS command in this example shows where the address 0 is mapped at different page table entry levels.

3.
```
SDA> SHOW ADDRESS FFFFFFFD.FF000000
FFFFFFFD.FF000000 is the address of a process-private Level-2 PTE
Mapped by Level-1 PTE at: FFFFFFFD.FF7FC000
Mapped by Selfmap PTE at: FFFFFFFD.FF7FDFF0
Range mapped at level 2: FFFFFFFC.00000000 to FFFFFFFC.00001FFF (1 page)
Range mapped at level 3: 00000000.00000000 to 00000000.007FFFFF (1024
 pages)
Mapped to physical address 00000000.01230000
```

   The SHOW ADDRESS command in this example shows where the address FFFFFFFD.FF7FC000 is mapped at page table entry and the range mapped by the PTE at this address.

4.
```
SDA> SHOW ADDRESS/PHYSICAL 0
Physical address 00000000.00000000 is mapped to system-space address
 FFFFFFFF.828FC000
```

   The SHOW ADDRESS command in this example shows physical address 00000000.00000000 mapped to system-space address FFFFFFFF.828FC000.

5.
```
SDA> SHOW ADDRESS/PHYSICAL 029A6000
Physical address 00000000.029A6000 is mapped to process-space address
 00000000.00030000
(process index 0024)
```

   The SHOW ADDRESS command in this example shows physical address 00000000.029A6000 mapped to process-space address 00000000.00030000 (process index 0024).

4.29. SHOW BUGCHECK

Displays the value, name, and text associated with one or all bugcheck codes.

Format

SHOW BUGCHECK {/ALL (d) | name | number}

Parameters

name

The name of the requested bugcheck code.

number

The value of the requested bugcheck code. The severity bits in the value are ignored.

The parameters **name** and **number** and the qualifier **/ALL** are all mutually exclusive.

Qualifier

/ALL

Displays complete list of all the bugcheck codes, giving their value, name, and text. It is the default.

Description

The SHOW BUGCHECK command displays the value, name, and text associated with bugcheck codes.

Examples

1.
```
SDA> SHOW BUGCHECK 104
0100  DIRENTRY       ACP failed to find same directory entry
```

The SHOW BUGCHECK command in this example shows the requested bugcheck by number, ignoring the severity (FATAL).

2.
```
SDA> SHOW BUGCHECK DECNET
08D0  DECNET         DECnet detected a fatal error
```

The SHOW BUGCHECK command in this example shows the requested bugcheck by name.

3.
```
SDA> SHOW BUGCHECK
BUGCHECK codes and texts
------------------------
0008  ACPMBFAIL      ACP failure to read mailbox
0010  ACPVAFAIL      ACP failure to return virtual address space
0018  ALCPHD         Allocate process header error
0020  ALCSMBCLR      ACP tried to allocate space already allocated
    .
    .
    .
```

The SHOW BUGCHECK command in this example shows the requested bugcheck by displaying all codes.

4.30. SHOW CALL_FRAME

Displays the locations and contents of the quadwords representing a procedure call frame.

Format

SHOW CALL_FRAME { [starting-address]

| /EXCEPTION_FRAME = intstk-address

| /NEXT_FRAME | /SUMMARY | /ALL}

Parameter

starting-address

For Alpha, an expression representing the starting address of the procedure call frame to be displayed. If no starting-address is given, the default starting address is the contents of the frame pointer (FP) register of the SDA current process. For a process that uses pthreads, the following SDA command can be used to display the starting addresses for all pthreads:

```
SDA> pthread thread -o u
```

For Integrity servers, the starting address is an expression representing one of the following:

- The invocation context handle of a frame.
- The address of an exception frame. This is equivalent to the following SDA command:

  ```
  SDA> SHOW CALL_FRAME /EXCEPTION_FRAME=intstk-address
  ```

- The address of a Thread Environment Block (TEB).

  For a list of all TEBs for the process, use the following SDA command:

  ```
  SDA> pthread thread -o u
  ```

If no starting address is given, the default starting address is the invocation context handle of the current procedure in the SDA current process.

Qualifier

/ALL

Displays details of all call frames beginning at the current frame and continuing until bottom of stack (equivalent to SHOW CALL and repeated execution of a SHOW CALL/NEXT command).

/EXCEPTION_FRAME=intstk-address

(Integrity servers only) Provides an alternate starting address for SHOW CALL_FRAME. intstk-address is the address of an exception frame from which SDA creates an initial invocation context and displays the procedure call frame.

/NEXT_FRAME

Displays the procedure call frame starting at the address stored in the frame longword of the last call frame displayed by this command. You must have issued a SHOW CALL_FRAME command previously in the current SDA session in order to use the /NEXT_FRAME qualifier to the command.

/SUMMARY

Provides a one-line summary for each call frame, including exception frames, system-service entry frames, ASTs, KPBs, and so on, until reaching the bottom of the stack.

Description

Whenever a procedure is called, information is stored on the stack of the calling routine in the form of a procedure call frame. The SHOW CALL_FRAME command displays the locations and contents of the call frame. The starting address of the call frame is determined from the specified starting address, the /NEXT_FRAME qualifier, or the address contained in the SDA current process frame register (the default action).

When using the SHOW CALL_FRAME/NEXT_FRAME command to follow a chain of call frames, SDA signals the end of the chain by the following message:

```
Cannot display further call frames (bottom of stack)
```

This message indicates that the saved frame in the previous call frame has a zero value (for Alpha) or that the current frame is marked Bottom of Stack (for Integrity servers).

Examples

1.
```
SDA> SHOW CALL_FRAME
Call Frame Information
----------------------
        Stack Frame Procedure Descriptor
Flags:  Base Register = FP, No Jacket, Native
        Procedure Entry: FFFFFFFF.837E9F10             EXCEPTION_PRO
+01F10
        Return address on stack = FFFFFFFF.837E8A1C     EXE$CONTSIGNAL_C
+0019C
Registers saved on stack
------------------------
7FF95F98  FFFFFFFF.FFFFFFFB  Saved R2
7FF95FA0  FFFFFFFF.8042AEA0  Saved R3     EXCEPTION_NPRW+040A0
7FF95FA8  00000000.00000002  Saved R5
7FF95FB0  FFFFFFFF.804344A0  Saved R13    SCH$CLREF+00188
7FF95FB8  00000000.7FF9FC00  Saved R29
.
.
.
SDA> SHOW CALL_FRAME/NEXT_FRAME
Call Frame Information
----------------------
        Stack Frame Procedure Descriptor
Flags:  Base Register = FP, No Jacket, Native
        Procedure Entry: FFFFFFFF.800FA388             RMS_NPRO+04388
        Return address on stack = FFFFFFFF.80040BFC     EXCEPTION_NPRO
+00BFC
Registers saved on stack
------------------------
7FF99F60  FFFFFFFF.FFFFFFFD  Saved R2
7FF99F68  FFFFFFFF.80425BA0  Saved R3     EXCEPTION_NPRW+03DA0
7FF99F70  FFFFFFFF.80422020  Saved R4     EXCEPTION_NPRW+00220
7FF99F78  00000000.00000000  Saved R5
```

```
7FF99F80  FFFFFFFF.835C24A8  Saved R6     RMS_PRO+004A8
7FF99F88  00000000.7FF99FC0  Saved R7
7FF99F90  00000000.7FF9FDE8  Saved R8
7FF99F98  00000000.7FF9FDF0  Saved R9
7FF99FA0  00000000.7FF9FE78  Saved R10
7FF99FA8  00000000.7FF9FEBC  Saved R11
7FF99FB0  FFFFFFFF.837626E0  Saved R13    EXE$OPEN_MESSAGE+00088
7FF99FB8  00000000.7FF9FD70  Saved R29
.
.
.
SDA> SHOW CALL_FRAME/NEXT_FRAME
Call Frame Information
----------------------
        Stack Frame Procedure Descriptor
Flags:  Base Register = FP, No Jacket, Native
        Procedure Entry: FFFFFFFF.835C2438              RMS_PRO+00438
        Return address on stack = FFFFFFFF.83766020     EXE
$OPEN_MESSAGE_C+00740
Registers saved on stack
------------------------
7FF9FD88  00000000.7FF9FDA4  Saved R2
7FF9FD90  00000000.7FF9FF00  Saved R3
7FF9FD98  00000000.7FFA0050  Saved R29
```

The SHOW CALL_FRAME commands in this SDA session follow a chain of call frames from that specified in the frame of the SDA current process.

2.
```
SDA> SHOW CALL/SUMMARY
Call Frame Summary
------------------

     Frame Type          Handle           Current PC
-------------------- -----------------  -----------------
Exception Dispatcher 00000000.7FF43EB0  FFFFFFFF.8049E160  EXCEPTION_MON
+5E360
Register Stack Frame 00000000.7FF12180  00000000.000122C0  KP_SAMPLE
+122C0
Memory Stack Frame   00000000.7FF43ED0  FFFFFFFF.8066B440  EXE$CMKRNL_C
+00330
Memory Stack Frame   00000000.7FF43F20  FFFFFFFF.80194890  EXE$SS_DISP_C
+00400
SS Dispatcher        00000000.3FFFDFC0  FFFFFFFF.8018D240  SWIS
$ENTER_KERNEL_SERVICE_C+003E0
Register Stack Frame 000007FD.BFF58000  00000000.000124C0  KP_SAMPLE
+124C0
KP Start Frame       00000000.7AC95A20  FFFFFFFF.80161670  EXE
$KP_START_C+003C0
Memory Stack Frame   00000000.7AC95B50  00000000.00012CE0  KP_SAMPLE
+12CE0
Memory Stack Frame   00000000.7AC95BC0  00000000.000126F0  KP_SAMPLE
+126F0
Base Frame           00000000.7AC95BE0  00000000.7ADE0BB0  DCL+82BB0
Bottom of stack
```

This example of SHOW CALL/SUMMARY on an Integrity server system shows the call frame summary of a process that has triggered an exception. The exception occurred while running a program called KP_SAMPLE which has invoked the $CMKRNL system service.

4.31. SHOW CBB

Displays contents of a Common Bitmask Block.

Format

SHOW CBB address

Parameter

address

The address of the Common Bitmask Block. This is required.

Qualifiers

None.

Description

The contents of the specified common bitmask block are displayed: the number of valid bits, the interlock state, the unit size and count, and the current settings for the bits in the bitmask.

Example

1.
```
SDA>  SHOW CBB SMP$GS_CBB_ACTIVE_SET
Common Bitmask Block at FFFFFFFF.8180CA00
-----------------------------------------

  Valid bits:                   00000040   State:
 00000000.00000000
  Unit count:                       0001   Unit size:
 QUADWORD

  Unit bitmask:
       ........ ........ 00000000 00000001   00000000
```

This example shows the active-CPU common bitmask block for a single-CPU system.

4.32. SHOW CEB

Displays information about Common Event flag Blocks, also known as Common Event flag clusters.

Format

SHOW CEB [address | /ALL]

Parameter

address

The address of a common event flag block. Detailed information is displayed for the specified common event flag block.

Qualifier

/ALL

Specifies that detailed information is to be displayed for each common event flag block. By default, a one-line summary is output for each common event flag block.

Description

The contents of one or all common event flag blocks is displayed. In one-line summary format, the address, name, creator process, reference count, current settings for the 32 event flags in the cluster, and the UIC of the cluster are displayed. In detailed format, the address of the cluster's Object Rights Block (ORB) and the count of waiting threads are also displayed, with lists of all associated processes and waiting threads.

You cannot specify both an address and /ALL; they are mutually exclusive.

SHOW COMMON_EVENT_BLOCK is a synonym for SHOW CEB.

Examples

1.
```
SDA> SHOW CEB
Common Event Flags
------------------

Address       Name              Creator       RefCount  EvtFlags
 UIC        Flags
-------- -------------- --------------------- --------  --------
 --------------  -----
81E1D340 clus6          0000009B Test1        00000001  00000000
 [11,1]       Permanent
81E294C0 clus5          0000009B Test2        00000001  00000000
 [11,1]       Permanent
8213A280 IPCACP_FLAGS   00000086 IPCACP       00000001  00000000
 [1,*]
```

   This example shows the one-line summary of all common event flag blocks.

2.
```
SDA> SHOW CEB 81E294C0
Common Event Flags
------------------

CEB Address:                     81E294C0   Name:
 clus5
Creator process EPID:            0000009B   Name:
 Test2
Event flag vector:               00000000   Reference count:
 00000001
ORB address:                     829F75B0   Wait count:
 00000001
UIC:                               [11,1]   Flags:
 00000002  Permanent

              Associated Processes             Waiting Threads
       -----------------------------------   ------------------------
         PCB       EPID          Name           KTB      Indx  WaitMask
```

```
--------  --------  ---------------   --------  ----  --------
81E1C740  000000A4  BISHOP_47         81E1C740  0000  FFFFFF84
```

This example shows the details for the CEB at the given address.

4.33. SHOW CLASS

Displays information about scheduling classes that are active in the system or dump being analyzed.

Format

SHOW CLASS [class-name | /ALL]

Parameter

class-name

Name of the class to be displayed.

Qualifier

/ALL

Indicates that details of all active classes are to be displayed.

Description

SDA displays information about active scheduling classes in the system. By default, a summary of the classes is displayed.

Examples

1.
```
SDA> SHOW CLASS
Scheduling Classes
------------------

                  Original  Current     Time    Process
   Class Name     Quantum   Quantum   Restrict   Count
----------------  --------  --------  --------  --------
BISH              000000C6  000000C6  00FE0000  00000001
```

This example shows the summary display of the SHOW CLASS command.

2.
```
SDA> SHOW CLASS bish
Class name:                        "BISH"
Original quantum:                  000000C6 (99%)
Current quantum:                   000000C6 (99%)
Time restrictions:                 00FE0000 (until 23:59)

Processes currently in class:

            PCB         EPID           Name
          --------    --------    ---------------
          83617D40    00000225    Milord_RTA1:
```

This example shows the detailed display of the SHOW CLASS command.

4.34. SHOW CLUSTER

Displays connection manager and system communications services (SCS) information for all nodes in a cluster.

Format

SHOW CLUSTER { [{/ADDRESS=*n* | /CIRCUIT=*pb-addr* | /CSID=*csid* | /NODE=*name*}] |

Parameters

None

Qualifier

/ADDRESS=*n*

Displays only the OpenVMS Cluster system information for a specific OpenVMS Cluster member node, given the address of the cluster system block (CSB) for the node. This is mutually exclusive with the /CIRCUIT=*pb-addr*, /CSID=*csid*, and /NODE=*name* qualifiers.

/CIRCUIT=*pb-addr*

Displays only the OpenVMS Cluster system information for a specific path, where *pb-addr* is the address of its path block. This qualifier is mutually exclusive with the /ADDRESS=*n*, /CSID=*csid*, and /NODE=*name* qualifiers.

/CSID=*csid*

Displays only the OpenVMS Cluster system information for a specific OpenVMS Cluster member node. The value *csid* is the cluster system identification number (CSID) of the node to be displayed. You can find the CSID for a specific node in a cluster by examining the CSB list display of the SHOW CLUSTER command. Other SDA displays refer to a system's CSID. For instance, the SHOW LOCKS command indicates where a lock is mastered or held by CSID. This is mutually exclusive with the /ADDRESS=*n*, /CIRCUIT=*pb-addr*, and /NODE=*name* qualifiers.

/NODE=*name*

Displays only the OpenVMS Cluster system information for a specific OpenVMS Cluster member node, given its SCS node name. This is mutually exclusive with the /ADDRESS=*n*, /CIRCUIT=*pb-addr*, and /CSID=*csid* qualifiers.

/SCS

Displays a view of the cluster as seen by SCS.

Description

The SHOW CLUSTER command provides a view of the OpenVMS Cluster system from either the perspective of the connection manager (the default behavior), or from the perspective of the port driver or drivers (if the /SCS qualifier is used).

OpenVMS Cluster as Seen by the Connection Manager

The SHOW CLUSTER command provides a series of displays.

The **OpenVMS Cluster summary** display supplies the following information:

- Number of votes required for a quorum
- Number of votes currently available
- Number of votes allocated to the quorum disk
- Status summary indicating whether or not a quorum is present

The **CSB list** displays information about the OpenVMS Cluster system blocks (CSBs) currently in operation; one CSB is assigned to each node of the cluster. For each CSB, the **CSB list** displays the following information:

- Address of the CSB
- Name of the OpenVMS Cluster node it describes
- CSID associated with the node
- Number of votes (if any) provided by the node
- State of the CSB
- Status of the CSB

For information about the state and status of nodes, see the description of the ADD CLUSTER command of the SHOW CLUSTER utility in the *VSI OpenVMS System Management Utilities Reference Manual*.

The **cluster block** display includes information recorded in the cluster block (CLUB), including a list of activated flags, a summary of quorum and vote information, and other data that applies to the cluster from the perspective of the node for which the SDA is being run.

The **cluster failover control block** display provides detailed information concerning the cluster failover control block (CLUFCB). The **cluster quorum disk control block** display provides detailed information from the cluster quorum disk control block (CLUDCB).

Subsequent displays provide information for each CSB listed previously in the **CSB list** display. Each display shows the state and flags of a CSB, as well as other specific node information. (See the ADD MEMBER command of the SHOW CLUSTER utility in the *VSI OpenVMS System Management Utilities Reference Manual* for information about the flags for OpenVMS Cluster nodes.)

If any of the qualifiers /ADDRESS=*n*, /CSID=*csid*, or /NODE=*name* are specified, then the SHOW CLUSTER command displays only the information from the CSB of the specified node.

OpenVMS Cluster as Seen by the Port Driver

The SHOW CLUSTER/SCS command provides a series of displays.

The **SCS listening process directory** lists those processes that are listening for incoming SCS connect requests. For each of these processes, this display records the following information:

- Address of its directory entry
- Connection ID
- Name
- Explanatory information, if available

The **SCS systems summary** display provides the system block (SB) address, node name, system type, system ID, and the number of connection paths for each SCS system. An **SCS system** can be a OpenVMS Cluster member, storage controller, or other such device.

Subsequent displays provide detailed information for each of the system blocks and the associated path blocks. The system block displays include the maximum message and datagram sizes, local hardware and software data, and SCS poller information. Path block displays include information that describes the connection, including remote functions and other path-related data.

If the qualifier /CIRCUIT=*pb-addr* is specified, the SHOW CLUSTER command displays only the information from the specified path block.

Examples

1.
```
SDA> SHOW CLUSTER
OpenVMS Cluster data structures
               --- OpenVMS Cluster Summary ---
     Quorum   Votes   Quorum Disk Votes   Status Summary
     ------   -----   -----------------   --------------
        2       2           1             qf_dynvote,qf_vote,quorum
                    --- CSB list ---
Address   Node    CSID      Votes   State     Status
-------   ----    ----      -----   -----     ------
805FA780  FLAM5   00010006    0     local   member,qf_same,qf_noaccess
8062C400  ROMRDR  000100ED    1     open
 member,qf_same,qf_watcher,qf_active
8062C780  VANDQ1  000100EF    0     open    member,qf_same,qf_noaccess
             --- Cluster Block (CLUB) 805FA380 ---
Flags: 16080005 cluster,qf_dynvote,init,qf_vote,qf_newvote,quorum
Quorum/Votes                  2/2    Last transaction code         02
Quorum Disk Votes               1    Last trans. number           596
Nodes                           3    Last coordinator CSID    000100EF
Quorum Disk               $1$DIA0    Last time stamp       31-DEC-1992
Found Node SYSID     00000000FC03                             17:26:35
Founding Time          3-JAN-1993    Largest trans. id        00000254
                         21:04:21    Resource Alloc. retry           0
Index of next CSID           0007    Figure of Merit          00000000
Quorum Disk Cntrl Block  805FADC0    Member State Seq. Num        0203
Timer Entry Address      00000000    Foreign Cluster          00000000
CSP Queue                   empty
     --- Cluster Failover Control Block (CLUFCB) 805FA4C0 ---
Flags: 00000000
Failover Step Index      00000037    CSB of Synchr. System    8062C780
Failover Instance ID     00000254
     --- Cluster Quorum Disk Control Block (CLUDCB) 805FADC0 ---
State     : 0002 qs_rem_act
Flags     : 0100 qf_noaccess
CSP Flags : 0000
Iteration Counter               0            UCB address     00000000
Activity Counter                0            TQE address     805FAE00
Quorum file LBN          00000000            IRP address     00000000
                                             Watcher CSID    000100ED
     --- FLAM5 Cluster System Block (CSB) 805FA780 ---
State:  0B local
Flags:  070260AA
 member,qf_same,qf_noaccess,selected,local,status_rcvd,send_status
Cpblty: 00000000
```

```
SWVers: 7.0
HWName: DEC 3000 Model 400
Quorum/Votes       1/0    Next seq. number    0000    Send queue
 00000000
Quor. Disk Vote      1    Last seq num rcvd   0000    Resend queue
 00000000
CSID          00010006    Last ack. seq num   0000    Block xfer Q.
 805FA7D8
Eco/Version       0/23    Unacked messages       0    CDT address
 00000000
Reconn. time  00000000    Ack limit              0    PDT address
 00000000
Ref. count           2    Incarnation   1-JAN-1993    TQE address
 00000000
Ref. time  31-AUG-1992                    00:00:00    SB address
 80421580
              17:26:35    Lock mgr dir wgt       0    Current CDRP
 00000001
     --- ROMRDR Cluster System Block (CSB) 8062C400 ---
State:  01 open
Flags:  0202039A member,qf_same,cluster,qf_active,selected,status_rcvd
Cpblty: 00000000
SWVers: 7.0
HWName: DEC 3000 Model 400

Quorum/Votes       2/1    Next seq. number    B350    Send queue
 00000000
Quor. Disk Vote      1    Last seq num rcvd   E786    Resend queue
 00000000
CSID          000100ED    Last ack. seq num   B350    Block xfer Q.
 8062C458
Eco/Version       0/22    Unacked messages       1    CDT address
 805E8870
Reconn. time  00000000    Ack limit              3    PDT address
 80618400
Ref. count           2    Incarnation  19-AUG-1992    TQE address
 00000000
Ref. time  19-AUG-1992                    16:15:00    SB address
 8062C140
              16:17:08    Lock mgr dir wgt       0    Current CDRP
 00000000
     --- VANDQ1 Cluster System Block (CSB) 8062C780 ---
State:  01 open
Flags:  020261AA member,qf_same,qf_noaccess,cluster,selected,status_rcvd
Cpblty: 00000000
SWVers: 7.0
HWName: DEC 3000 Model 400
Quorum/Votes       1/0    Next seq. number    32B6    Send queue
 00000000
Quor. Disk Vote      1    Last seq num rcvd   A908    Resend queue
 00000000
CSID          000100EF    Last ack. seq num   32B6    Block xfer Q.
 8062C7D8
Eco/Version       0/23    Unacked messages       1    CDT address
 805E8710
Reconn. time  00000000    Ack limit              3    PDT address
 80618400
```

```
Ref. count           2    Incarnation  17-AUG-1992    TQE address
 00000000
Ref. time  19-AUG-1992                   15:37:06    SB address
 8062BCC0
              16:21:22    Lock mgr dir wgt       0    Current CDRP
 00000000
        --- SWPCTX Cluster System Block (CSB) 80D3B1C0 ---
State:  0B local
Flags:  030A60AA
 member,qf_same,qf_noaccess,selected,send_ext_status,local,status_rcvd
Cpblty: 00000037 rm8sec,vcc,dts,cwcreprc,threads
SWVers: V7.0
HWName: DEC 3000 Model 400
Quorum/Votes       1/1    Next seq. number    0000    Send queue
 00000000
Quor. Disk Vote      1    Last seq num rcvd   0000    Resend queue
 00000000
CSID          00010001    Last ack. seq num   0000    Block xfer Q.
 80D3B218
Eco/Version       0/26    Unacked messages       0    CDT address
 00000000
Reconn. time  00000000    Ack limit              0    PDT address
 00000000
Ref. count           2    Incarnation  12-JUL-1996    TQE address
 00000000
Ref. time  16-JUL-1996                   15:36:17    SB address
 80C50800
              16:15:48    Lock mgr dir wgt       0    Current CDRP
 00000001
```

This example illustrates the default output of the SHOW CLUSTER command.

2.

```
SDA> SHOW CLUSTER/SCS
OpenVMS Cluster data structures
--------------------------

                --- SCS Listening Process Directory ---

Entry Address     Connection ID     Process Name         Information
-------------     -------------     ------------         -----------

  80C71EC0          74D20000        SCS$DIRECTORY        Directory
 Server
  80C72100          74D20001        MSCP$TAPE            NOT PRESENT
 HERE
  80E16940          74D20002        MSCP$DISK            MSCP$DISK
  80E23B40          74D20003        VMS$SDA_AXP          Remote SDA
  80E23B40          74D20003        VMS$SDA_AXP          Remote SDA
  80E25540          74D20004        VMS$VAXcluster
  ................
  80E29E80          74D20005        SCA$TRANSPORT
  813020C0          74D20053        PATHWORKScluster
  .....TurboServer

                   --- SCS Systems Summary ---

  SB Address     Node      Type       System ID        Paths
  ----------     ----      ----       ---------        -----
```

```
  8493BC00      ARUSHA     VMS       000000004CA1         2
  80E23800      HSJ201     HSJ       4200101A1B20         1
  80E3FF40      ORNOT      VMS       000000004CA7         2
  80E43F40      LOADQ      VMS       000000004C31         2
  80E473C0      HSJ300     HSJ       420010051D20         1
  80E47CC0      HSJ101     HSJ       420010081720         1
  80E47D40      HSJ100     HSJ       4200100B1520         1
  80E478C0      HSJ600     HSJ       420010070920         1
  80E49180      HSJ401     HSJ       4200100D0320         1
  80E47DC0      HSJ301     HSJ       420010091F20         1
  80E47E40      HSJ601     HSJ       4200100A0B20         1
  80E49500      HSJ400     HSJ       4200100C0120         1
  80E5BF80      CHOBE      VMS       000000004CD6         2
  80E5F080      ETOSHA     VMS       000000004CF3         2
  80E5FC00      VMS        VMS       000000004C7A         2
  80E4FF80      HSJ501     HSJ       4200101C0720         1
  80E5FD80      HSJ200     HSJ       420010191920         1
  80E5FE80      HSJ500     HSJ       4200101B0520         1
  80E5FE00      IPL31      VMS       000000004F52         2
  80E59F80      ZAPNOT     VMS       000000004CBB         2
  80E61F80      ALTOS      VMS       000000004D0F         2
  80E72000      TSAVO      VMS       000000004CFE         2
  80ED5D00      SLYTHE     VMS       000000004DD1         1
  80EDDD00      AZSUN      VMS       000000004D56         1
  80EDDE00      CALSUN     VMS       000000004EA4         1
  80EDFC00      4X4TRK     VMS       00000000FF26         1
  80EE93C0      GNRS       VMS       00000000FC2B         1
  80EE94C0      IXIVIV     VMS       000000004E56         1
  80EF1A80      CLAIR      VMS       000000004CDF         1
  80EF1C00      INT4       VMS       00000000FD70         1
  80EFDF80      SCOP       VMS       00000000FC87         1
  80EFFAC0      MOCKUP     VMS       00000000FCD5         1

                    --- ARUSHA System Block (SB) 8493BC00 ---

System ID             000000004CA1    Local software type          VMS
Max message size               216    Local software vers.        V7.2
Max datagram size              576    Local software incarn.   DF4AC300
Local hardware type           ALPH                             009F7570
Local hardware vers. 000000000003    SCS poller timeout           5AD3
                      040400000000    SCS poller enable mask         27
Status:  00000000

                    --- Path Block (PB) 80E55F80 ---

                Status:  0020  credit

Remote sta. addr.     000000000016    Remote port type          00000010
Remote state                  ENAB    Number of data paths             2
Remote hardware rev.      00000008    Cables state             A-OK B-OK
Remote func. mask         ABFF0D00    Local state                   OPEN
Reseting port                   16    Port dev. name                PNA0
Handshake retry cnt.             2    SCS MSGBUF address        80E4C528
Msg. buf. wait queue      80E55FB8    PDT address               80E2A180

                    --- Path Block (PB) 80ED0900 ---
```

```
                Status:  0020  credit

Remote sta. addr.    0000000000DF    Remote port type                NI
Remote state                 ENAB    Number of data paths             2
Remote hardware rev.     00000104    Cables state             A-OK B-OK
Remote func. mask        83FF0180    Local state                   OPEN
Reseting port                  00    Port dev. name                PEA0
Handshake retry cnt.            3    SCS MSGBUF address        80ED19A0
Msg. buf. wait queue     80ED0938    PDT address               80EC3C70

   .
   .
   .
```

This example illustrates the output of the SHOW CLUSTER /SCS command.

4.35. SHOW CONNECTIONS

Displays information about all active connections between System Communications Services (SCS) processes or a single connection.

Format

SHOW CONNECTIONS [{/ADDRESS=cdt-address | /NODE=name | /SYSAP=name }]

Parameters

None.

Qualifiers

/ADDRESS=*cdt-address*

Displays information contained in the connection descriptor table (CDT) for a specific connection. You can find the *cdt-address* for any active connection on the system in the *CDT summary page* display of the SHOW CONNECTIONS command. In addition, CDT addresses are stored in many individual data structures related to SCS connections. These data structures include class driver request packets (CDRPs) and unit control blocks (UCBs) for class drivers that use SCS, and cluster system blocks (CSBs) for the connection manager.

/NODE=*name*

Displays all CDTs associated with the specified remote SCS node name.

/SYSAP=*name*

Displays all CDTs associated with the specified local SYSAP.

Description

The SHOW CONNECTIONS command provides a series of displays.

The **CDT summary page** lists information regarding each connection on the local system, including the following:

- CDT address
- Name of the local process with which the CDT is associated
- Connection ID
- Current state
- Name of the remote node (if any) to which it is currently connected

The **CDT summary page** concludes with a count of CDTs that are free and available to the system.

SHOW CONNECTIONS next displays a page of detailed information for each active CDT listed previously.

Example

1.
```
SDA> SHOW CONNECTIONS
                  --- CDT Summary Page ---
CDT Address    Local Process     Connection ID     State       Remote
 Node
-----------    -------------     -------------     -----
 -----------
 805E7ED0      SCS$DIRECTORY       FF120000        listen
 805E8030      MSCP$TAPE           FF120001        listen
 805E8190      VMS$VMScluster      FF120002        listen
 805E82F0      MSCP$DISK           FF120003        listen
 805E8450      SCA$TRANSPORT       FF120004        listen
 805E85B0      MSCP$DISK           FF150005        open         VANDQ1
 805E8710      VMS$VMScluster      FF120006        open         VANDQ1
 805E8870      VMS$VMScluster      FF120007        open         ROMRDR
 805E89D0      MSCP$DISK           FF120008        open         ROMRDR
 805E8C90      VMS$DISK_CL_DRVR    FF12000A        open         ROMRDR
 805E8DF0      VMS$DISK_CL_DRVR    FF12000B        open         VANDQ1
 805E8F50      VMS$TAPE_CL_DRVR    FF12000C        open         VANDQ1
Number of free CDT's:  188
          --- Connection Descriptor Table (CDT) 80C44850 ---
State:  0001 listen               Local Process:        MSCP$TAPE
Blocked State:  0000
Local Con. ID   899F0003    Datagrams sent         0    Message queue
 80C4488C
Remote Con. ID  00000000    Datagrams rcvd         0    Send Credit Q.
 80C44894
Receive Credit         0    Datagram discard       0    PB address
 00000000
Send Credit            0    Message Sends          0    PDT address
 00000000
Min. Rec. Credit       0    Message Recvs          0    Error Notify
 822FFCC0
Pend Rec. Credit       0    Mess Sends NoFP        0    Receive Buffer
 00000000
Initial Rec. Credit    0    Mess Recvs NoFP        0    Connect Data
 00000000
Rem. Sta.   000000000000    Send Data Init.        0    Aux. Structure
 00000000
Rej/Disconn Reason     0    Req Data Init.         0    Fast Recvmsg Rq
 00000000
```

```
Queued for BDLT        0    Bytes Sent            0    Fast Recvmsg PM
 00000000
Queued Send Credit     0    Bytes rcvd            0    Change Affinity
 00000000
                            Total bytes map       0
      --- Connection Descriptor Table (CDT) 805E8030 ---
State:  0001 listen           Local Process:        MSCP$TAPE
Blocked State:  0000
Local Con. ID   FF120001    Datagrams sent        0    Message queue
 805E8060
Remote Con. ID  00000000    Datagrams rcvd        0    Send Credit Q.
 805E8068
Receive Credit         0    Datagram discard      0    PB address
 00000000
Send Credit            0    Messages Sent         0    PDT address
 00000000
Min. Rec. Credit       0    Messages Rcvd.        0    Error Notify
 804540D0
Pend Rec. Credit       0    Send Data Init.       0    Receive Buffer
 00000000
Initial Rec. Credit    0    Req Data Init.        0    Connect Data
 00000000
Rem. Sta.   000000000000    Bytes Sent            0    Aux. Structure
 00000000
Rej/Disconn Reason     0    Bytes rcvd            0
Queued for BDLT        0    Total bytes map       0
Queued Send Credit     0
   .
   .
   .
```

This example shows the default output of the SHOW CONNECTIONS command.

4.36. SHOW CPU

When analyzing a dump, displays information about the state of a CPU at the time of the system failure. SHOW CPU is only valid when you are analyzing a crash dump. It is not a valid command when you are analyzing the running system, because all the CPU-specific information may not be available. If invoked when you are analyzing a running system, SHOW CPU will only list the CPU database address(es) for the specified CPU or all CPUs.

Format

SHOW CPU [cpu-id | /FIRST | /NEXT | /PRIMARY]

Parameter

cpu-id

Numeric value indicating the identity of the CPU for which context information is to be displayed. If you specify the **cpu-id** parameter, the SHOW CPU command performs an implicit SET CPU command, making the CPU indicated by **cpu-id** the current CPU for subsequent SDA commands.

If you do not specify a **cpu-id**, the state of the SDA current CPU is displayed.

If you specify the **cpu-id** of a CPU that was not active at the time of the system failure, SDA displays the following message:

```
%SDA-E-CPUNOTVLD, CPU not booted or CPU number out of range
```

See the description of the SET CPU command and Section 2.5 for information on how this can affect the CPU context---and process context---in which SDA commands execute.

Qualifiers

/FIRST

The state of the lowest numbered CPU (not necessarily the primary CPU) is displayed.

/NEXT

The state of the next higher numbered CPU is displayed. SDA skips CPUs not in the configuration at the time of system failure. If there are no further CPUs, SDA returns an error.

/PRIMARY

The state of the primary CPU is displayed.

Description

The SHOW CPU command displays system failure information about the CPU specified by **cpu-id** or, by default, the SDA current CPU, as defined in Section 2.5.

The SHOW CPU command produces several displays. The first display is a brief description of the system failure and its environment that includes the following:

- Reason for the bugcheck.
- Name of the currently executing process. If no process has been scheduled on this CPU, SDA displays the following message:

```
Process currently executing: no processes currently scheduled on the
 processor
```

- File specification of the image executing within the current process (if there is a current process).
- Interrupt priority level (IPL) of the CPU at the time of the system failure.
- The CPU database address.
- The CPU's capability set.
- On Integrity server systems, the Exception Frame Summary.

On Alpha, the **register display** follows. First the *general registers* are output, showing the contents of the CPU's integer registers (R0 to R30), and the AI, RA, PV, FP, PC, and PS at the time of the system failure.

The Alpha *processor registers* display consists of the following parts:

- Common processor registers

- Processor-specific registers
- Stack pointers

The first part of the processor registers display includes registers common to all Alpha processors, which are used by the operating system to maintain the current process virtual address space, system space, or other system functions. This part of the display includes the following registers:

- Hardware privileged context block base register (PCBB)
- System control block base register (SCBB)
- Software interrupt summary register (SISR)
- Address space number register (ASN)
- AST summary register (ASTSR)
- AST enable register (ASTEN)
- Interrupt priority level register (IPL)
- Processor priority level register (PRBR)
- Page table base register (PTBR)
- Virtual page table base register (VPTB)
- Floating-point control register (FPCR)
- Machine check error summary register (MCES)

On Integrity server systems, the *register display* is in the form of the contents of the exception frame generated by the bugcheck. See SHOW CRASH for more details.

The last part of the display includes the four stack pointers: the pointers of the kernel, executive, supervisor, and user stacks (KSP, ESP, SSP, and USP, respectively). In addition, on Integrity servers, the four register stack pointers are displayed: KBSP, EBSP, SBSP, UBSP.

The SHOW CPU command concludes with a listing of the spinlocks, if any, owned by the CPU at the time of the system failure, reproducing some of the information given by the SHOW SPINLOCKS command. The spinlock display includes the following information:

- Name of the spinlock.
- Address of the spinlock data structure (SPL).
- The owning CPU's CPU ID.
- IPL of the spinlock.
- Indication of the depth of this CPU's ownership of the spinlock. A number greater than 1 indicates that this CPU has nested acquisitions of the spinlock.
- Rank of the spinlock.

- Timeout interval for spinlock acquisition (in terms of 10 milliseconds).
- Shared array (shared spinlock context block pointers)

Examples

1.
```
SDA> SHOW CPU 0
CPU 00 Processor crash information
----------------------------------
CPU 00 reason for Bugcheck: CPUEXIT, Shutdown requested by another CPU

Process currently executing on this CPU:   None

Current IPL: 31  (decimal)

CPU database address:  81414000

CPUs Capabilities:    PRIMARY,QUORUM,RUN

General registers:

R0   = FFFFFFFF.81414000  R1   = FFFFFFFF.81414000  R2   =
 00000000.00000000
R3   = FFFFFFFF.810AD960  R4   = 00000000.01668E90  R5   =
 00000000.00000001
R6   = 66666666.66666666  R7   = 77777777.77777777  R8   =
 FFFFFFFF.814FB040
R9   = 99999999.99999999  R10  = FFFFFFFF.814FB0C0  R11  =
 BBBBBBBB.BBBBBBBB
R12  = CCCCCCCC.CCCCCCCC  R13  = FFFFFFFF.810AD960  R14  =
 FFFFFFFF.81414018
R15  = 00000000.00000004  R16  = 00000000.000006AC  R17  =
 00000000.00000047
R18  = 00000000.00000000  R19  = 00000000.00000000  R20  =
 FFFFFFFF.8051A494
R21  = 00000000.00000000  R22  = 00000000.00000001  R23  =
 00000000.00000010
R24  = FFFFFFFF.81414000  AI   = FFFFFFFF.81414000  RA   =
 FFFFFFFF.81006000
PV   = 00000001.FFFFFFFF  R28  = 00000000.00000000  FP   =
 FFFFFFFF.88ABDFD0
PC   = FFFFFFFF.8009C95C  PS   = 18000000.00001F04

Processor Internal Registers:

ASN  = 00000000.00000000                     ASTSR/ASTEN =
 00000000
IPL  =          0000001F  PCBB = 00000000.01014080  PRBR =
 FFFFFFFF.81414000
PTBR = 00000000.0000FFBF  SCBB = 00000000.000001E8  SISR =
 00000000.00000100
VPTB = FFFFFEFC.00000000  FPCR = 00000000.00000000  MCES =
 00000000.00000000

        KSP    = FFFFFFFF.88ABDCD8
        ESP    = FFFFFFFF.88ABF000
        SSP    = FFFFFFFF.88AB9000
        USP    = FFFFFFFF.88AB9000
```

```
                     Spinlocks currently owned by CPU 00

SCS                                    Address        810AF300
Owner CPU ID       00000000            IPL            00000008
Ownership Depth    00000000            Rank           0000001A
Timeout Interval   002DC6C0            Share Array    00000000
```

This example shows the default output of the SHOW CPU command on an Alpha system.

4.37. SHOW CRASH

Provides system information identifying a running system, or displays information about the state of the system at the time of a system failure.

Format

`SHOW CRASH [/ALL | /CPU=n]`

Parameters

None.

Qualifiers

/ALL

Displays exception data for all CPUs. By default, the registers (on Alpha) or exception frame contents (on Integrity servers) are omitted from the display for any CPUs with CPUEXIT or DBGCPUEXIT bugchecks.

/CPU=*n*

Allows exception data to be displayed from CPUs other than the one considered as the crash CPU when more than one CPU crashes simultaneously.

Description

The SHOW CRASH command has two different functions, depending on whether you use it to analyze a running system or a system failure.

When used during the analysis of a running system, the SHOW CRASH command produces a display that describes the system and the version of OpenVMS that it is running. The **system crash information** display contains the following information:

- Name and version number of the operating system
- Major and minor IDs of the operating system
- Identity of the OpenVMS system, including an indication of its cluster membership
- CPU ID of the primary CPU
- Address of all CPU databases

When used during the analysis of a system failure, the SHOW CRASH command produces several displays that identify the system and describe its state at the time of the failure.

If the current CPU context for SDA is not that of the processor that signaled the bugcheck, or the CPU specified with the /CPU=*n* qualifier, the SHOW CRASH command first performs an implicit SET CPU command to make that processor the current CPU for SDA. (See the description of the SET CPU command and Section 2.5 for a discussion of how this can affect the CPU context---and process context---in which SDA commands execute.)

The **system crash information** display in this context provides the following information:

- Date and time of the system failure.
- Name and version number of the operating system.
- Major and minor IDs of the operating system.
- Identity of the system.
- CPU IDs of both the primary CPU and the CPU that initiated the bugcheck. In a uniprocessor system, these IDs are identical.
- Bitmask of the active and available CPUs in the system.
- For each active processor in the system, the address of its CPU database and the name of the bugcheck that caused the system failure. Generally, there will be only one significant bugcheck in the system. All other processors typically display the following as their reason for taking a bugcheck:

  ```
  CPUEXIT, Shutdown requested by another CPU
  ```

Subsequent screens of the SHOW CRASH command display information about the state of each active processor on the system at the time of the system failure. The information in these screens is identical to that produced by the SHOW CPU command, including the registers (on Alpha), exception frame (on Integrity servers), stack pointers, and records of spinlock ownership. The first such screen presents information about the processor that caused the failure; others follow according to the numeric order of their CPU IDs. For the processor that caused the failure, if an exception bugcheck (INVEXCEPTN, SSRVEXCEPT, FATALEXCEPT, UNXSIGNAL) or, for Integrity servers only, also a KRNLSTAKNV or DEBUGCRASH bugcheck has occurred, SHOW CRASH first displays the exception frame from the original exception. If /ALL is not specified, the registers (on Alpha) or exception frame contents (on Integrity servers) are omitted from the display for any CPUs with CPUEXIT or DBGCPUEXIT bugchecks.

SHOW CRASH displays the original exception in process dumps.

Examples

1.
```
SDA> SHOW CRASH
Version of system: OpenVMS (TM) Alpha Operating System, Version X901-SSB

System Version Major ID/Minor ID: 3/0

VMScluster node: VMSTS6, a

Crash CPU ID/Primary CPU ID:  00/00

Bitmask of CPUs active/available:  00000001/00000001

CPU bugcheck codes:
        CPU 00 -- INVEXCEPTN, Exception while above ASTDEL
```

```
System State at Time of Exception
---------------------------------
Exception Frame:
----------------
        R2  = FFFFFFFF.810416C0  SCS$GA_LOCALSB+005C0
        R3  = FFFFFFFF.81007E60  EXE$GPL_HWRPB_L
        R4  = FFFFFFFF.850AEB80
        R5  = FFFFFFFF.81041330  SCS$GA_LOCALSB+00230
        R6  = FFFFFFFF.81038868  CON$INITLINE
        R7  = FFFFFFFF.81041330  SCS$GA_LOCALSB+00230
        PC  = FFFFFFFF.803EF81C  SYS$TTDRIVER+0F81C
        PS  = 30000000.00001F04

         FFFFFFFF.803EF80C:     STL             R24,#X0060(R5)
         FFFFFFFF.803EF810:     LDL             R28,#X0138(R5)
         FFFFFFFF.803EF814:     BIC             R28,R27,R28
         FFFFFFFF.803EF818:    00000138
   PC => FFFFFFFF.803EF81C:     HALT
         FFFFFFFF.803EF820:     HALT
         FFFFFFFF.803EF824:     BR              R31,#XFF0000
         FFFFFFFF.803EF828:     LDL             R24,#X0138(R5)
         FFFFFFFF.803EF82C:     BIC             R24,#X40,R24

   PS =>
         MBZ SPAL       MBZ     IPL VMM MBZ CURMOD INT PRVMOD de
           0   30   00000000000 1F  0   0    KERN   1   KERN

Signal Array
------------
        Length = 00000003
        Type   = 0000043C
        Arg    = FFFFFFFF.803EF81C  SYS$TTDRIVER+0F81C
        Arg    = 30000000.00001F04
%SYSTEM-F-OPCDEC, opcode reserved to Digital fault at
 PC=FFFFFFFF803EF81C, PS=00001F04

Saved Scratch Registers in Mechanism Array
------------------------------------------
R0   = 00000000.00000000  R1   = FFFFFFFF.811998B8  R16  =
 00000000.00001000
R17  = FFFFFFFF.8119B1F0  R18  = 00000000.00000010  R19  =
 FFFFFFFF.810194F0
R20  = 00000000.00000000  R21  = 0000000F.00000000  R22  =
 00000000.00000000
R23  = 00000000.00004000  R24  = 00000000.00001000  R25  =
 00000000.00000000
R26  = FFFFFFFF.81041474  R27  = 00000000.00004000  R28  =
 00000000.00001000

   .
   .
   .
                           (CPU-specific display omitted)
   .
   .
   .
```

This long display reflects the output of the SHOW CRASH command within the analysis of a system failure on an OpenVMS Alpha system.

2.
```
SDA> SHOW CRASH
System crash information
------------------------
Time of system crash: 12-OCT-2000 11:27:58.02

Version of system: OpenVMS (TM) Alpha Operating System, Version X74B-FT2

System Version Major ID/Minor ID: 3/0

System type: DEC 3000 Model 400

Crash CPU ID/Primary CPU ID:  00/00

Bitmask of CPUs active/available:  00000001/00000001

CPU bugcheck codes:
        CPU 00 -- PGFIPLHI, Pagefault with IPL too high

System State at Time of Page Fault:
-----------------------------------

Page fault for address 00000000.00046000 occurred at IPL: 8
Memory management flags: 00000000.00000001 (instruction fetch)

Exception Frame:
----------------
        R2  = 00000000.00000003
        R3  = FFFFFFFF.810B9280  EXCEPTION_MON+39C80
        R4  = FFFFFFFF.81564540  PCB
        R5  = 00000000.00000088
        R6  = 00000000.000458B0
        R7  = 00000000.7FFA1FC0
        PC  = 00000000.00046000
        PS  = 20000000.00000803

         00000000.00045FF0:     LDQ             R2,#X0050(FP)
         00000000.00045FF4:     LDQ             R12,#X0058(FP)
         00000000.00045FF8:     LDQ             R13,#X0060(FP)
         00000000.00045FFC:     LDQ             R14,#X0068(FP)
   PC => 00000000.00046000:     BIS             R1,R17,R1
         00000000.00046004:     BIS             R31,#X01,R25
         00000000.00046008:     STQ_U           R1,#X0002(R10)
         00000000.0004600C:     BSR             R26,#X00738C
         00000000.00046010:     LDQ_U           R16,#X0002(R10)

   PS =>
         MBZ SPAL      MBZ     IPL VMM MBZ CURMOD INT PRVMOD de
          0   20   00000000000 08   0   0   KERN   0   USER

   .
   .
   .
                                              (CPU-specific display omitted)
   .
```

```
.
.
```

This display reflects the output of a SHOW CRASH command within the analysis of a PGFIPLHI bugcheck on an OpenVMS Alpha system.

3.
```
SDA> SHOW CRASH /ALL
System crash information
------------------------

Time of system crash:  1-DEC-2003 13:31:10.50


Version of system: OpenVMS I64 Operating System, Version XA2T-J2S

System Version Major ID/Minor ID: 3/0


System type: HP rx2600  (900MHz/1.5MB)

Crash CPU ID/Primary CPU ID:  01/00

Bitmask of CPUs active/available:  00000003/00000003


CPU bugcheck codes:
        CPU 01 -- database address 8396DD80 -- SSRVEXCEPT, Unexpected
 system se

        1 other -- CPUEXIT, Shutdown requested by another CPU
                CPU 00 -- database address 83864000



System State at Time of Original Exception
------------------------------------------

Exception Frame at 00000000.7FF43BD0
------------------------------------

 IPL             =                00
 TRAP_TYPE       =          00000008 Access control violation fault
 IVT_OFFSET      =          00000800 Data TLB Fault
 IIP             =  00000000.00020120 SYS$K_VERSION_08+00100
 IIPA            =  00000000.00020110 SYS$K_VERSION_08+000F0
 IFA             =  00000000.00000000

 IPSR            =  00001010.0A0A6010

                    RT  TB  LP  DB  SI  DI  PP  SP  DFH DFL DT  PK  I
 IC  MFH MFL AC  BE  UP
                    1   0   1   0   0   0   0   0   1   0   1   0   1
 1   0   1   0   0   0
                    IA  BN  ED  RI  SS  DD  DA  ID  IT  MC  IS  CPL
                    0   1   0   0   0   0   0   0   1   0   0   0

 PREVSTACK       =                00
 BSP             =  00000000.7FF12240
```

```
BSPSTORE        =  00000000.7FF120C0
BSPBASE         =  00000000.7FF120C0
RNAT            =  00000000.00000000

RSC             =  00000000.00000003 LOADRS   BE   PL   MODE
                                     0000     0    0    Eager

PFS             =  00000000.00000B9F

                   PPL    PEC    RRB.PR   RRB.FR   RRB.GR     SOR
SOL            SOF
                   0       0.       0.       0.       0.       0.
23. (32-54)    31. (32-62)

FLAGS           =                00
STKALIGN        =          000002D0
PREDS           =  00000000.FF562AA3
IHA             =  FFFFFFFF.7FF3E120
INTERRUPT_DEPTH =                00

ISR             =  00000804.00000000


                   ED  EI  SO  NI  IR  RS  SP  NA  R   W   X   CODE
                   1   0   0   0   0   0   0   0   1   0   0   0000


ITIR            =  00000000.FFFF0934 KEY        PS
                                     FFFF09     0D

IFS             =  80000000.00000593


                   Valid         RRB.PR   RRB.FR   RRB.GR     SOR
SOL            SOF
                   1                0.       0.       0.       0.
11. (32-42)    19. (32-50)


B0              =  FFFFFFFF.80241AE0 AMAC$EMUL_CALL_NATIVE_C+00340
B1              =  80000000.FFD643B0
B2              =  00000000.00000000
B3              =  00000000.00000000
B4              =  00000000.00000000
B5              =  00000000.7FF43E38
B6              =  00000000.00020110 SYS$K_VERSION_08+000F0
B7              =  FFFFFFFF.80A28170 NSA$CHECK_PRIVILEGE_C

GP              =  00000000.00240000
R2              =  FFFFFFFF.839B8098 PSB+00058
R3              =  E0000000.00000068
R4              =  FFFFFFFF.839731C0 PCB
R5              =  00000000.00000008
R6              =  00000000.7FF43F40
R7              =  00000000.00000002
R8              =  00000000.00010000 SYS$K_VERSION_07
R9              =  00000000.00000020
R10             =  00000000.0000003E
```

```
R11             =  00000000.00000001

KSP             =  00000000.7FF43EA0

R13             =  00000000.00000000
R14             =  00000000.00040008 UCB$M_SUPMVMSG+00008
R15             =  00000000.00020110 SYS$K_VERSION_08+000F0
R16             =  FFFFFFFF.802417A0 AMAC$EMUL_CALL_NATIVE_C
R17             =  00000000.00010004 UCB$M_DELETEUCB+00004
R18             =  00000000.00040000 UCB$M_CHAN_TEAR_DOWN
R19             =  00000000.00040000 UCB$M_CHAN_TEAR_DOWN
R20             =  00000000.7FF43F38
R21             =  00000000.7FF43F80
R22             =  00000000.00040000 UCB$M_CHAN_TEAR_DOWN
R23             =  00000000.00000000
R24             =  00000000.00000000
R25             =  00000000.00000000
R26             =  00000000.00000000
R27             =  00000000.FF565663
R28             =  00000000.00000003
R29             =  00000000.7FF43EA0
R30             =  000007FD.C0000300
R31             =  FFFFFFFF.806549D0 PROCESS_MANAGEMENT_MON+677D0

R32             =  00000000.7AC9DBC0
R33             =  00000000.00000001
R34             =  00000000.7FFCF88C MMG$IMGHDRBUF+0008C
R35             =  FFFFFFFF.83973528 ARB+00230
R36             =  00000000.00000000
R37             =  00000000.00000000
R38             =  FFFFFFFF.80A28410 NSA$CHECK_PRIVILEGE_C+002A0
R39             =  00000000.00000915
R40             =  FFFFFFFF.82D01640 SYSTEM_PRIMITIVES+00221440
R41             =  00000000.00000B9F
R42             =  00000000.7FF43EA0

R43/OUT0        =  00000000.7FFCF87C MMG$IMGHDRBUF+0007C
R44/OUT1        =  E0000000.00000068
R45/OUT2        =  00000000.00000000
R46/OUT3        =  00000000.FF561663
R47/OUT4        =  00000000.7FFCDA68 CTL$AG_CLIDATA
R48/OUT5        =  00000000.7FFCDBE8 CTL$AG_CLIDATA+00180
R49/OUT6        =  00000000.00000003
R50/OUT7        =  FFFFFFFF.839731C0 PCB

NATMASK         =               003A
NATS            =  00000000.00000000
CSD             =  CFFFFFFF.00000000
SSD             =  CCCC0BAD.BAD0CCCC
LC              =  00000000.00000000
EC              =  00000000.00000000

FPSR            =  0009804C.0270033F SF3    SF2    SF1    SF0    TRAPS
                                     004C   004C   004E   000C   3F

F6              =  0FFC9.C0000000.00000000
F7              =  1003E.00000000.00000018
F8              =  1000B.FF000000.00000000
```

```
 F9              =  10007.A8000000.00000000
 F10             =  10003.C2492492.49249249
 F11             =  0FFF6.C30C30C3.0C30C30C

 PPREVMODE        =                03

Instruction Stream:
-------------------
                                   { .mfb
         SYS$K_VERSION_08+000E0:               nop.m       000000
                                               nop.f       000000
                                               br.ret.sptk.many b0 ;;
                                   }
                                   { .mii
         SYS$K_VERSION_08+000F0:               alloc       r41 =
 ar.pfs,  0B, 08, 00
                                               mov         r29 = r12
                                               mov         r42 = r12
                                   }
                                   { .mmi
   PC => SYS$K_VERSION_08+00100:               ld4         r24 =
 [r0] ;;
                                               nop.m       000000
                                               sxt4        r24 = r24 ;;
                                   }
                                   { .mii
         SYS$K_VERSION_08+00110:               nop.m       000000

                                               sxt4        r14 = r24 ;;
                                               cmp.eq      p6, p7 =
 r14, r0
                                   }
                                   { .mfb
         SYS$K_VERSION_08+00120:               nop.m       000000
                                               nop.f       000000
                                          (p6) br.cond.dpnt.few 0000060
                                   }

Signal Array
------------
        Length = 00000005
        Type   = 0000000C
        Arg    = 00000000.00000000
        Arg    = 00000000.00000000
        Arg    = 00000000.00020120
        Arg    = 00000000.00000003
%SYSTEM-F-ACCVIO, access violation, reason mask=00, virtual
 address=0000000000000000,
                                                   PC=0000000000020120,
 PS=00000003


CPU 01 Processor state at time of SSRVEXCEPT bugcheck
-----------------------------------------------------


CPU 01 reason for Bugcheck: SSRVEXCEPT, Unexpected system service
 exception
```

```
Process currently executing on this CPU: SYSTEM

Current image file: IPFEX3$DKB200:[SYS0.][SYSMGR]X.EXE;2

Current IPL: 0  (decimal)

CPU database address: 8396DD80

CPUs Capabilities:    QUORUM,RUN

Exception Frame at 00000000.7FF435B0
------------------------------------

    IPL             =                00
    TRAP_TYPE       =          00000041      Bugcheck Breakpoint Trap
    IVT_OFFSET      =          00002C00      Break Instruction
    IIP             =  FFFFFFFF.80491E90     EXCEPTION_MON+5E690
    IIPA            =  FFFFFFFF.80491E80     EXCEPTION_MON+5E680
    IFA             =  00000000.00030000     SYS$K_VERSION_01

.
.
.

    IIM             =  00000000.00100002     BREAK$C_SYS_BUGCHECK

    PPREVMODE       =                00

    KR0             =  00000000.00000000
    KR1             =  00000000.00000000
    KR2             =  00000000.00000000
    KR3             =  00000000.00000003
    KR4             =  00000000.00000000
    KR5 (Next Timer) =  000000BC.DEA95C24
    KR6 (CPUdb VA)   =  FFFFFFFF.8396DD80
    KR7 (Slot VA)    =  FFFFFFFF.86910000

    KSP             =  00000000.7FF43880
    ESP             =  00000000.7FF68000
    SSP             =  00000000.7FFAC000
    USP             =  00000000.7AC9DB60
                No spinlocks currently owned by CPU 01


CPU 00 Processor state at time of CPUEXIT bugcheck
--------------------------------------------------


CPU 00 reason for Bugcheck: CPUEXIT, Shutdown requested by another CPU
```

```
Process currently executing on this CPU:   None

Current IPL: 31  (decimal)


CPU database address: 83864000


CPUs Capabilities:    PRIMARY,QUORUM,RUN


Exception Frame at FFFFFFFF.8696F9F0
------------------------------------

    IPL              =                1F
    TRAP_TYPE        =          00000041      Bugcheck Breakpoint Trap
    IVT_OFFSET       =          00002C00      Break Instruction
    IIP              =  FFFFFFFF.802F62F0      SYSTEM_SYNCHRONIZATION
+43BF0
    IIPA             =  FFFFFFFF.802F62F0      SYSTEM_SYNCHRONIZATION
+43BF0
    IFA              =  FFFFFFFF.86A280C0

.
.
.

    IIM              =  00000000.00100002      BREAK$C_SYS_BUGCHECK

    PPREVMODE        =                00

    KR0              =  00000000.203D0000
    KR1              =  00000000.60000000
    KR2              =  00000000.00000000
    KR3              =  00000000.0001001F
    KR4              =  00000000.00000000
    KR5 (Next Timer) =  000000C4.FDFE03C8
    KR6 (CPUdb VA)   =  FFFFFFFF.83864000
    KR7 (Slot VA)    =  FFFFFFFF.8690F000

    KSP              =  FFFFFFFF.8696FCC0
    ESP              =  FFFFFFFF.86971000
    SSP              =  FFFFFFFF.86957000
    USP              =  FFFFFFFF.86957000

                No spinlocks currently owned by CPU 00
```

This example from an OpenVMS Integrity server system shows summary information on the crash: the time it occurred, its OpenVMS version, hardware type, and bugcheck codes. This is followed by the exception frame from the exception that triggered the crash, the instruction stream active at the time of the exception, and the signal array that describes the exception. The exception frame from the bugcheck triggered by the original exception is then displayed (that is, the bugcheck on the crash CPU) followed by the bugcheck exception frame for the other CPU in the system.

4.38. SHOW DEVICE

Displays a list of all devices in the system and their associated data structures, or displays the data structures associated with a given device or devices.

Format

```
SHOW DEVICE [ device-name[:] | /ADDRESS=ucb-address | /BITMAP | /CDT=cdt_addr
```

Parameters

device-name

Device or devices for which data structures are to be displayed. The following table lists several uses of the **device-name** parameter:

To display the structures for:	Take the following action:
All devices in the system	Do not specify a **device-name** (for example, SHOW DEVICE).
A single device	Specify an entire **device-name** (for example, SHOW DEVICE VTA20).
All devices of a certain type on a single controller	Specify only the device type and controller designation (for example, SHOW DEVICE RTA or SHOW DEVICE RTB).
All devices of a certain type on any controller	Specify only the devicetype (for example, SHOW DEVICE RT).
All devices whose names begin with a certain character or character string	Specify the character or character string (for example, SHOW DEVICE D).
All devices on a single node or HSC	Specify only the node name or HSC name (for example, SHOW DEVICE GREEN$).
All devices with a certain allocation class	Specify the allocation class including leading and trailing $, for example, SHOW DEVICE 63.

A colon (:) at the end of a device name is optional.

Note

All qualifiers specific to Memory Channel (CHANNELS, HOMEPAGE, and PDT) are disabled for OpenVMS Integrity server systems.

Qualifiers

/ADDRESS=ucb-address

Indicates the device for which data structure information is to be displayed by the address of its unit control block (UCB). The /ADDRESS qualifier is an alternate method of supplying a device name to the SHOW DEVICE command. If both the device-name parameter and the /ADDRESS qualifier appear in a single SHOW DEVICE command, SDA responds only to the parameter or qualifier that appears first. /ADDRESS is functionally equivalent to /UCB.

/BITMAP

Displays information about data structures related to Write Bitmap (WBM). Bitmaps are used by Host-Base Volume Shadowing (HBVS) for the implementation of Mini Copy and Host-Based Minimerge (HBMM). If the /BITMAP qualifier is specified with a device that is not an HBVS virtual unit, the error NOSUCHDEV is returned

A device name must be specified. If SHOW DEVICE/BITMAP DSis entered, bitmaps for all HBVS virtual units are displayed.

/CDT=cdt_address

Identifies the device by the address of its Connector Descriptor Table (CDT). This applies to cluster port devices only.

/CHANNELS

Displays information on active Memory Channel channel blocks. This qualifier is ignored for devices other than Memory Channel.

/HOMEPAGE

Displays fields from the Memory Channel Home Page. This qualifier is ignored for devices other than Memory Channel.

/PDT

Displays the Memory Channel Port Descriptor Table. This qualifier is ignored for devices other than Memory Channel.

/UCB=ucb-address

See the description of /ADDRESS, which is functionally equivalent to /UCB.

Description

The SHOW DEVICE command produces several displays taken from system data structures that describe the devices in the system configuration.

If you use the SHOW DEVICE command to display information for more than one device or one or more controllers, it initially produces the **device data block (DDB) list** to provide a brief summary of the devices for which it renders information in subsequent screens.

Information in the **DDB list** appears in five columns, the contents of which are as follows:

- Address of the device data block (DDB)
- Controller name
- Name of the ancillary control process (ACP) associated with the device

- Name of the device driver
- Address of the driver prologue table (DPT)

The SHOW DEVICE command then produces a display of information pertinent to the device controller. This display includes information gathered from the following structures:

- Device data block (DDB)
- Primary channel request block (CRB)
- Interrupt dispatch block (IDB)
- Driver dispatch table (DDT)

If the controller is an HSC controller, SHOW DEVICE also displays information from its system block (SB) and each path block (PB).

Many of these structures contain pointers to other structures and driver routines. Most notably, the DDT display points to various routines located within driver code, such as the start I/O routine, unit initialization routine, and cancel I/O routine.

For each device unit subject to the SHOW DEVICE command, SDA displays information taken from its unit control block, including a list of all I/O request packets (IRPs) in its I/O request queue. For certain mass storage devices, SHOW DEVICE also displays information from the primary class driver data block (CDDB), the volume control block (VCB), and the ACP queue block (AQB). For units that are part of a shadow set, SDA displays a summary of shadow set membership.

As it displays information for a given device unit, SHOW DEVICE defines the symbols of the table below as appropriate:

Symbol	Meaning
UCB	Address of unit control block
SB	Address of system block
ORB	Address of object rights block
DDB	Address of device data block
DDT	Address of driver dispatch table
CRB	Address of channel request block
SUD	Address of supplementary VCB data
SHAD	Address of host-based shadowing data structure
AMB	Associated mailbox UCB pointer
IRP	Address of I/O request packet
2P_UCB	Address of alternate UCB for dual-pathed device
LNM	Address of logical name block for mailbox
PDT	Address of port descriptor table
CDDB	Address of class driver descriptor block for MSCP served device
2P_CDDB	Address of alternate CDDB for MSCP served device

Symbol	Meaning
RWAITCNT	Resource wait count for MSCP served device
VCB	Address of volume control block for mounted device
2P_DDB	Address of secondary DDB
VP_IRP	Address of volume processing IRP
MMB	Address of merge management block
CPYLOCK	ID of copier lock
VU_TO	Virtual Unit Timeout (seconds)
VU_UCB	UCB address of Virtual Unit
MPDEV	Address of multipath data structure
PRIMARY_UCB	UCB address for primary path
CURRENT_UCB	UCB address for current path

If you are examining a driver-related system failure, you may find it helpful to issue a SHOW STACK command after the appropriate SHOW DEVICE command, to examine the stack for any of these symbols. Note, however, that although the SHOW DEVICE command defines those symbols relevant to the last device unit it has displayed, and redefines symbols relevant to any subsequently displayed device unit, it does not undefine symbols. (For instance, SHOW DEVICE DUA0 defines the symbol PDT, but SHOW DEVICE MBA0 does not undefine it, even though the PDT structure is not associated with a mailbox device.) To maintain the accuracy of such symbols that appear in the stack listing, use the DEFINE command to modify the symbol name. For example:

```
SDA> DEFINE DUA0_PDT PDT
SDA> DEFINE MBA0_UCB UCB
```

See the descriptions of the READ and FORMAT commands for additional information on defining and examining the contents of device data structures.

Examples

1.
```
SDA> SHOW DEVICE/ADDRESS=8041E540
OPA0                                   VT300_Series       UCB address
 8041E540

Device status:   00000010 online
Characteristics: 0C040007 rec,ccl,trm,avl,idv,odv
                 00000200 nnm
Owner UIC [000001 ,000004]  Operation count        160    ORB address
 8041E4E8
      PID         00010008  Error count              0    DDB address
 8041E3F8
Class/Type           42/70  Reference count          2    DDT address
 8041E438
Def. buf. size          80  BOFF              00000001    CRB address
 8041E740
DEVDEPEND         180093A0  Byte count        0000012C    I/O wait queue
 8041E5AC
DEVDEPND2         FB101000  SVAPTE            80537B80
DEVDEPND3         00000000  DEVSTS            00000001
FLCK index              3A
```

```
DLCK address       8041E880
*** I/O request queue is empty ***
```

This example reproduces the SHOW DEVICE display for a single device unit, OPA0. Whereas this display lists information from the UCB for OPA0, including some addresses of key data structures and a list of pending I/O requests for the unit, it does not display information about the controller or its device driver. To display the latter information, specify the device-name as OPA (for example, SHOW DEVICE OPA).

2.
```
SDA>  SHOW DEVICE DU
I/O data structures
-------------------
                            DDB list
                            --------

       Address    Controller     ACP         Driver               DPT
       -------    ----------   --------    ------------           ---

      80D0B3C0    BLUES$DUA     F11XQP    SYS$DKDRIVER          807735B0
      8000B2B8    RED$DUA       F11XQP    SYS$DKDRIVER          807735B0
      80D08BA0    BIGTOP$DUA    F11XQP    SYS$DKDRIVER          807735B0
      80D08AE0    TIMEIN$DUA    F11XQP    SYS$DKDRIVER          807735B0
   .
   .
   .
Press RETURN for more.
   .
   .
   .
```

This excerpt from the output of the SHOW DEVICE DU command illustrates the format of the DDB list. In this case, the DDB list concerns itself with those devices whose device type begins with DU. It displays devices of these types attached to various HSCs (RED$ and BLUES$) and systems in a cluster (BIGTOP$ and TIMEIN$).

4.39. SHOW DUMP

Displays formatted information from the header, error log buffers, logical memory blocks (LMBs), memory map, compression data, and a summary of the dump. Also displays hexadecimal information of individual blocks.

Format

SHOW DUMP [/ALL

| /BLOCK[=m [{:|;}n]]

| /COLLECTION [= {ALL|n}]

| /COMPRESSION_MAP [=m [:n[:p[{:|;}q]]]]

| /ERROR_LOGS

| /FILE = {COLLECTION | DUMP [=n]}

| /HEADER

| /LMB [= {ALL|n}]

| /MEMORY_MAP

| /SUMMARY]

Parameters

None.

Qualifiers

/ALL

Displays the equivalent to specifying all the /SUMMARY, /HEADER, /ERROR_LOGS, / COMPRESSION_MAP, /LMB=ALL, /MEMORY_MAP, and /COLLECTION qualifiers.

/BLOCK [=*m* [{:|;}*n*]]

Displays a hexadecimal dump of one or more blocks. You can specify ranges by using the following syntax:

no value	Displays next block
m	Displays single block
m:n	Displays a range of blocks from *m* to *n*, inclusive
m;n	Displays a range of blocks starting at *m* and continuing for *n* blocks

/COLLECTION [= {ALL|*n*}]

Displays the contents of the file identification or unwind data collection (on Integrity servers only) appended to a copy of the dump using COPY/COLLECT or written to a separate collection file using COLLECT/SAVE. By default, a summary of the collection is displayed. You can specify that the details of a single entry or all entries are to be displayed. *n* is the start block number of the collection entry, as displayed in the collection summary.

/COMPRESSION_MAP [=*m* [:*n*[:*p*[{:|;}*q*]]]]

In a compressed dump, displays details of the compression data. You can specify levels of detail by using the following syntax, where m,n,p,q may each be wildcarded (*):

no value	Displays a summary of all compression map blocks.
m	Displays contents of a single compression map block.
m:n	Displays details of single compression map entry.
m:n:p	Displays compressed and raw data for the specified compression section (item *p* in section

	m:n). Note that *m:n:p* may contain wildcards (*).
m:n:p:q	Displays compressed and raw data for the specified range of compression sections (items *p* to *q* inclusive in section *m:n*).
m:n:p;q	Displays compressed and raw data for the specified range of compression sections (*q* items starting from item *p* in section *m:n*).

/ERROR_LOGS

Displays a summary of the error log buffers.

/FILE = {COLLECTION | DUMP [=*n*]}

If analyzing multiple dump files from a partial dump copy, or if a separate collection file is in use, the /FILE qualifier indicates whether the SHOW DUMP command applies to one of the dump files or to the collection file.

If /FILE is not specified, by default, the SHOW DUMP/SUMMARY, SHOW DUMP/HEADER, SHOW DUMP/COLLECTION, and SHOW DUMP/ALL commands apply to all open files, and the SHOW DUMP/LMB=ALL and SHOW DUMP/COMPRESSION commands apply to all open dump files. If /FILE=DUMP is specified without a file number, then these commands apply to the primary dump file.

By default, SHOW DUMP/BLOCK applies to the primary dump file. By default, SHOW DUMP/LMB=n and SHOW DUMP/COMPRESSION=n apply to the primary dump file or to the dump file for which the command was last used.

All other qualifiers are applicable only to the primary dump file.

/HEADER

Displays the formatted contents of the dump header.

/LMB[= {ALL|*n*}]

In a selective dump, displays the formatted contents of logical memory block (LMB) headers and the virtual address (VA) ranges within the LMB. You can specify the LMBs to be displayed by using the following syntax:

no value	Displays next LMB
n	Displays LMB at block *n* of the dump
ALL	Displays all LMBs

/MEMORY_MAP

In a full dump, displays the contents of the memory map.

/SUMMARY

Displays a summary of the dump. This is the default.

Description

The SHOW DUMP command displays information about the structure of the dump file. It displays the header, the error log buffers, and, if appropriate, the compression map, the logical memory block (LMB) headers, the memory map, the file identification collection, and the unwind data collection (on Integrity server systems only). Use this command when troubleshooting dump analysis problems.

Examples

1.
```
SDA> SHOW DUMP/SUMMARY
Summary of dump file DKA300:[SYS0.SYSEXE]SYSDUMP.DMP;8
------------------------------------------------------
Dump type:                    Compressed selective
Size of dump file:            000203A0/000203A0 (132000./132000.)
Highest VBN written:          0000D407          (54279.)
Uncompressed equivalent:      0001AF1C          (110364.)
Compression ratio:            2.03:1            (49.2%)



 Uncomp    Uncomp
                      Dump file section            VBN     Blocks
 VBN     blocks
----------------------------------------------  ---------- --------
 -------  --------
Dump header                                      00000001 00000002
Error log buffers                                00000003 00000020
Compression map                                  00000023 00000010
LMB 0000 (PT space)                              00000033 00000038
 00000033 000000D2
LMB 0001 (S0/S1 space)                           0000006B 0000621B
 00000105 000095A5
LMB 0002 (S2 space)                              00006286 000001A3
 000096AA 00000352
LMB 0003 (Page tables of key process "SYSTEM")   00006429 00000005
 000099FC 00000062
LMB 0004 (Memory of key process "SYSTEM")        0000642E 00000071
 00009A5E 00000342
   .
   .
   .
LMB 0003 (Page tables of key process "NETACP")   0000697B 00000009
 0000AE14 00000052
LMB 0004 (Memory of key process "NETACP")        00006984 000013F7
 0000AE66 00001F42
LMB 0005 (Key global pages)                      00007D7B 000002BA
 0000CDA8 00000312
LMB 0006 (Page tables of process "DTWM")         00008035 00000013
 0000D0BA 00000082
LMB 0007 (Memory of process "DTWM")              00008048 000013A3
 0000D13C 000022E4
   .
   .
   .
LMB 0006 (Page tables of process "Milord_FTA1:")  0000C5E3 00000005
 00019A44 00000062
```

```
LMB 0007 (Memory of process "Milord_FTA1:")       0000C5E8 00000074
 00019AA6 00000222
LMB 0008 (Remaining global pages)                 0000C65C 00000DAC
 00019CC8 00001255
```

This example of the SHOW DUMP/SUMMARY command gives a summary of a selective dump.

2.
```
SDA> SHOW DUMP/HEADER
Dump header
-----------
    Header field                      Meaning
 Value
--------------------  ---------------------------------------
 -----------------
DMP$W_FLAGS           Flags
    0FC1
                       DMP$V_OLDDUMP:    Dump has been analyzed
                       DMP$V_WRITECOMP:  Dump write was completed
                       DMP$V_ERRLOGCOMP: Error log buffers written
                       DMP$V_DUMP_STYLE: Selective dump
                                         Verbose messages
                                         Dump off system disk
                                         Compressed
DMP$B_FLAGS2          Additional flags
      09
                       DMP$V_COMPRESSED: Dump is compressed
                       DMP$V_ALPHADUMP:  This is an OpenVMS Alpha dump
DMP$Q_SYSIDENT        System version
 "X69G-FT1"
DMP$Q_LINKTIME        Base image link date/time        " 8-JUN-1996
 02:07:27.31"
DMP$L_SYSVER          Base image version
 03000000
DMP$W_DUMPVER         Dump version
    0704
DMP$L_DUMPBLOCKCNT    Count of blocks dumped for memory
 0000D3D5
DMP$L_NOCOMPBLOCKCNT  Uncompressed blocks dumped for memory
 0001AEEA
DMP$L_SAVEPRCCNT      Number of processes saved
 00000014
   .
   .
   .
EMB$Q_CR_TIME         Crash date/time                  " 3-JUL-1996
 09:30:13.36"
EMB$L_CR_CODE         Bugcheck code
 "SSRVEXCEPT"
EMB$B_CR_SCS_NAME     Node name
 "SWPCTX  "
EMB$T_CR_HW_NAME      Model name                            "DEC 3000
 Model 400"
EMB$T_CR_LNAME        Process name
 "SYSTEM"
DMP$L_CHECKSUM        Dump header checksum
 439E5E91
```

This example of the SHOW DUMP/HEADER command shows the information in the header.

3.
```
SDA> SHOW DUMP/COLLECTION

File and unwind data collection
-------------------------------

Collection start VBN:     0002155B
Collection end VBN:       00022071
Collection block count:   00000B17

  VBN       Blocks        Contents
--------   --------   ------------------------------
0002155B   000000C1   Unwind data segment 00000001 of _$30$DKB200:[VMS
$COMMON.SYSEXE]DCL.EXE;1
0002161C   00000001   Unwind data segment 00000001 of _$30$DKB200:[VMS
$COMMON.SYSEXE]USB$UC...
0002161D   0000000C   Unwind data segment 00000008 of _$30$DKB200:[VMS
$COMMON.SYSEXE]USB$UC...
.
.
.
0002200F   0000001F   Unwind data segment 00000007 of _$30$DKB200:[VMS
$COMMON.SYSEXE]LATACP...
0002202E   00000006   Unwind data segment 0000000B of _$30$DKB200:[VMS
$COMMON.SYSEXE]LATACP...
00022034   00000001   Unwind data segment 00000002 of _$30$DKB200:
[BISHOP]CMEXEC_LOOP.EXE;1
00022035   00000001   File data for _$30$DKA0:
00022036   0000003B   File data for _$30$DKB200:
00022071   00000001   Disk data
```

This example of the SHOW DUMP/COLLECTION command shows the contents of the file identification and unwind data collection appended to a system dump when it was copied using the SDA command COPY/COLLECT. Note that unwind data segments are found only in system dumps taken on OpenVMS Integrity server systems.

4.40. SHOW EFI (Integrity servers Only)

Displays information from the Extensible Firmware Interface (EFI) data structures. Currently, the only display provided by SDA is the EFI memory map.

Format

SHOW EFI /MEMMAP [=ALL] [*range*]

Parameters

range

The entry or range of entries to be displayed, expressed using the following syntax:

m	Displays entry *m*
m:n	Displays the entries from *m* to *n*
m;n	Displays *n* entries starting at *m*

You cannot specify a range with /MEMMAP=ALL.

Qualifiers

/MEMMAP [=ALL]

Displays the EFI memory map. This qualifier is required. By default, only entries in the EFI memory map with the RUNTIME attribute are displayed. If /MEMMAP=ALL is specified, all entries are displayed.

You cannot specify /MEMMAP=ALL and also supply a range of entries to be displayed.

Description

SDA locates the EFI memory map in the system or dump and displays the contents. If no range is given, SDA also displays information about the location and size of the memory map.

Examples

1.
```
SDA> SHOW EFI/MEMMAP

EFI Memory Map
--------------

Memory map address:            FFFFF802.06402000
Entry count:                            00000025
Size of entry:                          00000030

Entry        Memory Type       Physical Address    Virtual Address
 Pages (4KB)        Attributes
-----  ----------------------  -----------------  -----------------
 -----------------  -----------------
 0003  Runtime_Services_Code   00000000.000C0000  FFFFF802.00000000
 00000000.00000040  80000000.00000001  UC  Runtime
 0016  Runtime_Services_Data   00000000.3F048000  FFFFF802.00040000
 00000000.00000304  80000000.00000008  UCE Runtime
 0017  Runtime_Services_Code   00000000.3F34C000  FFFFF802.00344000
 00000000.0000003C  80000000.00000008  UCE Runtime
 0019  Runtime_Services_Data   00000000.3F3E2000  FFFFF802.00380000
 00000000.00000012  80000000.00000008  UCE Runtime
 001A  Runtime_Services_Code   00000000.3F3F4000  FFFFF802.00392000
 00000000.0000006E  80000000.00000008  UCE Runtime
 001B  Runtime_Services_Data   00000000.3F462000  FFFFF802.00400000
 00000000.00000182  80000000.00000008  UCE Runtime
 001C  Runtime_Services_Code   00000000.3F5E4000  FFFFF802.00582000
 00000000.000004DC  80000000.00000008  UCE Runtime
 001D  PAL_Code                00000000.3FAC0000  FFFFF802.00A80000
 00000000.00000040  80000000.00000008  UCE Runtime
 0020  Runtime_Services_Data   00000000.3FB38000  FFFFF802.00AC0000
 00000000.000004C8  80000000.00000008  UCE Runtime
 0022  Memory_Mapped_IO        00000000.FED00000  FFFFF802.01000000
 00000000.00001300  80000000.00000001  UC  Runtime
 0024  Mem_Map_IO_Port_Space   0003FFFF.FC000000  FFFFF802.02400000
 00000000.00004000  80000000.00000001  UC  Runtime
```

This example shows a typical display from the SHOW EFI/MEMMAP command.

4.41. SHOW EXCEPTION_FRAME

Displays the contents of the exception frame at the given address or searches to display a one-line summary of all exception frames found on all applicable stacks.

Format

`SHOW EXCEPTION_FRAME {address | [/SUMMARY] [range]}`

Parameter

address

Address of the exception frame.

range

Range of addresses specifiable as *start:end* or *start;length*.

Qualifier

/SUMMARY (D)

- The /SUMMARY qualifier is the default.
- SHOW EXCEPTION and SHOW EXCEPTION *range* imply /SUMMARY.
- If a range, either *start:end* or *start;length*, is given, then that range is searched instead of the stacks.

Description

Displays the contents of the exception frame at the given address (which is rounded down to an octaword-aligned address), or searches to display a one-line summary of all exception frames found on all applicable stacks.

Under some circumstances, the exception frame of the actual bugcheck is copied (by BUGCHECK) to the system stack for the CPU. Since this stack is also searched, multiple hits may occur for this exception frame.

On Alpha, the search for exception frames relies on valid processor status (PS) values in the PS offset from each possible 64-byte-aligned start address for an exception frame. Since only some of the bits in the PS can be validated, there may be frames displayed that are not exception frames (false positives). Do not assume that each frame displayed is actually an exception frame without further investigation.

On Integrity servers, the search for exception frames is focused on the type/subtype offsets from each possible octaword-aligned start address for an exception frame. Thus, it is likely that frames displayed are exception frames.

Examples

1.
```
SDA>  SHOW EXCEPTION
Exception Frame Summary
-----------------------
```

```
 Exception Frame  Type            Stack   IIP / Ret_Addr   Trap_Type /
 Service_Number
----------------- ----            -----  -----------------
 --------------------------
00000000.7FF43540 ORIGINAL_INTSTK Kernel FFFFFFFF.8048DB70 00000041
 Bugcheck Breakpoint Trap
00000000.7FF43BA0 INTSTK          Kernel 00000000.00020200 00000008
 Access control violation fault
00000000.7FF43F40 SSENTRY         Kernel 00000000.00020090 01000019 SYS
$CMKRNL
```

The SHOW EXCEPTION_FRAME command example displays the summary.

Examples of the display of the contents of an exception frame are available in the SHOW CRASH description.

4.42. SHOW EXECUTIVE

Displays the location and size of each loadable image that makes up the executive.

Format

SHOW EXECUTIVE [execlet-name | /ALL | /SUMMARY (D)]

Parameter

execlet-name

Displays detailed data for the specified loadable image only. If you use wildcards in **execlet-name**, SDA displays detailed data for all matching loadable images.

If the command is specified with no parameter or qualifier, the default is to display one line of data for each loadable image.

Qualifiers

/ALL

Displays detailed data for all loadable images.

/SUMMARY

Displays a single line of data for all loadable images. This is the default.

Description

The executive consists of two base images and a number of other executive images.

The base image called SYS$BASE_IMAGE.EXE contains:

- Symbol vectors for universal executive routines and data cells
- Procedure descriptors for universal executive routines
- Globally referenced data cells

The base image called SYS$PUBLIC_VECTORS.EXE contains:

- Symbol vectors for system service procedures
- Procedure descriptors for system services
- Transfer routines for system services

The base images are the pathways to routines and system service procedures in the other executive images.

The SHOW EXECUTIVE command lists the location and size of each executive image with other information such as link date and time. It can enable you to determine whether a given memory address falls within the range occupied by a particular image. (Table 4.1 describes the contents of each executive image.)

SHOW EXECUTIVE also displays the base address and length for each nonzero length image section.

On OpenVMS Alpha the execlets can be sliced; on OpenVMS Integrity servers all execlets are sliced. This means each different image section can be relocated in system memory so that the sections are no longer contiguous. The SHOW EXECUTIVE display contains information on where each image section resides.

The difference between a sliced image and a non-sliced image in the display is that the base, the end, and the length of a sliced image are blank. Only the image section base, end, and length are valid.

On Alpha, there are six different image section types: nonpaged read only, nonpaged read-write, paged read only, paged read-write, init, and fixup. Each section type can occur only once. Only the image sections loaded into system memory are displayed.

On Integrity servers, there are six different image section types: code, short data, read-only data, read-write data, init, and fixup. Some section types can occur more than once. Only the image sections loaded into system memory are displayed.

The MAP command makes it easier to find out in which execlet an address resides. See the description of the MAP command for details.

By default, SDA displays each location within an executive image as an offset from the beginning of the image, for instance, EXCEPTION+00282. Similarly, those symbols that represent system services point to the transfer routine in SYS$PUBLIC_VECTORS.EXE and not to the actual system service procedure. When tracing the course of a system failure through the listings of modules contained within a given executive image, you may find it useful to load into the SDA symbol table all global symbols and global entry points defined within one or all executive images. See the description of the READ command for additional information.

The SHOW EXECUTIVE command usually shows all components of the executive, as illustrated in the following example. In rare circumstances, you may obtain a partial listing. For instance, after it has loaded the EXCEPTION module (in the INIT phase of system initialization), the system can successfully post a bugcheck exception and save a crash dump before loading all the executive images that are normally loaded.

Examples

1.
```
SDA> SHOW EXECUTIVE
VMS Executive layout summary
----------------------------
```

```
Image           LDRIMG   SeqNum        Base              End
  Length        SymVec
-------------- -------- -------- ----------------- -----------------
 ----------------- --------
SYS$MADDRIVER  8161BCC0 00000094 FFFFFFFF.837C2000 FFFFFFFF.837DDFFF
 00000000.0001C000
SYS$DADDRIVER  8161AB80 00000092 FFFFFFFF.82238000 FFFFFFFF.82247FFF
 00000000.00010000
SYS$LASTDRIVER 81617540 00000090 FFFFFFFF.813DA000 FFFFFFFF.813F5FFF
 00000000.0001C000
SYS$LTDRIVER   81611B40 0000008E FFFFFFFF.813A2000 FFFFFFFF.813D9FFF
 00000000.00038000
LAT$RATING     81611440 0000008C FFFFFFFF.8139A000 FFFFFFFF.813A1FFF
 00000000.00008000
PWIPDRIVER     8160B440 0000008A FFFFFFFF.81386000 FFFFFFFF.81399FFF
 00000000.00014000
  .
  .
  .
ERRORLOG               814195C0 00000014 --< sliced >--
SYSTEM_SYNCHRONIZATION 81418840 00000012 --< sliced >--
SYSTEM_PRIMITIVES      81417AC0 00000010 --< sliced >--
SYSTEM_DEBUG           81416D40 0000000E FFFFFFFF.83382000
 FFFFFFFF.833E5FFF 00000000.00064000
SYS$OPDRIVER           81415FC0 0000000C --< sliced >--
SYS$ESBTDRIVER         81415240 0000000A --< sliced >--
```

The SHOW EXECUTIVE command displays a summary list of the executive images. The display has been moved left to fit within the page boundaries of the manual.

2.
```
SDA> SHOW EXECUTIVE EX*
VMS Executive layout
--------------------


Image                    Base              End               Length
  ImageOff  SymVec
------------------  ----------------- -----------------
 ----------------- -------- --------
EXCEPTION_MON
 Data (read/write)  FFFFFFFF.841BAC00 FFFFFFFF.841BAC13
 00000000.00000014 00010000
 Data (read/write)  FFFFFFFF.841BAE00 FFFFFFFF.841BAE03
 00000000.00000004 00014000
 Code               FFFFFFFF.8041E600 FFFFFFFF.80508D5F
 00000000.000EA760 00018000
 Data (read only)   FFFFFFFF.841BB000 FFFFFFFF.841C278F
 00000000.00007790 00104000
 Data (read/write)  FFFFFFFF.841C2800 FFFFFFFF.841D049F
 00000000.0000DCA0 0010C000
 Data (read/write)  FFFFFFFF.841D0600 FFFFFFFF.841D0613
 00000000.00000014 0011C000
 Data (read only)   FFFFFFFF.841D0800 FFFFFFFF.841D7D93
 00000000.00007594 00120000
 Short data         FFFFFFFF.841D7E00 FFFFFFFF.841DF247
 00000000.00007448 00130000
```

```
 Linked  2-APR-2004 13:08  LDRIMG 84891900   SeqNum 00000022       GP
FFFFFFFF.843D7E00

EXEC_INIT
 Code               FFFFFFFF.80327700 FFFFFFFF.803B304F
 00000000.0008B950 00010000
 Data (read only)   FFFFFFFF.84196C00 FFFFFFFF.8419D62F
 00000000.00006A30 0009C000
 Data (read/write)  FFFFFFFF.8419D800 FFFFFFFF.841A7987
 00000000.0000A188 000A4000
 Short data         FFFFFFFF.841A7A00 FFFFFFFF.841AA2DF
 00000000.000028E0 000B0000
  Linked 23-MAR-2004 15:02   LDRIMG 84889040   SeqNum 0000001E       GP
 FFFFFFFF.843A7A00
```

This example from Integrity servers displays the use of the wildcard with the SHOW EXECUTIVE command. The display has been moved left to fit within the page boundaries of the manual.

4.43. SHOW GALAXY

Displays a brief one-page summary of the state of the Galaxy and all the instances in the Galaxy.

Format

SHOW GALAXY

Parameters

None.

Qualifiers

None.

Examples

```
SDA> SHOW GALAXY
Galaxy summary
--------------
  GMDB address        Creator node ID  Revision       Creation time
-----------------     ---------------  --------   -----------------------
 -----
FFFFFFFF.7F234000         00000001        1.0    31-MAR-1999 13:15:08.08
   0

Node ID     NODEB address      Name    Version        Join time
--------  -----------------  --------  --------   -----------------------
 -----
00000000  FFFFFFFF.7F236000  ANDA1A       1.0    31-MAR-1999 14:11:09.08
00000001  FFFFFFFF.7F236200  ANDA2A       1.0    31-MAR-1999 14:10:49.06
00000002  FFFFFFFF.7F236400  ANDA3A       1.0    31-MAR-1999 14:13:26.16
00000003  FFFFFFFF.7F236600                      - Node block is empty -
```

This SHOW GALAXY example shows the summary of the state of the Galaxy.

4.44. SHOW GCT

Displays the contents of the Galaxy configuration tree either in summary (hierarchical format) or in detail, node by node.

Format

SHOW GCT [/ADDRESS=n | /ALL | /HANDLE | /OWNER=n

| /SUMMARY (D) | /TYPE=type]

[/CHILDREN] | [/FULL]

Parameters

None.

Qualifiers

/ADDRESS=*n*

Displays the Galaxy configuration tree (GCT) node at the given address.

/ALL

Provides a detailed display of all nodes in the tree.

/CHILDREN

When used with /ADDRESS=*n* or /HANDLE=*n*, the /CHILDREN qualifier causes SDA to display all nodes in the configuration tree that are children of the specified node.

/FULL

When used with /CHILDREN, /OWNER=n, or /TYPE=type, the /FULL qualifier causes SDA to provide a detailed display of each node.

/HANDLE=*n*

Provides a detailed display of the Galaxy configuration tree (GCT) node with the given handle.

/OWNER=*n*

Displays all nodes in the tree currently owned by the node with the given handle.

/SUMMARY

Provides a summary display of the Galaxy configuration tree (GCT) in hierarchical form. This qualifier is the default.

/TYPE=*type*

Displays all nodes in the tree of the given type, which can be one of the following:

BUS	CAB	COMMUNITY

CORE	CPU	CPU_MODULE
EXP_CHASSIS	FRU_DESC	FRU_ROOT
HARD_PARTITION	HOSE	HW_ROOT
IO_CTRL	IOP	MEMORY_CTRL
MEMORY_DESC	MEMORY_SUB	PARTITION
POWER_ENVIR	PSEUDO	RISER
ROOT	SBB	SLOT
SMB	SOC	SOCKET
SW_ROOT	SYS_CHASSIS	SYS_INTER_SWITCH
TEMPLATE_ROOT	THREAD	

The type given may be an exact match, in which case just that type is displayed (for example, a CPU); or a partial match, in which case all matching types are displayed (for example, /TYPE=CP displays both CPU and CPU_MODULE nodes).

Description

Examples

1.
```
SDA> SHOW GCT
Galaxy Configuration Tree summary
---------------------------------
Base address of Config Tree: FFFFFFFF.83694040 (2 pages)
Initial Current Name/Min PA/ OS type/Max PA/
Handle Hierarchy Id Owner Owner Base PA Size (bytes) Flags
-------- ------------------- ----------------- -------- --------
 ----------------- ----------------- ------------------------
00000000 Root 00000000.00000000 414C4147-5958-0030-0000-......
|
00000240 |_HW_Root 00000000.00000000
00000280 | |_IOP 00000000.00000006 00001800 000000A0.00000000
 000000AF.FFFFFFFF
00000300 | |_IOP 00000000.00000007 00001700 000000B0.00000000
 000000BF.FFFFFFFF
00000380 | |_IOP 00000000.00000008 00001600 000000C0.00000000
 000000CF.FFFFFFFF
00000400 | |_CPU_Module 00000000.00000000 00001580
00000440 | | |_CPU 00000000.09000000 00001600 Primary
00000480 | | |_CPU 00000000.1B000001 00001600 00001800
000004C0 | |_CPU_Module 00000000.00000001 00001580
00000500 | | |_CPU 00000000.1B000002 00001600 00001800
00000540 | | |_CPU 00000000.10000003 00001600 00001700
00000580 | |_CPU_Module 00000000.00000002 00001580
000005C0 | | |_CPU 00000000.07000004 00001700 Primary
00000600 | | |_CPU 00000000.0A000005 00001700 00001800
00000640 | |_CPU_Module 00000000.00000003 00001580
00000680 | | |_CPU 00000000.07000006 00001800 Primary
000006C0 | | |_CPU 00000000.0C000007 00001800 00001600
00000700 | |_Memory_Sub 00000000.00000000 00001580 00000000.00000000
 00000000.FFFFFFFF
00000780 | |_Memory_Ctrl 00000000.00000005 00001600
```

```
000007C0 | |_Memory_Desc 00000000.00000000 00001600 00000000.00000000
 00000000.40000000
| | |_Fragment 00001600 00000000.00000000 00000000.00200000 Console
 Private Base
| | |_Fragment 00001600 00000000.00200000 00000000.3FD7E000 Private Base
| | |_Fragment 00001600 00000000.3FF7E000 00000000.00082000 Console
 Private Base
00000A40 | |_Memory_Desc 00000000.40000000 00001700 00000000.40000000
 00000000.40000000
| | |_Fragment 00001700 00000000.40000000 00000000.00200000 Console
 Private Base
| | |_Fragment 00001700 00000000.40200000 00000000.3FD7E000 Private Base
| | |_Fragment 00001700 00000000.7FF7E000 00000000.00082000 Console
 Private Base
00000CC0 | |_Memory_Desc 00000000.80000000 00001800 00000000.80000000
 00000000.40000000
| | |_Fragment 00001800 00000000.80000000 00000000.00200000 Console
 Private Base
| | |_Fragment 00001800 00000000.80200000 00000000.3FD7E000 Private Base
| | |_Fragment 00001800 00000000.BFF7E000 00000000.00082000 Console
 Private Base
00000F40 | |_Memory_Desc 00000000.C0000000 00001580 00000000.C0000000
 00000000.40000000
| |_Fragment 00001580 00000000.C0000000 00000000.40000000 Shared
|
000011C0 |_SW_Root 00000000.00000000
00001580 | |_Community 00000000.00000000 000011C0
00001600 | |_Partition 00000000.00000000 00001580 ANDA1A OpenVMS Alpha
00001700 | |_Partition 00000000.00000001 00001580 ANDA2A OpenVMS Alpha
00001800 | |_Partition 00000000.00000002 00001580 ANDA3A OpenVMS Alpha
|
00001200 |_Template_Root 00000000.00000000
00001240 |_IOP 00000000.00000000
000012C0 |_CPU 00000000.00000000
00001300 |_Memory_Desc 00000000.00000000 00000000.02000000
```

This command shows the summary (hierarchical) display of the configuration tree.

2. ```
SDA> SHOW GCT/HANDLE=00000700

Galaxy Configuration Tree

Handle: 00000700   Address:
 FFFFFFFF.83694740
Node type: Memory_Sub   Size:
  0080
Id: 00000000.00000000   Flags:
 00000000.00000001 Hardware

Related nodes:

    Node relationship   Handle   Type   Id
  --------------------- --------   ---------------------

  Initial owner   00001580   Community
 00000000.00000000
```
```

```
 Current owner           -<Same>-
 Parent                  00000240    HW_Root
00000000.00000000
 Previous sibling        00000640    CPU_Module
00000000.00000003
 Next sibling            -<None>-
 Child                   00000780    Memory_Ctrl
00000000.00000005
 Configuration binding  00000240    HW_Root
00000000.00000000
 Affinity binding        00000240    HW_Root
00000000.00000000

Min. physical address:   00000000.00000000
Max. physical address:   00000000.FFFFFFFF
```

This command shows the detailed display of the specified node.

4.45. SHOW GLOBAL_SECTION_TABLE

Displays information contained in the global section table, including pageable sections of loadable images. Functionally equivalent to SHOW GST.

Format

SHOW GLOBAL_SECTION_TABLE [/SECTION_INDEX=n]

SHOW GST [/SECTION_INDEX=n]

Parameters

None.

Qualifiers

/SECTION_INDEX=*n*

Displays only the global section table entry for the specified section.

Description

Displays the entire contents of the global section table, unless you specify the qualifier /SECTION_INDEX. This command is equivalent to SHOW PROCESS/PROCESS_SECTION_TABLE/SYSTEM. SDA displays the information in the table below for each GST entry.

Part	Definition
INDEX	Index number of the entry. Entries in the global section table begin at the highest location in the table, and the table expands toward lower addresses.
ADDRESS	Address of the global section table entry.
SECT/GPTE	Virtual address that marks the beginning of the first page of the section described by this entry,

Part	Definition
	if a loadable image; or the virtual address of the global page table entry for the first page, if a global section.
GSD	Address of the corresponding Global Section Descriptor. This field is zero for loadable images.
PAGELETS	Length of the global section. This is in units of pagelets, except for a PFN-mapped section in which the units are pages.
VBN	Virtual block number. The number of the file's virtual block that is mapped into the section's first page.
WINDOW	Address of the window control block on which the section file is open.
REFCNT	Number of pages of this section that are currently mapped.
FLINK	Forward link. The pointer to the next entry in the GST list.
BLINK	Backward link. The pointer to the previous entry in the GST list.
FLAGS	Flags that describe the access that the system and processes have to the global section.

Examples

1.
```
SDA> SHOW GST
Global Section Table
--------------------
Global section table information
--------------------------------
Last entry allocated 00000238
First free entry 00000000
Global section table
--------------------
 Index Address Sect/GPTE Addr CCB/GSD Pagelets VBN Window Refcnt Flink
 Blink Flags
 -------- -------- ----------------- -------- -------- -------- --------
 -------- ----- ----- --------------------
00000001 81409FD8 FFFFFFFF.83384000 00000000 00000025 00000003 81419E40
 00000003 0000 0000 AMOD=KRNL
00000002 81409FB0 FFFFFFFF.833AE000 00000000 00000064 00000220 8141A040
 00000007 0000 0000 AMOD=KRNL
00000003 81409F88 FFFFFFFF.83312000 00000000 00000001 0000063A 81450BC0
 00000001 0000 0000 CRF WRT AMOD=KRNL
00000004 81409F60 FFFFFFFF.833C0000 00000000 00000003 00000003 814233C0
 00000001 0000 0000 AMOD=KRNL
00000005 81409F38 FFFFFEFE.00058890 82065C70 00000002 0000000D 814F9AC0
 00000003 0005 0005 WRTMOD=EXEC AMOD=USER PERM
Name = INS$82065BC0_003 SYSGBL
File = DISK$X97D_R2Y:[VMS$COMMON.SYSLIB]DECW$TRANSPORT_COMMON.EXE;1
00000006 81409F10 FFFFFFFF.833E6000 00000000 00000011 00000023 8142E480
 00000002 0000 0000 AMOD=KRNL
```

```
00000007 81409EE8 FFFFFEFE.00052010 82025CA0 0000000C 00000004 814C0600
 00000000 0007 0007 WRTMOD=EXEC AMOD=USER PERM
File = DISK$X97D_R2Y:[VMS$COMMON.SYSLIB]SYS$SSISHR.EXE;1 SYSGBL
00000008 81409EC0 FFFFFFFF.83400000 00000000 000000B4 00000003 81446340
 0000000C 0000 0000 AMOD=KRNL
00000009 81409E98 FFFFFFFF.83418000 00000000 00000038 000000B7 81446340
 00000001 0000 0000 CRF WRT AMOD=KRNL
0000000A 81409E70 FFFFFEFE.00052028 820261B0 00000027 00000019 814C0AC0
 00000003 000A 000A WRTMOD=EXEC AMOD=USER PERM
Name = INS$82026130_006 SYSGBL
File = DISK$X97D_R2Y:[VMS$COMMON.SYSLIB]DISMNTSHR.EXE;1
0000000B 81409E48 FFFFFEFE.00052050 82026630 0000007A 00000004 814C0D00
 00000008 000B 000B WRTMOD=EXEC AMOD=USER PERM
Name = INS$82026540_002 SYSGBL
File = DISK$X97D_R2Y:[VMS$COMMON.SYSLIB]DTI$SHARE.EXE;1
.
.
.
```

4.46. SHOW GLOCK

Displays the Galaxy locks for the Galaxy Management Database (GMDB), process tables, and/or system tables.

Format

SHOW GLOCK [/ADDRESS=n [/PHYSICAL]

| /ALL

| /GMDB_TABLE

| /HANDLE=n [/LINKED]

| /PROCESS_TABLE [=n]

| /SYSTEM_TABLE [=n]]

[/BRIEF]

Parameters

None.

Qualifiers

/ALL

Displays information provided by the /GMDB_TABLE, /PROCESS_TABLE, and / SYSTEM_TABLE qualifiers. The /ALL qualifier also displays information from the base GMDB Galaxy lock.

/BRIEF

Displays a single line for each Galaxy lock, regardless of any other qualifiers.

/GMDB_TABLE

Displays the Galaxy lock table for the Galaxy Management Database (GMDB) including the embedded and attached Galaxy locks.

/PROCESS_TABLE [=*n*]

Displays all the process Galaxy lock tables with the embedded and attached Galaxy locks, as well as a summary table. The /PROCESS_TABLE=*n* qualifier displays the single Galaxy lock table without a summary page.

/SYSTEM_TABLE [=*n*]

Displays all the system Galaxy lock tables with the embedded and attached Galaxy locks, as well as a summary table. The /SYSTEM_TABLE=*n* qualifier displays the single Galaxy lock table without a summary page.

/ADDRESS=*n* [/PHYSICAL]

Displays the single Galaxy lock at address *n*. Because process Galaxy locks are located by their physical address, you must use the /PHYSICAL qualifier to enter such an address.

/HANDLE=*n* [/LINKED]

Displays the single Galaxy lock whose handle is *n*. The optional qualifier /LINKED causes SDA to display all Galaxy locks linked to the one specified.

Examples

1.
```
SDA> SHOW GLOCK
Galaxy Lock Database
--------------------

Base address of GLock segment of GMDB:       FFFFFFFF.7F238000
Length:                                      00000000.00082000

  Nodes:                  00000000.00000007   Flags:
 00000000.00000000

Process tables:           00000000.00000400   System tables:
 00000000.00000400
  First free:                      00000002
 00000001
  First used:                      00000001
 00000000

Embedded GLocks:

GLock address:            FFFFFFFF.7F238020   Handle:
 80000000.00000805

  GLock name:             GMDB_GLOCK_LOCK     Flags:
    00
  Owner count:                           00   Owner node:
    00
  Node sequence:                       0000   Owner:
 000000
```

```
  IPL:                              08   Previous IPL:
    00
  Wait bitmask:         00000000.00000000   Timeout:
 00000000
  Thread ID:            00000000.00000000

GLock address:          FFFFFFFF.7F238190   Handle:
 80000000.00000833

  GLock name:           PRC_LCKTBL_LOCK     Flags:
    00
  Owner count:                      00   Owner node:
    00
  Node sequence:                  0000   Owner:
 000000
  IPL:                              08   Previous IPL:
    00
  Wait bitmask:         00000000.00000000   Timeout:
 00000000
  Thread ID:            00000000.00000000

GLock address:          FFFFFFFF.7F2381D0   Handle:
 80000000.0000083B

  GLock name:           SYS_LCKTBL_LOCK     Flags:
    00
  Owner count:                      00   Owner node:
    00
  Node sequence:                  0000   Owner:
 000000
  IPL:                              08   Previous IPL:
    00
  Wait bitmask:         00000000.00000000   Timeout:
 00000000
  Thread ID:            00000000.00000000
```

This example shows the summary of the Galaxy lock database.

2.
```
SDA> SHOW GLOCK/PROCESS_TABLE
Galaxy Lock Database: Process Lock Table #0001
----------------------------------------------

Base address of Process Lock Table #0001:    FFFFFFFF.7F23A000

  Lock size:                      0040   Flags:
    01  VALID
  Region Index/Sequence:     0008/00000001   Access mode:
    03
  Region physical size:  00000000.00002000   Virtual size:
 00000000.00002000
  Number of locks:       00000000.00000080   Nodes:
 00000000.00000007

Per-node reference counts:

    Node   Count
    ----   -----
    0000    0001
```

```
    0001    0001
    0002    0001

Embedded GLock:

GLock address:          FFFFFFFF.7F23A040   Handle:
 80000000.00000C09

  GLock name:           PLCKTBL_LOCK001     Flags:
    00
  Owner count:                        00   Owner node:
    00
  Node sequence:                    0000   Owner:
 000000
  IPL:                                00   Previous IPL:
    00
  Wait bitmask:         00000000.00000000   Timeout:
 00000000
  Thread ID:            00000000.00000000

Attached GLocks:

GLock address:         P00000000.C05EC7C0   Handle:
 00000001.000000F9

  GLock name:           CPU_BAL_LOCK        Flags:
    00
  Owner count:                        00   Owner node:
    00
  Node sequence:                    0000   Owner:
 000000
  IPL:                                00   Previous IPL:
    00
  Wait bitmask:         00000000.00000000   Timeout:
 00000000
  Thread ID:            00000000.00000000

   .
   .
   .

GLock address:         P00000000.C05EC000   Handle:
 00000001.00000001

  GLock name:           CPU_BAL_LOCK        Flags:
    00
  Owner count:                        00   Owner node:
    00
  Node sequence:                    0000   Owner:
 000000
  IPL:                                00   Previous IPL:
    00
  Wait bitmask:         00000000.00000000   Timeout:
 00000000
  Thread ID:            00000000.00000000

Used GLock count = 0020
```

```
Free GLock count = 0060

Galaxy Lock Database: Process Lock Table Summary
------------------------------------------------

Total used Process Lock Tables:            00000001
Total free Process Lock Tables:            000003FF
```

This example shows the Galaxy locks for all processes.

4.47. SHOW GMDB

Displays the contents of the Galaxy Management Database (GMDB) and/or the node blocks of the instances in the Galaxy system.

Format

SHOW GMDB [/ALL]

[/NODE [=name | =n | /ADDRESS=n] [/SUMMARY]

Parameters

None.

Qualifiers

/ADDRESS

Specifies the address of a single node block to be displayed when used with the /NODE qualifier. See the description of the /NODE qualifier.

/ALL

Displays the contents of the Galaxy Management Database and all node blocks that have ever been used (contents nonzero).

/NODE [=*name* | =*n* | /ADDRESS=*n*]

Displays the contents of the specified node block, given by either the name of the instance, the partition number, or the address of the node block. If you specify only the /NODE qualifier, the node block for the current instance is displayed.

/SUMMARY

Displays a one-page summary of the GMDB and all node blocks.

Note

The default action displays the contents of the Galaxy Management Database.

Examples

1.
```
SDA> SHOW GMDB

Galaxy Management Database
```

```
-------------------------

Base address of GMDB:                        FFFFFFFF.7F234000
Base address of NODEB for this instance:     FFFFFFFF.7F236000

  Revision:                          1.0   Maximum node ID:
 00000003
  Creation time:   31-MAR-1999 13:15:08.08   Incarnation:
 00000000.00000003
  State:                     OPERATIONAL   Creator node:
 00000001
  Base size:           00000000.00004000   Total size:
 00000000.000A6000
  Last joiner ID:               00000002   Remover node ID:
 FFFFFFFF
  Last leaver ID:               00000002   Node timeout (msec)
  5000.
  Lock owner                    00000002   Lock flags:
  0000
  Break owner:                  FFFFFFFF   Breaker ID:
 FFFFFFFF

Version Information:

  Min Version Operational            1.0   Min Version Allowed
   1.0
  Max Version Operational            1.0

Membership bitmask:      FFFFFFFF.7F236800

  Valid bits:                   00000004   State:
 00000000.0000001E  AUTO_LOCK TIMEOUT_CRASH....
  Unit count:                       0001   Unit size:
 QUADWORD
  Lock IPL:                           16   Saved IPL:
 00000008
  Count of bits set:            00000003
  Timeout count:                000186A0
  Summary bitmask:       00000000.00000001

  Unit bitmask:
       ........ ........ ........ .......7   00000000

Remove node bitmask:     FFFFFFFF.7F236880

  Valid bits:                   00000004   State:
 00000000.00000018  SUMMARY_BITS SET_COUNT
  Unit count:                       0001   Unit size:
 QUADWORD
  Count of bits set:            00000000
  Summary bitmask:       00000000.00000000

  Unit bitmask:
       ........ ........ ........ .......0   00000000

Subfacility validation flags:     00000000
```

```
  Galaxy locks segment:  FFFFFFFF.7F238000   Length:
 00000000.00082000
  Shared memory segment: FFFFFFFF.7F2BA000   Length:
 00000000.0000A000
  CPU comms segment:     FFFFFFFF.7F2C4000   Length:
 00000000.00014000
  CPU info segment:      FFFFFFFF.7F2D8000   Length:
 00000000.00002000
  Membership segment:    FFFFFFFF.7F2DA000   Length:         (empty)

MMAP address:            FFFFFFFF.7F234200

  Level count:                       0000   Flags:
  0001  VALID
  Top page count:                00000053   Virtual size:
 00000000.000A6000
  PFN list page count:           00000000   First PFN:
 00060000
  Data page count:               00000053
```

This example shows the overall summary of the Galaxy Management Database.

2.
```
SDA> SHOW GMDB/NODE=0

GMDB: Node ID 00000000 (current instance)
-----------------------------------------

Base address of node block:                 FFFFFFFF.7F236000

  Version:                            1.0   Node name:
 ANDA1A
  Join time:       31-MAR-1999 14:11:09.08   Incarnation:
 00000000.00000005
  State:                           MEMBER   Crash_all acknowledge:
 00000000
  Validation done:               00000000   Reform done:
 00000000

  IP interrupt mask:     00000000.00000000

Little brother:                  00000002   Heartbeat:
 00000000.0019EAD1
Big brother:                     00000001   Last watched_node:
 00000000

  Watched_node #0:       FFFFFFFF.7F236078   Node watched:
 00000002
  Last heartbeat:        00000000.0017C1AD   Miss count:
 00000000
```

This example shows Galaxy Management Database information for the specified instance.

4.48. SHOW GSD

Displays information contained in the global section descriptors.

Format

SHOW GSD [/ADDRESS=n | /ALL | /DELETED | /GLXGRP

| /GLXSYS | /GROUP | /SYSTEM]

Parameters

None.

Qualifiers

/ADDRESS=*n*

Displays a specific global section descriptor entry, given its address.

/ALL

Displays information in all the global section descriptors, that is, the system, group, and deleted global section descriptors, plus the Galaxy group and Galaxy system global section descriptors, if the system or dump being analyzed is a member of an OpenVMS Galaxy system. This qualifier is the default.

/DELETED

Displays information in the deleted (that is, delete pending) global section descriptors.

/GLXGRP

Displays information in the group global section descriptors of a Galaxy system.

/GLXSYS

Displays information in the system global section descriptors of a Galaxy system.

/GROUP

Displays information in the group global section descriptors.

/SYSTEM

Displays information in the system global section descriptors.

Description

The SHOW GSD command displays information that resides in the global section descriptors. The table below shows the fields and their meaning.

Field	Meaning
ADDRESS	Gives the address of the global section descriptor.
NAME	Gives the name of the global section.

Field	Meaning
GSTX	Gives the global section table index.
FLAGS	Gives the settings of flags for specified global section, as a hexadecimal number; also displays key flag bits by name.
BASEPFN 1	Gives physical page frame number at which the section starts. This field applies only to PFN mapped global sections.
PAGES 1	Gives number of pages (not pagelets) in section. This field applies only to PFN mapped global sections.
REFCNT 1	Gives number of times this global section is mapped. This field applies only to PFN mapped global sections.

Examples

```
SDA > SHOW GSD

System Global Section Descriptor List
--------------------------------------                                      -----------PFNMAP----------

ADDRESS    NAME         GSTX    FLAGS                                       BASEPFN    PAGES    REFCNT

817DAF30   SECIDX_422   02DD    0082C3C9   WRT AMOD=USER PERM
817DAE60   SECIDX_421   02DC    008A83CD   DZRO WRT AMOD=USER PAGFIL
817DAD90   SECDIX_420   02DB    0088C3CD   DZRO WRT AMOD=USER PERM PAGFIL
817DACC0   SECDIX_419   02DA    008883DC   DZRO WRT AMOD=USER PAGFIL
817DABE0   SECIDX_418   0000    0001C3C1   AMOD=USER PERM                   00000B0B   00000002 00000000
817DAB00   SECIDX_417   0000    0001C3C1   AMOD=USER PERM                   00000B0B   00000002 00000000
817DA890   SECIDX_412   02D6    0080C3CD   DZRO WRT AMOD=USER PERM
817DA850   SECIDX_411   02D5    008083CD   DZRO WRT AMOD=USER
       .
       .
       .
```

4.49. SHOW GST

See SHOW GLOBAL_SECTION_TABLE.

4.50. SHOW HEADER

Displays the header of the dump file.

Format

SHOW HEADER

Parameters

None.

Qualifiers

None.

Description

The SHOW HEADER command produces a 10-column display, each line of which displays both the hexadecimal and ASCII representation of the contents of the dump file header in 32-byte intervals. Thus, the first eight columns, when read right to left, represent the hexadecimal contents of 32 bytes of the header; the ninth column, when read left to right, records the ASCII equivalent of the contents. (The period [.] in this column indicates an ASCII character that cannot be displayed.)

After it displays the contents of the header blocks, the SHOW HEADER command displays the hexadecimal contents of the saved error log buffers.

See the *OpenVMS AXP Internals and Data Structures* manual for a discussion of the information contained in the dump file header. See also the SHOW DUMP and CLUE ERRLOG commands, which you can use to obtain formatted displays of the dump header and error log buffers.

See also the SHOW DUMP command, which will output a formatted display of the contents of the dump header.

Examples

```
SDA> SHOW HEADER

Dump file header
----------------
00000000 7FFA6000 00000000 7FFA1C98 00000000 0000187C 08090FC1 00000004  ....Á...|.........ú......‘ú.....     00000000
00001FFF 0000000D 00002000 80D0A000 00000000 7AFFBAD0 00000000 7FFAC100  .Áú.....Ðº.z......Ð............     00000020
0000B162 00000000 00000001 00000000 00040704 FCFFFFFF 03000000 80C13670  p6Á........ü................b±..     00000040
00000000 00000400 00000008 00000000 3154462D 31393658 00000011 00000000  ........X691-FT1...............     00000060
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000  ...............................     00000080
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000  ...............................     000000A0
FF7FC000 FFFFFFFD FF000000 80C220F0 00000000 00000000 00000000 00000000  ...........ð Â.....ý....À......     000000C0
.
.
.

Saved error log messages
------------------------
0004FFF9 0000040B 00000001 00000000 00000070 80D0B000 80D0A00C 00000000  ......Ð..°Ð.p.......ù...........     80D0A000
B4510020 60030000 00000000 00000020 20585443 50575308 00000000 00020000  .........SWPCTX  ......‘ .Q´....     80D0A020
30303320 43454412 00000002 00000000 3154462D 31393658 0000009A 2C31075A  Z.1,....X691-FT1.........DEC 300     80D0A040
000000AA 59EC7C0A 00000000 00000000 00000000 00303034 206C6564 6F4D2030  0 Model 400..............|ìYª...     80D0A060
20585443 50575308 00000000 00020000 0004FFF9 0000040B 00000001 00000000  ............ù............SWPCTX     80D0A080
3154462D 31393658 0001009A 2C3107FD 1DDB0040 60030000 00000000 00000020   ..........‘@.Û.ý.1,....X691-FT1     80D0A0A0
00000000 00303034 206C6564 6F4D2030 30303320 43454412 00000003 00000000  .........DEC 3000 Model 400.....     80D0A0C0
4B442458 54435057 530A0064 000001AB 00000000 00010001 00000000 00000000  ................«...d..SWPCTX$DK     80D0A0E0
.
.
.
```

4.51. SHOW IMAGE

Displays information about an image, regardless of the type of image (executive, activated, or installed).

Format

`SHOW IMAGE image-name`

Parameters

image-name

Name of the image to be displayed. This is a required parameter that may include wildcards.

Qualifiers

None.

Description

Searches the executive image list for the image name, and, if a match is found, displays the loaded image information. Next, searches the activated image list for the process (if SDA has a current process context). If a match is found, displays the activated image information. Finally, searches the installed image lists, directory by directory. If a match is found, displays the installed image (known file entry) information.

SHOW IMAGE x is equivalent to SHOW EXECUTIVE x followed by SHOW PROCESS/IMAGE=x followed by SHOW KFE x .

Examples

1.
```
SDA> show image sys$public_vectors

Image SYS$PUBLIC_VECTORS
------------------------

                            VMS Executive image layout
                            --------------------------

Image                                   Base               End
   Length       ImageOff  SymVec
--------------------------------- ----------------- -----------------
 ----------------- -------- --------
SYS$PUBLIC_VECTORS
                         81804B18
    Nonpaged read only           FFFFFFFF.80000000 FFFFFFFF.800025FF
 00000000.00002600 00000000
    Nonpaged read/write          FFFFFFFF.81800000 FFFFFFFF.81807FFF
 00000000.00008000 00004000
        Linked 30-AUG-2004 09:36  LDRIMG 81C17480   SeqNum 00000000 --<
 sliced >--


                            Process activated images
                            ------------------------

   Image Name/Link Time/Section Type     Start     End     Type/File Id
--------------------------------------- -------- -------- ------------
SYS$PUBLIC_VECTORS                      81804B18 818071B7 GLBL

                        IMCB   Sym Vect Maj,Minor ID   Base     End
 ImageOff
                      -------- -------- ------------ -------- --------
 --------
                      7FF6A250 81804B18 113,16596271



                            Known File Entries
                            ------------------

KFD Device/Directory/Type: $31$DKB100:<SYS0.SYSCOMMON.SYSLIB>.EXE
-----------------------------------------------------------------
```

```
    KFE                  Image Name/                KFERES Address/
   File ID/      Flags/
  Address                Section Type                     Base
     End        ImageOff
  --------  --------------------------------------- -----------------
 ----------------- --------
  82984C50  SYS$PUBLIC_VECTORS;1
 (3923,194,0)
```

This example shows the output from SHOW IMAGE for SYS$PUBLIC_VECTORS. Part of the example has been moved left to stay within page boundaries of the manual.

4.52. SHOW KFE

Displays information about known file entries (installed images).

Format

SHOW KFE [image_name | /ADDRESS=kfe_address | /ALL]

SHOW KNOWN_FILE_ENTRY [image_name | /ADDRESS=kfe_address | /ALL]

Parameters

image-name

Name of the image to be displayed. This may include wildcards, but cannot include device or directory information.

Qualifiers

/ADDRESS=kfe_address

Specifies the address of a single KFE of interest. The details are displayed for this KFE with device/ directory information from the corresponding KFD (Known File Directory).

/ALL

Displays details for all KFEs, including device/directory information from the corresponding KFDs, with the contents of the Known File Pointer Block (KFPB).

Description

The SHOW KFE command displays information about known files (installed images). By default, a summary line without image-section information is given for each image. Use the /ALL qualifier to obtain detailed information for all images. For a single image, specify the image name or KFE address.

The image_name parameter, the /ADDRESS, and /ALL qualifiers cannot be used together. SHOW KNOWN_FILE_ENTRY is a synonym for SHOW KFE.

Examples

1. `SDA> SHOW KFE`

```
Known File Entries
------------------

KFPB address:                 8292D860
Hash table address:           82975360
Hash table size:                  0080
Entry count:                      016F

KFD Device/Directory/Type: $31$DKB100:<SYS0.SYSCOMMON.CDE
$DEFAULTS.SYSTEM.BIN>.EXE
---------------------------------------------------------

  KFD address:                829E8D60
  Reference count:                0002

    KFE     Image Name          KFERES Address    File ID         Flags
  --------  ------------------- ----------------- -------------
 --------
  829E8290  DECW$LOGINOUT;1     (7204,49,0)       LIM Open HdrRes Shared
  829E8DB0  DTGREET;1           (5651,19,0)       Open HdrRes     Shared

KFD Device/Directory/Type: $31$DKB100:<SYS0.SYSCOMMON.SYSEXE>.EXE
-----------------------------------------------------------------

  KFD address:                8299C140
  Reference count:                0066

    KFE     Image Name                 KFERES Address       File ID
  Flags
  --------  ------------------------ ----------------- -----------------
 --------
  8299C210  AUTHORIZE;1                                  (72,176,0)
 ProcPriv AuthPriv
  829ACE10  BACKUP;1                                     (73,176,0)
  8299C2A0  CDU;1                                        (75,176,0)
 ProcPriv Open HdrRes AuthPriv
  8299C660  CIA;1                                        (510,176,0)
 ProcPriv AuthPriv
  829ACE90  CONVERT;1                                    (77,176,0)
  829A3AD0  COPY;1                   829A3E70            (78,176,0)
 Open HdrRes Shared
  829ACF10  CREATE;1                                     (79,176,0)
  .
  .
  .
```

This example shows the first page of summary output for all known images.

2. `SDA> show kfe decc*`

```
Known File Entries
------------------

KFD Device/Directory/Type: $31$DKB100:<SYS0.SYSCOMMON.SYSLIB>.EXE
-----------------------------------------------------------------

    KFE          Image Name/               KFERES Address/       File
 ID/      Flags/
```

```
 Address        Section Type                    Base             End
     ImageOff
 --------  ----------------------------- -----------------
----------------- --------
 829900B0  DECC$SHR;1                    82990960         (2431,189,0)
     LIM Open HdrRes

              Shared ResCode

               Paged read only           FFFFFFFF.80A70000
FFFFFFFF.80C815FF 00000000
               Initialization            00000000.7BEC0000
00000000.7BF00DFF 00220000
               Fixup                     00000000.7BF10000
00000000.7BF1B1FF 00270000
               Nonpaged read/write       00000000.7BF20000
00000000.7BF2FBFF 00280000
               Nonpaged read/write       00000000.7BF30000
00000000.7BF309FF 00290000

               Fixup                     00000000.7BF40000
00000000.7BF401FF 002A0000
               Paged read/write          00000000.7BF50000
00000000.7BF56FFF 002B0000


  KFD Device/Directory/Type: $31$DKB100:<SYS0.SYSCOMMON.SYSMSG>.EXE
  -----------------------------------------------------------------

    KFE        Image Name/               KFERES Address/     File ID/
Flags/
 Address       Section Type                    Base            End
ImageOff
 --------  --------------------------------------- ------------ ---
--------
 829AE4F0  DECC$MSG;1                                     (257,176,0)
LIM Open HdrRes Shared
```

This example shows the details for all images that match the wildcard DECC*.

4.53. SHOW KNOWN_FILE_ENTRY

See SHOW KFE.

4.54. SHOW LAN

Displays information contained in various local area network (LAN) data structures.

Format

SHOW LAN [/qualifier[,...]]

Parameters

None.

Qualifiers

/ATM

Specifies that asynchronous transfer mode (ATM) information for the LAN be displayed.

/CLIENT=*name*

Specifies that information be displayed for the specified client. Valid client designators are SCA, DECNET, LAT, MOPRC, TCPIP, DIAG, ELN, BIOS, LAST, USER, ARP, MOPDL, LOOP, BRIDGE, DNAME, ENCRY, DTIME, and LTM. The /CLIENT, /DEVICE, and /UNIT qualifiers are synonymous and mutually exclusive.

/COUNTERS

Specifies that the LAN station block (LSB) and unit control block (UCB) counters be displayed.

/CSMACD

Specifies that Carrier Sense Multiple Access with Collision Detect (CSMA/CD) information for the LAN be displayed. By default, both CSMA/CD and Fiber Distributed Data Interface (FDDI) information is displayed.

/DEVICE=*name*

Specifies that information be displayed for the specified device, unit, or client. For each LAN adapter on the system, there is one **device** and multiple users of that device called, **units** or **clients**. Device designators are specified in the format **XXdn**, where **XX** is the type of device, **d** is the device letter, and **n** is the unit number. The device letter and unit number are optional. The first unit, which is always present, is the template unit. These are specified as indicated in this example for a DEMNA called EX:

/DEVICE=EX---display all EX devices on the system

/DEVICE=EXA---display the first EX device only

/DEVICE=EXA0---display the first EXA unit

/DEVICE=SCA---display SCA unit

/DEVICE=LAT---display LAT units

Valid client names are listed in the /CLIENT=*name* qualifier. The /CLIENT, /DEVICE, and /UNIT qualifiers are synonymous and mutually exclusive.

/ELAN

Specifies information from an Emulated LAN (ELAN) that runs over an asynchronous transfer mode (ATM) network. The /ELAN qualifier displays the LAN Station Block (LSB) address, device state, and the LSB fields pertinent to an ELAN for both the parent ATM device and the ELAN pseudo-device drivers. It also specifies the name, description, parent device, state, and LAN emulation client (LEC) attributes of the ELAN.

The qualifier /ELAN used with the device qualifier (/ELAN/DEVICE=ELA) will only display information for the specified device or pseudo-device.

/ERRORS

Specifies that the LSB and UCB error counters be displayed.

/FDDI

Specifies that Fiber Distributed Data Interface (FDDI) information for the LAN be displayed. By default, both CSMA/CD and FDDI information is displayed.

/FULL

Specifies that all information from the LAN, LSB, and UCB data structures be displayed.

/INTERNAL

Specifies internal counters of the drivers by displaying the internal counters. If the /INTERNAL qualifier is used with the /DEVICE qualifier, the /INTERNAL specifies the internal counters of a specific driver.

/QUEUES

Specifies a listing of all queues, whether their status is valid or invalid, and all elements of the queues. If the /QUEUES qualifier is used with the /DEVICE qualifier, the /QUEUES specifies a specific queue.

/SOURCEROUTING

Specifies that the information in the source routing table maintained by the Token Ring driver be displayed.

/SUMMARY

Specifies that only a summary of LAN information (a list of flags, LSBs, UCBs, and base addresses) be printed. This is the default.

/TIMESTAMPS

Specifies that time information (such as start and stop times and error times) from the device and unit data structures be printed. SDA displays the data in chronological order.

/TR

Specifies that Token Ring information for the LAN be displayed.

/UNIT=*name*

Specifies that information be displayed for the specified unit. See the descriptions for / CLIENT=*name* and /DEVICE=*name* qualifiers.

/VCI

Specifies that information be displayed for the VMS Communication Interface Block (VCIB) for each LAN device with an active VCI user. If you use the /VCI qualifier with the /DEVICE qualifier, the VCIB is only displayed for the specified device.

Description

The SHOW LAN command displays information contained in various local area network (LAN) data structures. By default, or when the /SUMMARY qualifier is specified, SHOW LAN displays a list of flags, LSBs, UCBs, and base addresses. When the /FULL qualifier is specified, SHOW LAN displays all information found in the LAN, LSB, and UCB data structures.

Examples

1.
```
SDA>  SHOW LAN/FULL
LAN Data Structures
-------------------
               -- LAN Information Summary 23-MAY-1996 13:07:52 --
LAN flags:  00000004 LAN_INIT
LAN block address           80DB7140    Timer DELTA time
 10000000
Number of stations                 2    DAT sequence number
   1
LAN module version                 1    First SVAPTE
 FFDF60F0
LANIDEF version                   51    Number of PTEs
   3
LANUDEF version                   26    SVA of first page
 8183C000
First LSB address           80DCA980

            -- LAN CSMACD Network Management 23-MAY-1996 13:07:52 --
Creation time                   None    Times created
   0
Deletion time                   None    Times deleted
   0
Module EAB                  00000000    Latest EIB
 00000000
Port EAB                    00000000
Station EAB                 00000000
NM flags:   00000000
             -- LAN FDDI Network Management 23-MAY-1996 13:07:52 --
Creation time                   None    Times created
   0
Deletion time                   None    Times deleted
   0
Module EAB                  00000000    Link EAB
 00000000
Port EAB                    00000000    PHY port EAB
 00000000
Station EAB                 00000000    Module EIB
 00000000
NM flags:   00000000
LAN Data Structures
-------------------
               -- ESA Device Information 23-MAY-1996 13:07:52 --
LSB address                 80DCA980    Driver code address
 80CAE838
Driver version     00000001.07010037    Device1 code address
 00000000
Device1 version    00000000.00000000    Device2 code address
 00000000
Device2 version    00000000.00000000    LAN code address
 80CAFA00
LAN version        00000001.07010112    DLL type
 CSMACD
```

```
Device name                 EY_NITC2    MOP name
 MXE
MOP ID                            94    HW serial              Not
 supplied
HW version                  00000000    Promiscuous mode
 OFF
Controller mode               NORMAL    Promiscuous UCB
 00000000
Internal loopback                OFF    All multicast state
 OFF
Hardware address   08-00-03-DE-00-12    CRC generation mode
  ON
Physical address   AA-00-04-00-88-FE    Full Duplex Enable
 OFF
Active unit count                  1    Full Duplex State
 OFF
Line speed                        10
Flags:  00000000
Char:   00000000
Status: 00000003 RUN,INITED



LAN Data Structures
-------------------
            -- ESA Device Information (cont) 23-MAY-1996 13:07:52 --
Put rcv ptr/index           00000000    Get rcv ptr/index
 00000015
Put xmt ptr/index           80DCB620    Get xmt ptr/index
 80DCB620
Put cmd ptr/index           00000000    Get cmd ptr/index
 00000000
Put uns ptr/index           00000000    Get uns ptr/index
 00000000
Put smt ptr/index           00000000    Get smt ptr/index
 00000000
RBufs owned by dev                 0    Rcv packet limit
  32
XEnts owned by dev                 0    XEnts owned by host
   4
CEnts owned by dev                 0    Transmit timer
   0
UEnts owned by dev                 0    Control timer
   0
SEnts owned by dev                 0    Periodic SYSID timer
 599
Current rcv buffers               17    Ring unavail timer
   0
Rqst MAX rcv buffers              32    USB timer
  26
Rqst MIN rcv buffers              16    Receive alignment
   0
Curr MAX rcv buffers              32    Receive buffer size
 1518
Curr MIN rcv buffers              16    Min 1st chain segment
   0
```

```
FILL rcv buffers                  16    Min transmit length
   0
ADD  rcv buffers                  32    Dev xmt header size
   0
LAN Data Structures
-------------------
            -- ESA Device Information (cont) 23-MAY-1996 13:07:52 --
Last receive         23-MAY 13:07:51    Last transmit        23-MAY
 13:07:50
ADP address                 80D4B280    IDB address
 80DCA880
DAT stage                   00000000    DAT xmt status
 0000003C.003C0001
DAT number started                 1    DAT xmt complete     23-MAY
 13:07:19
DAT number failed                  0    DAT rcv found
 None
DAT VCRP                    80DCBB80    DAT UCB
 00000000
Mailbox enable flag                0    CRAM read comman
 00000000
CSR base phys addr 00000000.00000000    CRAM write comma
 00000000
Mailboxes in use                   0    Media
 UNDF
2nd LW status flags         00000000
LAN Data Structures
-------------------
         -- ESA Network Management Information 23-MAY-1996 13:07:52 --
Creation time                   None    Create count
   0
Deletion time                   None    Enable count
   0
Enabled time                    None    Number of ports
   0
Disabled time                   None    Events logged
   0
EIB address                 00000000    NMgmt assigned addr
 None
LLB address                 00000000    Station name itmlst
 00000000
LHB address                 00000000    Station itmlst len
   0
First LPB address           00000000
LAN Data Structures
-------------------
                -- ESA Fork Information 23-MAY-1996 13:07:52 --
ISR   FKB sched      23-MAY 13:07:51    ISR   FKB in use flag
 FREE
ISR   FKB time       23-MAY 13:07:51    ISR   FKB count
 200
IPL8  FKB sched      23-MAY 13:07:20    IPL8  FKB in use flag
 FREE
IPL8  FKB time       23-MAY 13:07:20    IPL8  FKB count
   1
RESET FKB sched                 None    RESET FKB in use flag
 FREE
```

```
RESET FKB time                  None    RESET FKB count
   0
NM    FKB sched                 None    NM    FKB in use flag
 FREE
NM    FKB time                  None    NM    FKB count
   0
Fork status code                   0




LAN Data Structures
-------------------
                -- ESA Queue Information 23-MAY-1996 13:07:52 --
Control hold queue      80DCACF0  Status:  Valid, empty
Control request queue   80DCACF8  Status:  Valid, empty
Control pending queue   80DCAD00  Status:  Valid, empty
Transmit request queue  80DCACE8  Status:  Valid, empty
Transmit pending queue  80DCAD18  Status:  Valid, empty
Receive buffer list     80DCAD38  Status:  Valid, 17 elements
Receive pending queue   80DCAD20  Status:  Valid, empty
Post process queue      80DCAD08  Status:  Valid, empty
Delay queue             80DCAD10  Status:  Valid, empty
Auto restart queue      80DCAD28  Status:  Valid, empty
Netwrk mgmt hold queue  80DCAD30  Status:  Valid, empty
          -- ESA Multicast Address Information 23-MAY-1996 13:07:52 --
AB-00-00-04-00-00
                  -- ESA Unit Summary 23-MAY-1996 13:07:52 --
UCB      UCB Addr  Fmt   Value           Client     State
---      --------  ---   -----           ------  -----------
ESA0     80D4F6C0
ESA1     80E35400  Eth   60-03           DECNET  0017
 STRTN,LEN,UNIQ,STRTD
LAN Data Structures
-------------------
              -- ESA Counters Information 23-MAY-1996 13:07:52 --
Octets received                  596    Octets sent
 230
PDUs received                      8    PDUs sent
   5
Mcast octets received            596    Mcast octets sent
 138
Mcast PDUs received                8    Mcast PDUs sent
   3
Unrec indiv dest PDUs              0    PDUs sent, deferred
   0
Unrec mcast dest PDUs              1    PDUs sent, one coll
   0
Data overruns                      0    PDUs sent, mul coll
   0
Unavail station buffs              0    Excessive collisions
   0
Unavail user buffers               0    Late collisions
   0
CRC errors                         0    Carrier check failure
   0
Alignment errors                   0    Last carrier failure
 None
```

```
Rcv data length err              0    Coll detect chk fail
   5
Frame size errors                0    Short circuit failure
   0
Frames too long                  0    Open circuit failure
   0
Seconds since zeroed            34    Transmits too long
   0
Station failures                 0    Send data length err
   0



LAN Data Structures
-------------------
           -- ESA Counters Information (cont) 23-MAY-1996 13:07:52 --
No work transmits                0    Ring avail transitions
   0
Buffer_Addr transmits            0    Ring unavail transitions
   0
SVAPTE/BOFF transmits            0    Loopback sent
   0
Global page transmits            0    System ID sent
   0
Bad PTE transmits                0    ReqCounters sent
   0
Restart pending counter          0    Internal counters size
  40
+00 MCA not enabled            187    +2C Generic (or unused)
 00000000
+04 Xmt underflows               0    +30 Generic (or unused)
 00000000
+08 Rcv overflows                0    +34 Generic (or unused)
 00000000
+0C Memory errors                0    +38 Generic (or unused)
 80DCAD18
+10 Babbling errors              0    +3C Generic (or unused)
 80DCAD18
+14 Local buffer errors          0    +40 Generic (or unused)
 004E0840
+18 LANCE interrupts           202    +44 Generic (or unused)
 61616161
+1C Xmt ring <31:0>       00000000    +48 Generic (or unused)
 61616161
+20 Xmt ring <63:32>      00000000    +4C Generic (or unused)
 61616161
+24 Soft errors handled          0    +50 Generic (or unused)
 61616161
+28 Generic (or unused)   00000000    +54 Generic (or unused)
 61616161
LAN Data Structures
-------------------
                -- ESA Error Information 23-MAY-1996 13:07:52 --
Fatal error count                0    Last error CSR
 00000000
Fatal error code              None    Last fatal error
 None
```

```
Prev  error code               None    Prev fatal error
 None
Transmit timeouts                 0    Last USB time
 None
Control timeouts                  0    Last UUB time
 None
Restart failures                  0    Last CRC time
 None
Power failures                    0    Last CRC srcadr
 None
Bad PTE transmits                 0    Last length erro
 None
Loopback failures                 0    Last exc collisi
 None
System ID failures                0    Last carrier fai
 None
ReqCounters failures              0    Last late collis
 None
LAN Data Structures
-------------------
             -- ESA0 Template Unit Information 23-MAY-1996 13:07:52 --
LSB address                80DCA980    Error count
   0
VCIB address               00000000    Parameter mask
 00000000
Stop IRP address           00000000    Promiscuous mode
 OFF
Restart IRP address        00000000    All multicast mode
 OFF
LAN medium                   CSMACD    Source Routing mode
 TRANSPARENT
Packet format              Ethernet    Access mode
 EXCLUSIVE
Eth protocol type             00-00    Shared user DES
 None
802E protocol ID     00-00-00-00-00    Padding mode
  ON
802.2 SAP                        00    Automatic restart
 DISABLED
802.2 Group SAPs        00,00,00,00    Allow prom client
  ON
Controller mode              NORMAL    Can change address
 OFF
Internal loopback               OFF    802.2 service
 User
CRC generation mode              ON    Rcv buffers to save
   1
Functional Addr mod              ON    Minimum rcv buffers
   4
Hardware address  08-00-03-DE-00-12    User transmit FC/AC
  ON
Physical address  FF-FF-FF-FF-FF-FF    User receive FC/AC
 OFF



LAN Data Structures
```

```
-------------------
          -- ESA1 60-03 (DECNET) Unit Information 23-MAY-1996 13:07:52
 --
LSB address                 80DCA980    Error count
   0
VCIB address                00000000    Parameter mask
 00DA8695
Stop IRP address            80E047C0    Promiscuous mode
 OFF
Restart IRP address         00000000    All multicast mode
 OFF
LAN medium                    CSMACD    Source Routing mode
 TRANSPARENT
Packet format               Ethernet    Access mode
 EXCLUSIVE
Eth protocol type              60-03    Shared user DES
 None
802E protocol ID      00-00-00-00-00    Padding mode
  ON
802.2 SAP                         00    Automatic restart
 DISABLED
802.2 Group SAPs         00,00,00,00    Allow prom client
  ON
Controller mode               NORMAL    Can change address
 OFF
Internal loopback                OFF    802.2 service
 User
CRC generation mode               ON    Rcv buffers to save
  10
Functional Addr mod               ON    Minimum rcv buffers
   4
Hardware address   08-00-03-DE-00-12    User transmit FC/AC
  ON
Physical address   AA-00-04-00-88-FE    User receive FC/AC
 OFF
LAN Data Structures
-------------------
      -- ESA1 60-03 (DECNET) Unit Information (cont) 23-MAY-1996
 13:07:52 --
Last receive         23-MAY 13:07:47    Starter's PID
 0001000F
Last transmit        23-MAY 13:07:50    Maximum header size
  16
Last start attempt   23-MAY 13:07:20    Maximum buffer size
 1498
Last start done      23-MAY 13:07:20    Rcv quota charged
 15040
Last start failed               None    Default FC value
  00
MCA match enabled                 01    Default AC value
  00
Last MCA filtered  AB-00-00-04-00-00    Maintenance state
  ON
UCB status:  00000017 STRTN,LEN,UNIQ,STRTD
Receive IRP queue       80E356E8  Status:  Valid, 1 element
Receive pending queue   80E356E0  Status:  Valid, empty
Multicast address table, embedded:
  AB-00-00-04-00-00
```

```
LAN Data Structures
-------------------
        -- ESA1 60-03 (DECNET) Counters Information 23-MAY-1996 13:07:52
 --
Octets received                  483    Octets sent
 180
PDUs received                      7    PDUs sent
   3
Mcast octets received            483    Mcast octets sent
 180
Mcast PDUs received                7    Mcast PDUs sent
   3
Unavail user buffer                0    Multicast not enabled
   0
Last UUB time                   None    User buffer too small
   0
```

The SHOW LAN/FULL command displays information for all LAN, LSB, and UCB data structures.

2.
```
SDA>  SHOW LAN/TIME
               -- LAN History Information 12-FEB-1995 11:08:48 --
12-FEB 11:08:47.92  ESA               Last receive
12-FEB 11:08:47.92  ESA               Last fork scheduled
12-FEB 11:08:47.92  ESA               Last fork time
12-FEB 11:08:47.77  ESA5     LAST     Last receive
12-FEB 11:08:47.72  ESA3     LAT      Last receive
12-FEB 11:08:41.25  ESA               Last transmit
12-FEB 11:08:41.25  ESA5     LAST     Last transmit
12-FEB 11:08:40.02  ESA2     DECnet   Last receive
12-FEB 11:08:39.14  ESA2     DECnet   Last transmit
12-FEB 11:08:37.39  ESA3     LAT      Last transmit
12-FEB 10:19:25.31  ESA               Last unavail user buffer
12-FEB 10:19:25.31  ESA2     DECnet   Last unavail user buffer
11-FEB 14:10:20.09  ESA5     LAST     Last start completed
11-FEB 14:10:02.16  ESA3     LAT      Last start completed
11-FEB 14:09:58.44  ESA2     DECnet   Last start completed
11-FEB 14:09:57.44  ESA               Last DAT transmit
```

The SHOW LAN/TIME command displays print time information from device and unit data structures.

3.
```
SDA> SHOW LAN/VCI/DEVICE=ICB
               -- ICB VCI Information 17-APR-1996 14:22:07 --
LSB address  = 80A1D580
Device state = 00000003 RUN,INITED
         -- ICB2 80-41 (LAST) VCI Information 17-APR-1996 14:22:07 --
VCIB address =    8096F238
CLIENT flags:     00000001 RCV_DCB
LAN flags:        00000004 LAN_INIT
DLL flags:        00000005 XMT_CHAIN,PORT_STATUS
UCB status:       00000015 STRTN,UNIQ,STRTD
VCI ID                        LAST    VCI version
 00010001
UCB address               80A4C5C0    DP VCRP address
 00000000
Hardware address  00-00-93-08-52-CF    LDC address
 80A1D720
```

```
Physical address  00-00-93-08-52-CF    LAN medium
 TR
Transmit available         80A1D670    Outstanding operations
 0
Maximum receives                  0    Outstanding receives
 0
Max xmt size                   4444    Header size
 52
Build header rtn           808BF230    Report event rtn
 86327130
XMT initiate rtn           808BF200    Transmit complete rtn
 86326D80
XMT frame rtn              808BF210    Receive complete rtn
 86326A80
      -- ICB2 80-41 (LAST) VCI Information (cont) 17-APR-1996 14:22:07
 --
Portmgmt initiate rtn      808BF0C0    Portmgmt complete rtn
 86327100
Monitor request rtn        00000000    Monitor transmit rtn
 00000000
Monitor flags              00000000    Monitor receive rtn
 00000000
Port usable                00000000    Port unusable
 00000000
```

The SHOW LAN/VCI/DEVICE=ICB command displays the VCIB for a Token Ring device (ICB) that has an active VCI user (LAST).

4.
```
SDA> SHOW LAN/ELAN
        -- HCA Emulated LAN LSB Information 17-APR-1996 14:08:02 --
LSB address = 8098D200
Device state = 00000101 RUN,RING_AVAIL
Driver CM VC setup adr   808986A0    Driver CM VC teardown adr
 80898668
NIPG CM handle adr       8096C30C    NIPG CM SVC handle
 00000000
NIPG CM agent handle adr 809B364C    NIPG CM mgr lineup handle
 809B394C
NIPG CM ILMI IO handle   809B378C    MIB II handle adr
 809B94CC
MIB handle adr           809B3ACC    Queue header for EL LSBs
 00000000
DEC MIB handle adr       809BBD8C    NIPG current TQEs used
 00000000
Count of allocated TQEs  0000000D    NIPG current pool used
 0000D2C0
NIPG pool allocations    00075730
        -- ELA Emulated LAN LSB Information 17-APR-1996 14:08:02 --
LSB address = 80AB08C0
Device state = 00000001 RUN
ELAN name = ELAN 1
ELAN description = ATM ELAN
ELAN parent = HCA0
ELAN state = 00000001 ACTIVE
MAX transmit size     MTU_1516          ELAN media type      LAN_802_3
LEC attr buff adr     80AB1FC0          LEC attr buff size    00000328
Event mask            00000000          PVC identifer         00000000
Extended sense        00000000
```

```
         -- ELA Emulated LAN LEC Attributes 17-APR-1996 14:08:02 --
LAN type          00000000          LAN MTU              00000001
Proxy flag        00000000          Control timeout      0000000A
Max UF count      00000001          Max UF time          00000001
VCC timeout       000004B0          Max retry count      00000002
LEC id            00000002          Forw delay time      0000000F
Flush timeout     00000004          Path switch delay    00000006
SM state          00000070          Illegal CTRL frames  00000000
CTRL xmt failures 00000000          CTRL frames sent     0000000C
CTRL frames_rcvd  00000012          LEARPs sent          00000000
LEARPS rcvd       00000000          UCASTs sent direct   00000000
UCASTs flooded    00000006          UCASTs discarded     00000001
NUCASTs sent      00000000
Local ESI         00000000.00000000
BUS ATM addr      39999900000000008002BA57E80.AA000302FF12.00
LES ATM addr      39999900000000008002BA57E80.AA000302FF14.00
My ATM addr       39999900000000008002BA57E80.08002B2240A0.00
```

The SHOW LAN/ELAN command displays information for the parent ATM device (HCA) driver and the ELAN pseudo-device (ELA) driver.

5.
```
SDA> SHOW LAN/ELAN/DEV=ELA
        -- ELA Emulated LAN LSB Information 17-APR-1996 14:08:22 --
LSB address = 80AB08C0
Device state = 00000001 RUN
ELAN name = ELAN 1
ELAN description = ATM ELAN
ELAN parent = HCA0
ELAN state = 00000001 ACTIVE
MAX transmit size     MTU_1516          ELAN media type      LAN_802_3
LEC attr buff adr     80AB1FC0          LEC attr buff size    00000328
Event mask            00000000          PVC identifer         00000000
Extended sense        00000000
         -- ELA Emulated LAN LEC Attributes 17-APR-1996 14:08:22 --
LAN type             00000000          LAN MTU              00000001
Proxy flag           00000000          Control timeout      0000000A
Max UF count         00000001          Max UF time          00000001
VCC timeout          000004B0          Max retry count      00000002
LEC id               00000002          Forw delay time      0000000F
Flush timeout        00000004          Path switch delay    00000006
SM state             00000070          Illegal CTRL frames  00000000
CTRL xmt failures    00000000          CTRL frames sent     0000000C
CTRL frames_rcvd     00000012          LEARPs sent          00000000
LEARPS rcvd          00000000          UCASTs sent direct   00000000
UCASTs flooded       00000006          UCASTs discarded     00000001
NUCASTs sent         00000000
Local ESI            00000000.00000000
BUS ATM addr         39999900000000008002BA57E80.AA000302FF12.00
LES ATM addr         39999900000000008002BA57E80.AA000302FF14.00
My ATM addr          39999900000000008002BA57E80.08002B2240A0.00
```

The SHOW LAN/ELAN/DEVICE=ELA command displays information for the ELAN pseudo-device (ELA) driver only.

6.
```
SDA>  SHOW LAN/ELAN/DEVICE=HCA
       -- HCA Emulated LAN LSB Information 17-APR-1996 14:08:25 --
LSB address = 8098D200
Device state = 00000101 RUN,RING_AVAIL
```

```
Driver CM VC setup adr   808986A0    Driver CM VC teardown adr
 80898668
NIPG CM handle adr       8096C30C    NIPG CM SVC handle
 00000000
NIPG CM agent handle adr 809B364C    NIPG CM mgr lineup handle
 809B394C
NIPG CM ILMI IO handle   809B378C    MIB II handle adr
 809B94CC
MIB handle adr           809B3ACC    Queue header for EL LSBs
 00000000
DEC MIB handle adr       809BBD8C    NIPG current TQEs used
 00000000
Count of allocated TQEs  0000000D    NIPG current pool used
 0000D2C0
NIPG pool allocations    000757B2
```

The SHOW LAN/ELAN/DEVICE=HCA command displays information for the ATM device (HCA) driver only.

4.55. SHOW LOCKS

Displays information about all lock management locks in the system, or about a specified lock.

Format

SHOW LOCKS [lock-id

| /ADDRESS=n

| /ALL (d)

| /BRIEF

| /BLOCKING

| /CACHED

| /CONVERT

| /GRANTED

| /NAME=name

| /STATUS=(keyword[,...])

| /WAITING] or SHOW LOCKS {/POOL | /SUMMARY}

Parameters

lock-id

Name of a specific lock.

Qualifiers

/ADDRESS=*n*

Displays a specific lock, given the address of the lock block.

/ALL

Lists all locks that exist in the system. This is the default behavior of the SHOW LOCKS command.

/BLOCKING

Displays only the locks that have a blocking AST specified or attached.

/BRIEF

Displays a single line of information for each lock.

/CACHED

Displays locks that are no longer valid. The memory for these locks is saved so that later requests for locks can use them. Cached locks are not displayed in the other SHOW LOCKS commands.

/CONVERT

Displays only the locks that are on the conversion queue.

/GRANTED

Displays only the locks that are on the granted queue.

/NAME=*name*

Displays all locks on the specified resource. Name can be the actual name of the resource, if it only contains uppercase letters, numerals, the underscore (_), dollar sign, colon (:), and some other printable characters, as for example, /NAME=MY_LOCK. If it contains other printable characters (including lowercase letters), you may need to enclose the name in quotation marks (""), as for example, /NAME="My_Lock/47". If it contains nonprintable characters, you can specify the name as a comma-separated list comprised of strings and hexadecimal numbers. For example, /NAME=("My_Lock",0C00,"/47") would specify the name "My_Lock<NUL><FF>/47". The hexadecimal number can be no more than 8 digits (4 bytes) in length. Nonprintable sequences of more than 4 bytes must be split into multiple hexadecimal numbers. The maximum length of a resource name is 32 characters.

/POOL

Displays the lock manager's poolzone information, which contains the lock blocks (LKB) and resource blocks (RSB).

/STATUS=*(keyword[,...])*

Displays only the locks that have the specified status bits set in the LKB$L_STATUS field. If you specify only one keyword, you can omit the parentheses. Status keywords are as follows:

Keyword	Meaning
2PC_IP	Indicates a two-phase operation in progress
2PC_PEND	Indicates a two-phase operation pending
ASYNC	Completes request asynchronously
BLKASTFLG	Specifies a blocking AST
BLKASTQED	Indicates a blocking AST is queued
BRL	Indicates a byte range lock
CACHED	Indicates a lock block in cache

Keyword	Meaning
CVTSUBRNG	Indicates a sub-range convert request
CVTTOSYS	Converts back to system-owned lock
DBLKAST	Delivers a blocking AST
DCPLAST	Delivers a completion AST
DPC	Indicates a delete pending cache lock
FLOCK	Indicates a fork lock
GRSUBRNG	Grants sub-range lock
IP	Indicates operation in process
MSTCPY	Indicates a lock block is a master copy
NEWSUBRNG	Indicates a new sub-range request
NOQUOTA	Does not charge quota
PCACHED	Indicates lock block needs to be cached
PROTECT	Indicates a protected lock
RESEND	Resends during failover
RM_RBRQD	Requires remaster rebuild
RNGBLK	Specifies a range block
RNGCHG	Indicates a changing range
TIMOUTQ	Indicates lock block is on timeout queue
VALBLKRD	Indicates read access to lock value block
VALBLKWRT	Indicates write access to lock value block
WASSYSOWN	Indicates was system-owned lock

/SUMMARY

Displays summary data and performance counters.

/WAITING

Displays only the waiting locks.

Description

The SHOW LOCKS command displays the information described in the table below for each lock management lock in the system, or for the lock indicated by **lock-id**, an address or name. (Use the SHOW SPINLOCKS command to display information about spinlocks.) You can obtain a similar display for the locks owned by a specific process by issuing the appropriate SHOW PROCESS/LOCKS command. See the *VSI OpenVMS Programming Concepts Manual* for additional information.

You can display information about the resource to which a lock is queued by issuing the SHOW RESOURCES command specifying the resource's **lock-id**.

Table 4.3. Contents of the SHOW LOCKS and SHOW PROCESS/LOCKS Displays

Display Element	Description
Process Index	Index in the PCB array to a pointer to the process control block (PCB) of the process that owns the

Display Element	Description
	lock. This display element is produced only by the SHOW PROCESS/LOCKS command.
Name	Name of the process that owns the lock. This display element is produced only by the SHOW PROCESS/LOCKS command.
Extended PID	Clusterwide identification of the process that owns the lock. This display element is produced only by the SHOW PROCESS/LOCKS command.
Lock ID	Identification of the lock.
PID	Systemwide identification of the lock.
Flags	Information specified in the request for the lock.
Par. ID	Identification of the lock's parent lock.
Sublocks	Count of the locks that the lock owns.
LKB	Address of the lock block (LKB). If a blocking AST has been enabled for this lock, the notation "BLKAST" appears next to the LKB address.
Priority	The lock priority.
Granted at	Lock mode at which the lock was granted.
RSB	Address of the resource block.
Resource	Dump of the resource name. The two leftmost columns of the dump show its contents as hexadecimal values, the least significant byte being represented by the rightmost two digits. The rightmost column represents its contents as ASCII text, the least significant byte being represented by the leftmost character.
Status	Status of the lock, information used internally by the lock manager.
Length	Length of the resource name.
Mode	Processor access mode of the namespace in which the resource block (RSB) associated with the lock resides.
Owner	Owner of the resource. Certain resources owned by the operating system list "System" as the owner. Resources owned by a group have the number (in octal) of the owning group in this field.
Copy	Indication of whether the lock is mastered on the local system or is a process copy.

Examples

1.
```
SDA>  SHOW LOCKS
Lock Database
-------------
```

```
Lock id:  3E000002          PID:    00000000   Flags: CONVERT NOQUEUE
 SYNCSTS
Par. id:  00000000          SUBLCKs:       0          NOQUOTA CVTSYS
LKB:      FFFFFFFF.7DF48150   BLKAST: 81107278
Priority:     0000

Granted at    CR   00000000-FFFFFFFF

RSB:               FFFFFFFF.7DF68D50
Resource:          494D6224 42313146  F11B$bMI  Status: NOQUOTA VALBLKR
 VALBLKW
 Length   18       4D55445F 5944414C  LADY_DUM
 Kernel mode       00000000 00005350  PS......
 System            00000000 00000000  ........

Local copy

Lock Database
-------------

Lock id:  3F000003          PID:    00000000   Flags: VALBLK  CONVERT
 SYNCSTS
Par. id:  0100007A          SUBLCKs:       0          CVTSYS
LKB:      FFFFFFFF.7DF48250   BLKAST: 00000000
Priority:     0000

Granted at    NL   00000000-FFFFFFFF

RSB:               FFFFFFFF.7DF51D50
Resource:          01F77324 42313146  F11B$s÷.  Status: NOQUOTA VALBLKR
 VALBLKW
 Length   10       00000000 00000000  ........
 Kernel mode       00000000 00000000  ........
 System            00000000 00000000  ........

Local copy

Lock Database
-------------

Lock id:  0A000004          PID:    0001000F   Flags: VALBLK  CONVERT
 SYNCSTS
Par. id:  00000000          SUBLCKs:       0          SYSTEM  NODLCKW
 NODLCKB
LKB:      FFFFFFFF.7DF48350   BLKAST: 81190420        QUECVT
Priority:     0000

Granted at    EX   00000000-FFFFFFFF

RSB:               FFFFFFFF.7DF50850
Resource:          004F0FDF 24534D52  RMS$ß.O.  Status: VALBLKR VALBLKW
 Length   26       5F313039 58020000  ...X901_
 Exec. mode        00202020 204C354B  K5L    .
 System            00000000 00000000  ........

Local copy

   .
```

```
.
.
```

2.
```
SDA>  SHOW RESOURCES/LOCKID=0A000004
Resource Database
-----------------
RSB:           FFFFFFFF.7DF50850  GGMODE:     EX  Status: DIRENTR VALID
Parent RSB:    00000000.00000000  CGMODE:     EX
Sub-RSB count:        0           FGMODE:     EX
Lock Count:           1           RQSEQNM:  0000
BLKAST count:         1           CSID: 00000000  (MILADY)

Resource:           004F0FDF 24534D52  RMS$ß.O.  Valblk: 00000000
 00000000
 Length   26        5F313039 58020000  ...X901_          00000000
 00000000
 Exec. mode         00202020 204C354B  K5L    .
 System             00000000 00000000  ........  Seqnum: 00000000

Granted queue (Lock ID / Gr mode / Range):
 0A000004  EX 00000000-FFFFFFFF

Conversion queue (Lock ID / Gr mode / Range -> Rq mode / Range):
     *** EMPTY QUEUE ***

Waiting queue (Lock ID / Rq mode / Range):
     *** EMPTY QUEUE ***
```

This SDA session shows the output of the SHOW LOCKS command for several locks. The SHOW RESOURCES command, executed for the last displayed lock, verifies that the lock is in the resource's granted queue. (See Table 4-26 for a full explanation of the contents of the display of the SHOW RESOURCES command.)

3.
```
SDA> SHOW LOCK/BRIEF/BLOCKING

Lock Database
-------------
   LKB Address     Lockid   ParentId   PID     BLKAST  SubLocks RQ GR  Queue      RSB Address            Resource Name          Mode
----------------- -------- -------- -------- -------- -------- -- -- ------- ----------------- ------------------------------ ----
FFFFFFFF.7FF42450 51000003 00000000 00000000 80CC7648        0    CR Granted FFFFFFFF.7FF45050 F11B$bSWPCTX_DUMPS             Kern
FFFFFFFF.7FF42850 01000005 00000000 00000000 80CB5020      111    CR Granted FFFFFFFF.7FF42950 F11B$vX6JU_R3N                 Kern
FFFFFFFF.7FF42A50 01000006 00000000 00000000 80CD3D98        0    PR Granted FFFFFFFF.7FF42B50 VCC$vX6JU_R3N                  Kern
FFFFFFFF.7FF42E50 4D000008 00000000 00000000 80CC7648        0    CR Granted FFFFFFFF.7FF43150 F11B$bX6JU_R3N                 Kern
FFFFFFFF.7FF43E50 13000010 00000000 00000000 80CD3D98        0    PR Granted FFFFFFFF.7FF53D50 VCC$vSWPCTX_DUMPS              Kern
FFFFFFFF.7FF48750 12000033 03000094 00010008 80CE7220        0    PW Granted FFFFFFFF.7FF48E50 APPENDER                       Exec
FFFFFFFF.7FF49550 1500003A 00000000 00010008 00010B20        0    CR Granted FFFFFFFF.7FF54E50 AUDRSV$DJ......X6JU_R3N    ... User
FFFFFFFF.7FF49B50 1300003D 00000000 00010007 00035EF8        0    CR Granted FFFFFFFF.7FF56250 OPC$opcom-restart              User
FFFFFFFF.7FF4BE50 2100004F 00000000 0001000B 80CE66F0        4    NL Granted FFFFFFFF.7FF4DC50 RMS$y......X6JU_R3N    ...     Exec
FFFFFFFF.7FF4C950 13000054 00000000 0001000B 80CE66F0        0    EX Granted FFFFFFFF.7FF4CE50 RMS$ß.O....X6JU_R3N    ...     Exec
FFFFFFFF.7FF4E050 0B00005F 00000000 00010009 80CE66F0        4    NL Granted FFFFFFFF.7FF4AD50 RMS$£......X6JU_R3N    ...     Exec
FFFFFFFF.7FF4EA50 0C000064 00000000 00010007 00035F30        0    CR Granted FFFFFFFF.7FF56150 OPC$opcom-abort                User
FFFFFFFF.7FF51350 18000078 00000000 00010011 0000B930        0    PR Granted FFFFFFFF.7FF44E50 NET$NETPROXY_MODIFIED          Kern
FFFFFFFF.7FF52850 0C000082 00000000 00000000 80CB5020        0    CR Granted FFFFFFFF.7FF43550 F11B$vSWPCTX_DUMPS             Kern
FFFFFFFF.7FF53250 09000087 00000000 00010008 80CE66F0        4    EX Granted FFFFFFFF.7FF49850 RMS$J......X6JU_R3N    ...     Exec
FFFFFFFF.7FF46C50 2700008E 00000000 0001000A 80CE66F0        2    EX Granted FFFFFFFF.7FF53750 RMS$.......X6JU_R3N    ...     Exec
FFFFFFFF.7FF54750 03000094 00000000 00010008 80CE66F0        2    EX Granted FFFFFFFF.7FF4A950 RMS$K......X6JU_R3N    ...     Exec
FFFFFFFF.7FF54B50 04000098 10000042 00010008 00011358        0    CR Granted FFFFFFFF.7FF55050 WRITER                         User
FFFFFFFF.7FF54D50 05000099 11000047 00010009 00010F48        0    PR Granted FFFFFFFF.7FF56F50 JBC$_CHECK_DB                  User
FFFFFFFF.7FF55150 0100009A 10000042 00010008 000112E0        0    CR Granted FFFFFFFF.7FF55250 DOORBELL                       User
FFFFFFFF.7FF55350 0200009B 00000000 00010008 00010B20        0    CR Granted FFFFFFFF.7FF55450 AUDRSV$DK......X6JU_R3N    ... User
FFFFFFFF.7FF55550 0200009C 00000000 00010008 80CE66F0        2    EX Granted FFFFFFFF.7FF55850 RMS$L......X6JU_R3N    ...     Exec
FFFFFFFF.7FF55D50 020000A0 00000000 00010008 000123E0        0    CR Granted FFFFFFFF.7FF55C50 AUDRSV$OL......X6JU_R3N    ... User
FFFFFFFF.7FF57250 040000A9 00000000 0001000A 80CE66F0        2    EX Granted FFFFFFFF.7FF4AD50 RMS$£......X6JU_R3N    ...     Exec
FFFFFFFF.7FF57A50 030000AF 110000AA 0001000A 00012628        0    PR Granted FFFFFFFF.7FF57D50 QMAN$REF........               User
FFFFFFFF.7FF58150 010000B2 110000AA 0001000A 000109C0        0    PR Granted FFFFFFFF.7FF58050 QMAN$NEW_JOBCTL                User
FFFFFFFF.7FF58E50 050000B9 110000AA 0001000A 000147F8        0    PR Granted FFFFFFFF.7FF58F50 QMAN$MASTER_QUEUES             User
```

This example shows the brief display for all locks with a blocking AST.

4.56. SHOW MACHINE_CHECK

Displays the contents of the stored machine check frame. This command is valid for the DEC 4000 Alpha, DEC 7000 Alpha, and DEC 10000 Alpha computers only.

Format

SHOW MACHINE_CHECK [/FULL] [cpu-id]

Parameters

cpu-id

Numeric value indicating the identity of the CPU for which context information is to be displayed. This parameter changes the SDA current CPU (the default) to the CPU specified with **cpu-id**. If you specify the **cpu-id** of a processor that was not active at the time of the system failure, SDA displays the following message:

```
%SDA-E-CPUNOTVLD, CPU not booted or CPU number out of range
```

If you use the cpu-id parameter, the SHOW MACHINE_CHECK command performs an implicit SET CPU command, making the CPU indicated by cpu-id the current CPU for subsequent SDA commands. (See the description of the SET CPU command and Section 2.5 for information on how this can affect the CPU context---and process context---in which SDA commands execute.)

Qualifiers

/FULL

Specifies that a detailed version of the machine check information be displayed. This is currently identical to the default summary display.

Description

The SHOW MACHINE_CHECK command displays the contents of the stored machine check frame. A separate frame is allocated at boot time for every CPU in a multiple-CPU system. This command is valid for the DEC 4000 Alpha, DEC 7000 Alpha, and DEC 10000 Alpha computers only.

If you do not specify a qualifier, a summary version of the machine check frame is displayed.

The default **cpu-id** is the SDA current CPU.

Examples

1.
```
SDA> SHOW MACHINE_CHECK
CPU 00 Stored Machine Check Crash Data
--------------------------------------
Processor specific information:
-------------------------------
Exception address:    FFFFFFFF.800B0250    Exception Summary:
 00000000.00000000
Pal base address:     00000000.00008000    Exception Mask:
 00000000.00000000
HW Interrupt Request: 00000000.00000342    HW Interrupt Ena:
 00000001.FFC01CE0
MM_CSR                00000000.00003640    ICCSR:
 00000002.381F0000
D-cache address:      00000007.FFFFFFFF    D-cache status:
 00000000.000002E0
```

```
BIU status:           00000000.00000050    BIU address [7..0]:
 00000000.000060E0
BIU control:          00000008.50006447    Fill Address:
 00000000.00006120
Single-bit syndrome:  00000000.00000000    Processor mchck VA:
 00000000.00006190
A-box control:        00000000.0000040E    B-cache TAG:
 00106100.83008828
System specific information:
----------------------------
Garbage bus info:     00200009 00000038    Device type:
 000B8001
LCNR:                          00000001    Memory error:
 00000000
LBER:                          00000009    Bus error synd 0,1: 00000000
 00000000
Bus error cmd:        00048858 00AB1C88    Bus error synd 2,3: 00000000
 0000002C
LEP mode:                      00010010    LEP lock address:
 00041108
```

The SHOW MACHINE_CHECK command in this SDA display shows the contents of the stored machine check frame.

2.
```
SDA> SHOW MACHINE_CHECK 1
CPU 01 Stored Machine Check Crash Data
--------------------------------------
Processor specific information:
-------------------------------
Exception address:    FFFFFFFF.800868A0    Exception Summary:
 00000000.00000000
Pal base address:     00000000.00008000    Exception Mask:
 00000000.00000000
HW Interrupt Request: 00000000.00000342    HW Interrupt Ena:
 00000000.1FFE1CE0
MM_CSR                00000000.00005BF1    ICCSR:
 00000000.081F0000
D-cache address:      00000007.FFFFFFFF    D-cache status:
 00000000.000002E0
BIU status:           00000000.00000050    BIU address [7..0]:
 00000000.000063E0
BIU control:          00000008.50006447    Fill Address:
 00000000.00006420
Single-bit syndrome:  00000000.00000000    Processor mchck VA:
 00000000.00006490
A-box control:        00000000.0000040E    B-cache TAG:
 35028EA0.50833828
System specific information:
----------------------------
Garbage bus info:     00210001 00000038    Device type:
 000B8001
LCNR:                          00000001    Memory error:
 00000080
LBER:                          00040209    Bus error synd 0,1: 00000000
 00000000
Bus error cmd:        00048858 00AB1C88    Bus error synd 2,3: 00000000
 0000002C
```

```
LEP mode:                       00010010    LEP lock address:
 00041108
```

The SHOW MACHINE_CHECK command in this SDA display shows the contents of the stored machine check frame for **cpu-id** 01.

4.57. SHOW MEMORY

Displays the availability and usage of memory resources.

Format

SHOW MEMORY [/ALL][/BUFFER_OBJECTS][/CACHE][/FILES]

[/FULL][/GH_REGIONS][/PHYSICAL_PAGES][/POOL]

[/RESERVED][/SLOTS]

Parameters

None.

Qualifiers

/ALL

Displays all available information, that is, information displayed by the following qualifiers:

- /BUFFER_OBJECTS
- /CACHE
- /FILES
- /GH_REGIONS
- /PHYSICAL_PAGES
- /POOL
- /RESERVED
- /SLOTS

This is the default display.

/BUFFER_OBJECTS

Displays information about system resources used by buffer objects.

/CACHE

Displays information about either the Virtual I/O Cache facility or the Extended File Cache facility. The system parameter VCC_FLAGS determines which is used. The cache facility information is displayed as part of the SHOW MEMORY and SHOW MEMORY/CACHE/FULL commands.

/FILES

Displays information about the use of each paging and swapping file currently installed.

/FULL

When used with the /POOL and /CACHE qualifiers, displays additional information. This qualifier is ignored otherwise. For /CACHE, the additional information is only displayed when the Virtual I/O Cache facility is in use (Alpha only); /FULL is ignored if the Extended File Cache facility is in use. Additional information on how memory is being used by the Extended File Cache facility can be obtained using the XFC extension described in Chapter 9.

/GH_REGIONS

Displays information about the granularity hint regions (GHR) that have been established. For each of these regions, information is displayed about the size of the region, the amount of free memory, the amount of memory in use, and the amount of memory released to OpenVMS from the region. The granularity hint regions information is also displayed as part of SHOW MEMORY and SHOW MEMORY/ALL commands.

/PHYSICAL_PAGES

Displays information about the amount of physical memory and the number of free and modified pages.

/POOL

Displays information about the usage of each dynamic memory (pool) area, including the amount of free space and the size of the largest contiguous block in each area.

/RESERVED

Displays information about memory reservations.

/SLOTS

Displays information about the availability of process control block (PCB) vector slots and balance slots.

Description

For more information about the SHOW MEMORY command, see the description in the *VSI OpenVMS DCL Dictionary* or online help.

4.58. SHOW PAGE_TABLE

Displays a range of system page table entries, the entire system page table, or the entire global page table.

Format

`SHOW PAGE_TABLE [range | /FREE [/HEADER=address ]`

`| /GLOBAL | /GPT | /PT`

| /INVALID_PFN [=option]

| /NONMEMORY_PFN [=option]

| /PTE_ADDRESS | /SECTION_INDEX=n

| /S0S1 (d) | /S2 | /SPTW | /ALL]

[/L1 | /L2 | /L3 (d)]

Parameters

range

Range of virtual addresses or PTE addresses for which SDA displays page table entries. If the qualifier /PTE_ADDRESS is given, then the range is of PTE addresses; otherwise, the range is of virtual addresses. The range given can be of process-space addresses.

If /PTE_ADDRESS is given, the range is expressed using the following syntax:

m	Displays the single page table entry at address *m*
m:n	Displays the page table entries from address *m* to address *n*
m;n	Displays *n* bytes of page table entries starting at address *m*

If /PTE_ADDRESS is not given, then range is expressed using the following syntax:

m	Displays the single page table entry that corresponds to virtual address *m*
m:n	Displays the page table entries that correspond to the range of virtual addresses from *m* to *n*
m;n	Displays the page table entries that correspond to a range of *n* bytes starting at virtual address *m*

Note that OpenVMS Alpha and Integrity servers page protections are slightly different. For additional information, see Section 2.8.

Qualifiers

/FREE

Causes the starting addresses and sizes of blocks of pages in the free PTE list to be displayed. The qualifiers /S0S1 (default), /S2, /GLOBAL, and /HEADER determine which free PTE list is to be displayed. A range cannot be specified, and no other qualifiers can be combined with /FREE.

/GLOBAL

Lists the global page table. When used with the /FREE qualifier, /GLOBAL indicates the free PTE list to be displayed.

/HEADER=*address*

When used with the /FREE qualifier, the /HEADER=*address* qualifier displays the free PTE list for the specified private page table.

/GPT

Specifies the portion of page table space that maps the global page table as the address range.

/INVALID_PFN [=*option*]

The /INVALID_PFN qualifier, which is valid only on platforms that supply an I/O memory map, causes SDA to display only page table entries that map to PFNs that are not in the system's private memory or in Galaxy-shared memory, and which are not I/O access pages.

/INVALID_PFN has two optional keywords, READONLY and WRITABLE. If neither keyword is specified, all relevant pages are displayed.

If READONLY is specified, only pages marked for no write access are displayed. If WRITABLE is specified, only pages that allow write access are displayed. For example, SHOW PAGE_TABLE/ALL/INVALID_PFN=WRITABLE would display all system pages whose protection allows write, but which map to PFNs that do not belong to this system.

/L1

/L2

/L3 (D)

Specifies the level for which page table entries are to be displayed for the specified portion of memory. You can specify only one level. /L3 is the default.

/NONMEMORY_PFN [=*option*]

The /NONMEMORY_PFN qualifier causes SDA to display only page table entries that are not in the system's private memory or in Galaxy-shared memory.

/NONMEMORY_PFN has two optional keywords, READONLY and WRITABLE. If neither keyword is specified, all relevant pages are displayed.

If READONLY is specified, only pages marked for no write access are displayed. If WRITABLE is specified, only pages that allow write access are displayed. For example, SHOW PAGE_TABLE/ALL/NONMEMORY_PFN=WRITABLE would display all system pages whose protection allows write, but which map to PFNs that do not belong to this system.

/PT

Specifies that the page table entries for the page table region of system space are to be displayed.

/PTE_ADDRESS

Specifies that the range given is of PTE addresses instead of the virtual addresses mapped by the PTEs.

/SECTION_INDEX=*n*

Displays the page table for the range of pages in the global section or pageable part of a loaded image. For pageable portions of loaded images, one of the qualifiers /L1, /L2, or /L3 can also be specified.

/S0S1 (D)

/S2

Specifies the region whose page table entries are to be displayed. When used with the /FREE qualifier, indicates the free PTE list to be displayed. By default, the page table entries or the free list for S0 & S1 space is displayed.

/SPTW

Displays the contents of the system page table window.

/ALL

Displays the page table entries for all shared (system) addresses. It is equivalent to specifying all of /S0S1, /S2, and /PT.

Description

If the /FREE qualifier is not specified, this command displays page table entries for the specified range of addresses or section of memory. For each virtual address displayed by the SHOW PAGE_TABLE command, the first eight columns of the listing provide the associated page table entry and describe its location, characteristics, and contents. SDA obtains this information from the system page table or from the process page table if a process_space address is given. The table below desand IMGACT process pools. cribes the information displayed by the SHOW PAGE_TABLE command.

If the /FREE qualifier is specified, this command displays the free PTE list for the specified section of memory.

The /L1, /L2, and /L3 qualifiers are ignored when used with the /FREE, /GLOBAL, and /SPTW qualifiers.

Table 4.4. Virtual Page Information in the SHOW PAGE_TABLE Display

Value	Meaning
MAPPED ADDRESS	Virtual address that marks the base of the virtual page(s) mapped by the PTE.
PTE ADDRESS	Virtual address of the page table entry that maps the virtual page(s).
PTE	Contents of the page table entry, a quadword that describes a system virtual page.
TYPE	Type of virtual page. Table 4.5 shows the eight types and their meanings.
READ	(Alpha only.) A code, derived from bits in the PTE, that designates the processor access modes (kernel, executive, supervisor, or user) for which read access is granted.

Value	Meaning
WRIT	(Alpha only.) A code, derived from bits in the PTE, that designates the processor access modes (kernel, executive, supervisor, or user) for which write access is granted.
MLOA	(Alpha only.) Letters that represent the setting of a bit or a combination of bits in the PTE. These bits indicate attributes of a page. Table 4.6 shows the codes and their meanings.
AR/PL	(Integrity servers only) The access rights and privilege level of the page. Consists of a number (0-7) and a letter (K, E, S, or U) that determines access to a page in each mode.
KESU	(Integrity servers only) The access allowed to the page in each mode. This is an interpretation of the AR/PL values in the previous column. For an explanation of the access codes, see Section 2.8.
MLO	(Integrity servers only) Letters that represent the setting of a bit or a combination of bits in the PTE. These bits indicate attributes of a page. Table 4.6 shows the codes and their meanings.
GH	Contents of granularity hint bits.

Table 4.5. Types of Virtual Pages

Type	Meaning
VALID	Valid page (in main memory).
TRANS	Transitional page (on free or modified page list).
DZERO	Demand-allocated, zero-filled page.
PGFIL	Page within a paging file.
STX	Section table's index page.
GPTX	Index page for a global page table.
IOPAG	Page in I/O address space.
NXMEM	Page not represented in physical memory. The page frame number (PFN) of this page is not mapped by any of the system's memory controllers. This indicates an error condition.

Table 4.6. Bits In the PTE

Column Name	Code	Meaning
M	M	Page has been modified.
L	L	Page is locked into a working set.
L	P	Page is locked in physical memory.
O	K	Owner is kernel mode.

Column Name	Code	Meaning
O	E	Owner is executive mode.
O	S	Owner is supervisor mode.
O	U	Owner is user mode.
A	A	Address space match is set (Alpha only).

If the virtual page has been mapped to a physical page, the last five columns of the listing include information from the page frame number (PFN) database; otherwise, the section is left blank. Table 4.7 describes the physical page information displayed by the SHOW PAGE_TABLE command.

Table 4.7. Physical Page Information in the SHOW PAGE_TABLE Display

Category	Meaning
PGTYP	Type of physical page. Table 4.8 shows the types of physical pages.
LOC	Location of the page within the system. Table 4.9 shows the possible locations with their meaning.
BAK	Place to find information on this page when all links to this PTE are broken: either an index into a process section table or the number of a virtual block in the paging file.
REFCNT	Number of references being made to this page.
WSLX	Working Set List Index. This shows as zero for resident and global pages, and is left blank for transition pages.

Table 4.8. Types of Physical Pages

Page Type	Meaning
PROCESS	Page is part of process space.
SYSTEM	Page is part of system space.
GLOBAL	Page is part of a global section.
GBLWRT	Page is part of a global, writable section.
PPGTBL	Page is part of a process page table.
GPGTBL	Page is part of a global page table.
PHD	Page is part of a process PHD. These page types are variants of the PPGTBL page type.
PPT(Ln)	Page is a process page table page at level *n*. These page types are variants of the PPGTBL page type.
WSL	Page is part of a process's working list. These page types are variants of the PPGTBL page type.
SPT(Ln)	Page is a system page table page at level *n*. These page types are variants of the SYSTEM page type.
SHPT	Page is part of a shared page table. These page types are variants of the GBLWRT page type.

Page Type	Meaning
PFNLST	Page is in a Shared Memory Common Property Partition PFN database. These page types are variants of the SYSTEM page type.
SHM_REG	Page is in a Shared Memory Region. These page types are variants of the GBLWRT page type.
UNKNOWN	Unknown.

Table 4.9. Locations of Physical Pages

Location	Meaning
ACTIVE	Page is in a working set.
MFYLST	Page is in the modified page list.
FRELST	Page is in the free page list.
BADLST	Page is in the bad page list.
RELPND	Release of the page is pending.
RDERR	Page has had an error during an attempted read operation.
PAGOUT	Page is being written into a paging file.
PAGIN	Page is being brought into memory from a paging file.
ZROLST	Page is in the zeroed-page list.
UNKNWN	Location of page is unknown.

SDA indicates pages are inaccessible by displaying one of the following messages:

```
-------   1 null page:       VA   FFFFFFFE.00064000     PTE
 FFFFFFFD.FF800190

------- 974 null pages:      VA   FFFFFFFE.00064000     PTE
 FFFFFFFD.FF800190
                             -to- FFFFFFFE.007FDFFF     -to-
 FFFFFFFD.FF801FF8
```

In this case, the page table entries are not in use (page referenced is inaccessible).

```
-------      1 entry not in memory:    VA   FFFFFFFE.00800000   PTE
 FFFFFFFD.FF802000

------- 784384 entries not in memory:  VA   FFFFFFFE.00800000   PTE
 FFFFFFFD.FF802000
                                       -to- FFFFFFFF.7F7FDFFF   -to-
 FFFFFFFD.FFDFDFF8
```

In this case, the page table entries do not exist (PTE itself is inaccessible).

```
-------    1 free PTE:    VA   FFFFFFFF.7F800000   PTE   FFFFFFFD.FFDFEOOO

------- 1000 free PTEs:   VA   FFFFFFFF.7F800000   PTE   FFFFFFFD.FFDFE000
```

```
                                    -to- FFFFFFFF.7FFCDFFF   -to-  FFFFFFFD.FFDFFF38
```

In this case, the page table entries are in the list of free system pages.

In each case, VA is the MAPPED ADDRESS of the skipped entry, and PTE is the PTE ADDRESS of the skipped entry.

Examples

1. For an example of SHOW PAGE_TABLE output when the qualifier /FREE has not been given, see the SHOW PROCESS/PAGE_TABLES command.

2.
```
SDA> SHOW PAGE_TABLE/FREE
S0/S1 Space Free PTEs
---------------------
 MAPPED ADDRESS        PTE ADDRESS             PTE            COUNT

FFFFFFFF.82A08000   FFFFFFFD.FFE0A820   0001FFE0.A8580000   00000003
FFFFFFFF.82A16000   FFFFFFFD.FFE0A858   0001FFE0.A8900000   00000003
FFFFFFFF.82A24000   FFFFFFFD.FFE0A890   0001FFE0.B3C00000   00000003
FFFFFFFF.82CF0000   FFFFFFFD.FFE0B3C0   0001FFE0.B4010000   00000001
FFFFFFFF.82D00000   FFFFFFFD.FFE0B400   0001FFE0.B4680000   00000002
   .
   .
   .
FFFFFFFF.82E48000   FFFFFFFD.FFE0B920   0001FFE0.B9390000   00000001
FFFFFFFF.82E4E000   FFFFFFFD.FFE0B938   0001FFE0.BA200000   00000002
FFFFFFFF.82E88000   FFFFFFFD.FFE0BA20   0001FFE0.C9780000   00000003
FFFFFFFF.8325E000   FFFFFFFD.FFE0C978   0001FFE0.CC980000   00000003
FFFFFFFF.83326000   FFFFFFFD.FFE0CC98   00000000.00000000   0000066D
```

   This example shows the output when you invoke the SHOW PAGE_TABLE/FREE command.

4.59. SHOW PARAMETER

Displays the name, location, and value of one or more SYSGEN parameters currently in use or at the time that the system dump was taken.

Format

SHOW PARAMETER [sysgen_parameter]

[/ACP] [/ALL] [/CLUSTER] [/DYNAMIC] [/GALAXY] [/GEN] [/JOB] [/LGI] [/MAJOR] [/MULT

Parameter

sysgen_parameter

The name of a specific parameter to be displayed. The name can include wildcards. However, a truncated name is not recognized, unlike with the equivalent SYSGEN and SYSMAN commands.

Qualifiers

/ACP

Displays all Files-11 ACP parameters.

/ALL

Displays the values of all parameters except the special control parameters.

/CLUSTER

Displays all parameters specific to clusters.

/DYNAMIC

Displays all parameters that can be changed on a running system.

/GALAXY

Displays all parameters specific to Galaxy systems.

/GEN

Displays all general parameters.

/JOB

Displays all Job Controller parameters.

/LGI

Displays all LOGIN security control parameters.

/MAJOR

Displays the most important parameters.

/MULTIPROCESSING

Displays parameters specific to multiprocessing.

/OBSOLETE

Displays all obsolete system parameters. SDA displays obsolete parameters only if they are named explicitly (no wildcards) or if /OBSOLETE is given.

/PQL

Displays the parameters for all default and minimum process quotas.

/RMS

Displays all parameters specific to OpenVMS Record Management Services (RMS).

/SCS

Displays all parameters specific to OpenVMS Cluster System Communications Services.

/SPECIAL

Displays all special control parameters.

/STARTUP

Displays the name of the site-independent startup procedure.

/SYS

Displays all active system parameters.

/TTY

Displays all parameters for terminal drivers.

Description

The SHOW PARAMETER command displays the name, location, and value of one or more SYSGEN parameters at the time that the system dump is taken. You can specify either a parameter name, or one or more qualifiers, but not both a parameter and qualifiers. If you do not specify a parameter or qualifiers, then the last parameter displayed is displayed again.

The qualifiers are the equivalent to those available for the SHOW [parameter] command in the SYSGEN utility and the PARAMETERS SHOW command in the SYSMAN utility. See the *VSI OpenVMS System Management Utilities Reference Manual* for more information about these two commands. You can combine qualifiers, and all appropriate SYSGEN parameters are displayed.

Note

To see the entire set of parameters, use the SDA command SHOW PARAMETER /ALL /SPECIAL /STARTUP /OBSOLETE.

Examples

```
1. SDA> SHOW PARAMETER *SCS*

   Parameter                 Variable                Address    Value    (decimal)               Offset
---------------   ------------------------------   --------   --------  ----------  ------------------------------
SCSBUFFCNT        SCS$GW_BDTCNT                     80C159A0      0032          50
SCSCONNCNT        SCS$GW_CDTCNT                     80C159A8      0005           5
SCSRESPCNT        SCS$GW_RDTCNT                     80C159B0      012C         300
SCSMAXDG          SCS$GW_MAXDG                      80C159B8      0240         576
SCSMAXMSG         SCS$GW_MAXMSG                     80C159C0      00D8         216
SCSFLOWCUSH       SCS$GW_FLOWCUSH                   80C159C8      0001           1
SCSSYSTEMID       SCS$GB_SYSTEMID                   80C159D0  0000FE88       65160
SCSSYSTEMIDH      SCS$GB_SYSTEMIDH                  80C159D8  00000000           0
SCSNODE           SCS$GB_NODENAME                   80C159E0  "SWPCTX  "
NISCS_CONV_BOOT   CLU$GL_SGN_FLAGS                  80C15E68         0           0  CLU$V_NISCS_CONV_BOOT (1)
NISCS_LOAD_PEA0   CLU$GL_SGN_FLAGS                  80C15E68         0           0  CLU$V_NISCS_LOAD_PEA0 (0)
NISCS_PORT_SERV   CLU$GL_NISCS_PORT_SERV            80C15E70  00000000           0
SCSICLUSTER_P1    SGN$GB_SCSICLUSTER_P1             80C15EF8  "    "
SCSICLUSTER_P2    SGN$GB_SCSICLUSTER_P2             80C15F00  "    "
SCSICLUSTER_P3    SGN$GB_SCSICLUSTER_P3             80C15F08  "    "
SCSICLUSTER_P4    SGN$GB_SCSICLUSTER_P4             80C15F10  "    "
NISCS_MAX_PKTSZ   CLU$GL_NISCS_MAX_PKTSZ            80C16070  000005DA        1498
NISCS_LAN_OVRHD   CLU$GL_NISCS_LAN_OVRHD            80C16078  00000012          18
```

This example shows all parameters that have the string "SCS" in their name. For parameters defined as a single bit, the name and value of the bit offset within the location used for the parameter are also given.

```
2. SDA> SHOW PARAMETER WS*

   Parameter                 Variable                Address    Value    (decimal)               Offset
---------------   ------------------------------   --------   --------  ----------  ------------------------------
WSMAX             SGN$GL_MAXWSCNT_PAGELETS          80C15710  00006800       26624
     (internal)   SGN$GL_MAXWSCNT_PAGES             80C15718  00000680        1664
WSINC             SCH$GL_WSINC_PAGELETS             80C157F8  00000960        2400
     (internal)   SCH$GL_WSINC_PAGES                80C15800  00000096         150
WSDEC             SCH$GL_WSDEC_PAGELETS             80C15808  00000FA0        4000
     (internal)   SCH$GL_WSDEC_PAGES                80C15810  000000FA         250
```

This example shows all parameters whose names begin with the string "WS". For parameters that have both an external value (pagelets) and an internal value (pages), both are displayed.

```
3. SDA> SHOW PARAMETER /MULTIPROCESSING /STARTUP

SYSGEN parameters
-----------------

   Parameter              Variable                     Address    Value    (decimal)             Offset
---------------   -------------------------------   --------   --------   ----------  -------------------------------
SMP_CPUS          SGN$GL_SMP_CPUS                   80C15688   FFFFFFFF           -1
MULTIPROCESSING   SGN$GB_MULTIPROCESSING            80C15698         03            3
SMP_SANITY_CNT    SGN$GL_SMP_SANITY_CNT             80C156A8   0000012C          300
SMP_SPINWAIT      SGN$GL_SMP_SPINWAIT               80C156B8   000186A0       100000
SMP_LNGSPINWAIT   SGN$GL_SMP_LNGSPINWAIT            80C156C0   002DC6C0      3000000
IO_PREFER_CPUS    SMP$GL_AVAILABLE_PORT_CPUS        80C16130   FFFFFFFF           -1

  Startup command file = SYS$SYSTEM:STARTUP.COM
```

This example shows all the parameters specific to multiprocessing, plus the name of the site-independent startup command procedure.

4.60. SHOW PFN_DATA

Displays information that is contained in the page lists and PFN database.

Format

`SHOW PFN_DATA { [/qualifier] | pfn [{:end-pfn|;length}] }`

or

`SHOW PFN_DATA/MAP`

Parameters

pfn

Page frame number (PFN) of the physical page for which information is to be displayed.

end-pfn

Last PFN to be displayed. When you specify the **end-pfn** parameter, a range of PFNs is displayed. This range starts at the PFN specified by the **pfn** parameter and ends with the PFN specified by the **end-pfn** parameter.

length

Length of the PFN list to be displayed. When you specify the **length** parameter, a range of PFNs is displayed. This range starts at the PFN specified by the **pfn** parameter and contains the number of entries specified by the **length** parameter.

Qualifiers

/ADDRESS=PFN-entry-address

Displays the PFN database entry at the address specified. The address specified is rounded to the nearest entry address, so if you have an address that points to one of the fields of the entry, the correct database entry will still be found.

/ALL

Displays the following lists:

Free page list

Zeroed free page list

Modified page list

Bad page list

Untested page list

Private page lists, if any

Per-color or per-RAD free and zeroed free page lists

Entire database in order by page frame number

This is the default behavior of the SHOW PFN_DATA command. SDA precedes each list with a count of the pages it contains and its low and high limits.

/BAD

Displays the bad page list. SDA precedes the list with a count of the pages it contains, its low limit, and its high limit.

/COLOR [= {*n*|ALL}]

Displays data on page coloring. The table below shows the command options available with the COLOR and RAD qualifiers, which are functionally equivalent.

Table 4.10. Command Options with the /COLOR and /RAD Qualifiers

Options	Meaning
/COLOR 1 with no value	Displays a summary of the lengths of the color 1 page lists for both free pages and zeroed pages.
/COLOR= *n* where *n* is a color number	Displays the data in the PFN lists (for the specified color) for both free and zeroed pages.
/COLOR=ALL	Displays the data in the PFN lists (for all colors), for both free and zeroed free pages.
/COLOR= *n* or /COLOR=ALL with /FREE or / ZERO	Displays only the data in the PFN list (for the specified color or all colors), for either free or zeroed free pages as appropriate. The qualifiers / BAD and /MODIFIED are ignored with / COLOR= *n* and /COLOR=ALL.
/COLOR without an option specified together with one or more of /FREE, /ZERO, /BAD, or / MODIFIED	Displays the color summary in addition to the display of the requested list.

Wherever COLOR is used in this table, RAD is equally applicable, both in the qualifier name and the meaning.

For more information on page coloring, see *VSI OpenVMS System Management Utilities Reference Manual: M--Z.*

/FREE

Displays the free page list. SDA precedes the list with a count of the pages it contains, its low limit, and its high limit.

/MAP

Displays the contents of the PFN memory map. On platforms that support it, the I/O space map is also displayed. You cannot combine the /MAP qualifier with any parameters or other qualifiers.

/MODIFIED

Displays the modified page list. SDA precedes the list with a count of the pages it contains, its low limit, and its high limit.

/PRIVATE [=address]

Displays private PFN lists. If no address is given, all private PFN lists are displayed; if an address is given, only the PFN list whose head is at the given address is displayed.

/RAD [= {n|ALL}]

Displays data on the disposition of pages among the Resource Affinity Domains (RADs) on applicable systems. /RAD is functionally equivalent to /COLOR. See Table 4.10 for the command options available with /RAD.

/SUMMARY[=(option,...)]

By default, displays a summary of all pages in the system, totaling pages by page location (Free List, Modified List, Active, and so on) and by page type (Process, System, Global, and so on). Also, provides a breakdown of active system pages by their virtual address (S0/S1, S2, and so on).

Additional information is displayed if one or more options are given. If multiple options are given, they must be separated by commas and enclosed in parentheses. Available options are:

- /SUMMARY=PROCESS

  Displays a breakdown of active process pages for each process by virtual address (P0, P1, and so on), and of non-active process pages by page location.

- /SUMMARY=GLOBAL

  Displays a breakdown for each global section of its in-memory pages by page location.

- /SUMMARY=RAD

  If RADs are enabled on the system, displays a breakdown for each RAD of its in-memory pages by location and type.

- /SUMMARY=ALL

  Equivalent to /SUMMARY=(PROCESS,GLOBAL,RAD)

You cannot combine the /SUMMARY qualifier with any other qualifiers, but you can specify a range.

/SYSTEM

Displays the entire PFN database in order by page frame number, starting at PFN 0000.

/UNTESTED

Displays the state of the untested PFN list that was set up for deferred memory testing.

/ZERO

Displays the contents of the zeroed free page list.

Description

For each page frame number it displays, the SHOW PFN_DATA command lists information used in translating physical page addresses to virtual page addresses.

The display contains two or three lines: Table 4.11 shows the fields in line one, Table 4.12 shows the fields in line two, and Table 4.13 shows the fields in line three, displayed only if relevant (page table page or non-zero flags).

Table 4.11. PFN Data---Fields in Line One

Item	Contents
PFN	Page frame number.
DB ADDRESS	Address of PFN structure for this page.
PT PFN	PFN of the page table page that maps this page.
BAK	Place to find information on this page when all links to this PTE are broken: either an index into a process section table or the number of a virtual block in the paging file.
FLINK	Forward link within PFN database that points to the next physical page (if the page is on one of the lists: FREE, MODIFIED, BAD, or ZEROED); this longword also acts as the count of the number of processes that are sharing this global section.
BLINK	Backward link within PFN database (if the page is on one of the lists: FREE, MODIFIED, BAD, or ZEROED); also acts as an index into the working set list.
SWP/BO	Either a swap file page number or a buffer object reference count, depending on a flag set in the page state field.
LOC	Location of the page within the system. Table 4.9 shows the possible locations with their meaning.

Table 4.12. PFN Data---Fields in Line Two

Item	Contents
(Blank)	First field of line two is left blank.
PTE ADDRESS	Virtual address of the page table entry that describes the virtual page mapped into this physical page. If no virtual page is mapped into this physical page then "<no backpointer>" is displayed, and the next three fields are left blank.

Item	Contents
PTE Type	If a virtual page is mapped into this physical page, a description of the type of PTE is provided across the next three fields: one of "System-space PTE", "Global PTE (section index *nnnn*)", "Process PTE (process index *nnnn*)". If no virtual page is mapped into this physical page, these fields are left blank.
REFCNT	Number of references being made to this page.
PAGETYP	Type of physical page. See Table 4.8 for the types of physical pages and their meanings.

Table 4.13. PFN Data---Fields in Line Three

Item	Contents
COUNTS	If the page is a page table page, then the contents of the PRN$W_PT_VAL_CNT, PFN $W_PT_LCK_CNT, and PFN$W_PT_WIN_CNT fields are displayed. The format is as follows: VALCNT = *nnnn* LCKCNT = *nnnn* WINCNT = *nnnn*
FLAGS	The flags in text form that are set in page state. Table 4.14 shows the possible flags and their meaning.

Table 4.14. Flags Set in Page State

Flag	Meaning
BUFOBJ	Set if any buffer objects reference this page
COLLISION	Indicates an empty collision queue when page read is complete
BADPAG	Indicates a bad page
RPTEVT	Indicates a report event on I/O completion
DELCON	Indicates a delete PFN when REFCNT=0
MODIFY	Indicates a dirty page (modified)
UNAVAILABLE	Indicates PFN is unavailable; most likely a console page
SWPPAG_VALID	Indicated swap file page number is valid
TOP_LEVEL_PT	Level one (1) page table
SLOT	Page is part of process's balance set
SHARED	Shared memory page
ZEROED	Shared memory page that has been zeroed

Examples

1.
```
SDA> SHOW PFN_DATA/MAP
System Memory Map
-----------------
```

```
Start PFN   PFN count   Flags
---------   ---------   -----
00000000    000000FA    0009  Console Base
000000FA    00003306    000A  OpenVMS Base
00003C00    000003FF    000A  OpenVMS Base
00003FFF    00000001    0009  Console Base
00003400    00000800    0010  Galaxy_Shared
```

This example shows the output when you invoke the SHOW PFN/MAP command.

2.
```
SDA> SHOW PFN 598:59f

PFN data base for PFN range
---------------------------

       PFN           DB  ADDRESS          PT PFN              BAK
      FLINK             BLINK       SWP/BO   LOC
                 PTE ADDRESS
                              REFCNT PAGETYP
----------------- ----------------- ----------------- -----------------
 ----------------- ----------------- ------ -------
00000000.00000598 FFFFF802.06C16600 00000000.000001D7 FFFFFFFF.84D6F700
 00000000.00000000 00000000.00000000  ----  ACTIVE
                  FFFFF801.FFD072A0 System-space PTE
                               0001  SYSTEM

00000000.00000599 FFFFF802.06C16640 00000000.00000000 00000000.0001DBD9
 00000000.0001DBD9 00000000.000081B6  ----  FRELST
                  <no  backpointer>
                               0000  SYSTEM


00000000.0000059A FFFFF802.06C16680 00000000.00000565 FF000000.00000000
 00000000.00000000 00000000.000000D4  ----  ACTIVE
                  000007FF.FF700000 Process PTE (process index 001A)
                               0001  PROCESS
                  FLAGS  = Modify

00000000.0000059B FFFFF802.06C166C0 00000000.0000493A 000000FD.00010000
 00000000.00000003 00000000.00000000  ----  ACTIVE
                  FFFFF802.0F641680 Global PTE (section index 00FD)
                               0001  GLOBAL

00000000.0000059C FFFFF802.06C16700 00000000.000005E3 FF000000.00000000
 00000000.00000000 00000000.00000136  ----  ACTIVE
                  000007FE.00001C30 Process PTE (process index 000F)
                               0001  PROCESS

00000000.0000059D FFFFF802.06C16740 00000000.0000059D 00000000.8705A000
 00000000.00000002 00000000.00000001  ----  ACTIVE
                  000007FF.FFFFFFF8 Process PTE (process index 0005)
                               0001  PPT(L1)
                  VALCNT = 0002     LCKCNT = FFFF     WINCNT = FFFF
 FLAGS  = Modify,Top_Level_PT

00000000.0000059E FFFFF802.06C16780 00000000.000001D7 FFFFFFFF.84D6F700
 00000000.00000000 00000000.00000000  ----  ACTIVE
```

```
                  FFFFF801.FFD07420 System-space PTE
                                     0001  SYSTEM

00000000.0000059F FFFFF802.06C167C0 00000000.000001D7 FFFFFFFF.84D6F700
 00000000.00000000 00000000.00000000  ----  ACTIVE
                  FFFFF801.FFD07428 System-space PTE
                                     0001  SYSTEM
```

This example shows the output from SHOW PFN for a range of pages.

4.61. SHOW POOL

Displays the contents of the nonpaged dynamic storage pool, the bus-addressable pool, and the paged dynamic storage pool. You can display part or all of each pool. If you do not specify a range or qualifiers, the default is SHOW POOL/ALL. Optionally, you can display the pool history ring buffer and pool statistics.

Format

SHOW POOL [range | /ALL (d)| /BAP | /NONPAGED | /PAGED]

[/BRIEF | /CHECK | /FREE | /HEADER | /MAXIMUM_BYTES [=n] | /SUMMARY | /TYPE=

[/RING_BUFFER[=address]]

[/STATISTICS [=ALL] [/NONPAGED | /BAP | /PAGED]

Parameter

range

Range of virtual addresses in pool that SDA is to examine. You can express a range using the following syntax:

m:n	Range of virtual addresses in pool from *m* to *n*
m;n	Range of virtual addresses in pool starting at *m* and continuing for *n* bytes

Qualifiers

/ALL

Displays the entire contents of the dynamic storage pool, except for those portions that are free (available). This is the default behavior of the SHOW POOL command.

/BAP

Displays the contents of the bus-addressable dynamic storage pool currently in use.

/BRIEF

Displays only general information about the dynamic storage pool and its addresses.

/CHECK

Checks all free packets for POOLCHECK-style corruption, in exactly the same way that the system does when generating a POOLCHECK crash dump.

/FREE

Displays the entire contents, both allocated and free, of the specified region or regions of pool. Use the /FREE qualifier with a range to show all of the used and free pool in the given range.

/HEADER

Displays only the first 16 bytes of each data packet found within the specified region or regions of pool.

/MAXIMUM_BYTES [=*n*]

Displays only the first n bytes of a pool packet; if you specify /MAXIMUM_BYTES without a value, the default is 64 bytes.

/NONPAGED

Displays the contents of the nonpaged dynamic storage pool currently in use.

/PAGED

Displays the contents of the paged dynamic storage pool currently in use.

/RING_BUFFER [=*address*]

Displays the contents of the pool history ring buffer if pool checking has been enabled. Entries are displayed in reverse chronological order, that is, most to least recent. If *address* is specified, the only entries in the ring buffer displayed are for pool blocks that *address* lies within.

/STATISTICS [= ALL]

Displays usage statistics about each lookaside list and the variable free list. For each lookaside list, its queue header address, packet size, the number of packets, attempts, fails, and deallocations are displayed. (If pool checking is disabled, the attempts, fails, and deallocations are not displayed.) For the variable free list, its queue header address, the number of packets and the size of the smallest and largest packets are displayed. You can further qualify /STATISTICS by using either /NONPAGED, /BAP, or /PAGED to display statistics for a specified pool area. Paged pool only has lookaside lists if the system parameter PAGED_LAL_SIZE has been set to a nonzero value; therefore paged pool lookaside list statistics are only displayed if there has been activity on a list.

If you specify /STATISTICS without the ALL keyword, only active lookaside lists are displayed. Use /STATISTICS = ALL to display all lookaside lists.

/SUBTYPE=*packet-type*

Displays the packets within the specified region or regions of pool that are of the indicated *packet-type*. For information on *packet-type*, see *packet-type* in the Description section.

/SUMMARY

Displays only an allocation summary for each specified region of pool.

/TYPE=*packet-type*

Displays the packets within the specified region or regions of pool that are of the indicated *packet-type*. For information on *packet-type*, see *packet-type* in the Description section.

/UNUSED

Displays only variable free packets and lookaside list packets, not used packets.

Description

The SHOW POOL command displays information about the contents of any specified region of dynamic storage pool. There are several distinct display formats, as follows:

- Pool layout display. This display includes the addresses of the pool structures and lookaside lists, and the ranges of memory used for pool.

- Full pool packet display. This display has a section for each packet, consisting of a summary line (the packet type, its start address and size, and, on systems that have multiple Resource Affinity Domains (RADs), the RAD number), followed by a dump of the contents of the packet in hexadecimal and ASCII.

- Header pool packet display. This display has a single line for each packet. This line contains the packet type, its start address and size, and, on systems that have multiple RADs, the RAD number, followed by the first 16 bytes of the packet, in hexadecimal and ASCII.

- Pool summary display. This display consists of a single line for each packet type, and includes the type, the number of occurrences and the total size, and the percentage of used pool consumed by this packet type.

- Pool statistics display. This display consists of statistics for variable free pool and for each lookaside list. For variable free pool, it includes the number of packets, the total bytes available, and the sizes of the smallest and largest packets. In addition, if pool checking is enabled, the total bytes allocated from the variable list and the number of times pool has been expanded are also displayed.

  For lookaside lists, the display includes the listhead address and size, the number of packets (both the maintained count and the actual count), the operation sequence number for the list, the allocation attempts and failures, and the number of deallocations.

  On systems with multiple RADs, statistics for on-RAD deallocations are included in the display for the first RAD.

- Ring buffer display. This display is only available when pool checking is enabled. It consists of one line for each packet in the ring buffer and includes the address and size of the pool packet being allocated or deallocated, its type, the PC of the caller and the pool routine called, the CPU and IPL of the call, and the system time.

  Optionally, the ring buffer display can be limited to only the entries that contain a given address.

The qualifiers used on the SHOW POOL command determine which displays are generated. The default is the pool layout display, followed by the full pool packet display, followed by the pool summary display, these being generated in turn for Nonpaged Pool, Bus-Addressable Pool (if it exists in the system or dump being analyzed), and then Paged Pool.

If you specify a range, type, or subtype, then the pool layout display is not generated, and the pool summary display is a summary only for the range, type, or subtype, and not for the entire pool.

Not all displays are relevant for all pool types. For example, Paged Pool may have no lookaside lists, in which case the Paged Pool statistics display will consist only of variable free pool information. And because there is a single ring buffer for all pools, only one ring buffer display is generated even if all pools are being displayed.

Packet-type

Each packet of pool has a type field (a byte containing a value in the range of 0-255). Many of these type values have names associated that are defined in $DYNDEF in SYS$LIBRARY:LIB.MLB. The *packet-type* specified in the /TYPE qualifier of the SHOW POOL command can either be the value of the pool type or its associated name.

Some pool packet types have an additional subtype field (also a byte containing a value in the range of 0--255), many of which also have associated names. The *packet-type* specified in the /SUBTYPE qualifier of the SHOW POOL command can either be the value of the pool type or its associated name. However, if given as a value, a /TYPE qualifier (giving a value or name) must also be specified. Note also that /TYPE and /SUBTYPE are interchangeable if *packet-type* is given by name. The table below shows several examples.

Table 4.15. /TYPE and /SUBTYPE Qualifier Examples

/TYPE and /SUBTYPE Qualifiers	Meaning
/TYPE = CI	All CI packets regardless of subtype
/TYPE = CI_MSG	All CI packets with subtype CI_MSG
/TYPE = MISC/SUBTYPE = 120	All MISC packets with subtype 120
/TYPE = 0 or /TYPE = UNKNOWN	All packets with an unknown TYPE/SUBTYPE combination

Examples

1.

```
SDA> SHOW POOL

Non-Paged Dynamic Storage Pool
------------------------------

        NPOOL address:                                    81009088
        Pool map address:                                 81562900
        Number of lookaside lists:                             128
        Granularity size:                                       64
        Ring buffer address:                              81552200
        Most recent ring buffer entry:                    815553A0

LSTHDS(s)
---------

              LSTHDS               Variable              Lookaside
  RAD        address               listhead              listheads
  ---   -----------------    -----------------    -----------------
  00    FFFFFFFF.81008830    FFFFFFFF.8100883C    FFFFFFFF.81008868
  01    FFFFFFFF.7FFFE000    FFFFFFFF.7FFFE00C    FFFFFFFF.7FFFE038
  02    FFFFFFFF.7FFFC000    FFFFFFFF.7FFFC00C    FFFFFFFF.7FFFC038
  03    FFFFFFFF.7FFFA000    FFFFFFFF.7FFFA00C    FFFFFFFF.7FFFA038

Segment(s)
----------

         Start        End        Length     RAD
        --------   --------    --------     ---
        81548000   8172B9FF    001E3A00      00
        81735A00   8173D53F    00007B40      00
        81747540   8174BDBF    00004880      00
        81755DC0   81AFDFFF    003A8240      00
        81AFE000   81C43FFF    00146000      01
        81C44000   81D89FFF    00146000      02
        81D8A000   81ECFFFF    00146000      03
        81ED0000   81F1FFFF    00050000      02

Per-RAD Totals
--------------

        RAD                     Length
        ---                    --------
        00                     00598000
        01                     00146000
        02                     00196000
        03                     00146000

        Non-Paged total:       009BA000

Dump of packets allocated from Non-Paged Pool
---------------------------------------------

Packet: MP_CPU                                Start address:  81548000      Length:  000009C0     RAD:  00

00000000 00000000 0000003E 00000001 00000002 026A09C0 ACD1A180 81C52F40  @/Å..¡Ñ¬À.j.........>...........     81548000
81548038 81548038 81548030 81548030 81548028 81548028 00000000 00000001  ........(.T.(.T.0.T.0.T.8.T.8.T.     81548020
81548058 81548058 81548050 81548050 81548048 81548048 81548040 81548040  @.T.@.T.H.T.H.T.P.T.P.T.X.T.X.T.     81548040

.
.
.

Packet: Unknown                               Start address:  815489C0      Length:  00000180     RAD:  00

FFFFFFFF AD332000 00500000 00008020 FFFFFFFF 81548B00 FFFFFFFF 81548A80  ..T.......T..... .....P.. 3—....     815489C0

.
.
.

Packet: DDB                                   Start address:  81548B40      Length:  00000300     RAD:  00

AD410000 81564480 81548BC0 000F4240 00000000 63060300 008B798F 962DA431  1¤–..y.....c....@B..À.T..DV...A—     81548B40

.
.
.

Summary of Non-Paged Pool contents
----------------------------------

    Packet type/subtype        Packet count      Packet bytes     Percent
---------------------------  ----------------  ----------------  --------
Unknown                      000001E4          00145BC0           (50.7%)
ADP                          00000009          00000A00            (0.1%)
ACB                          0000008D          00002500            (0.4%)
AQB                          00000002          00001080            (0.2%)

.
.
.

LOADCODE                     0000003D          00004C40            (0.7%)
  LDRIMG                             0000003D          00004C40    (0.7%)

INIT                         00000008          00003B80            (0.6%)
  PCBVEC                             00000001          00001BC0    (0.3%)
  PHVEC                              00000001          00000700    (0.1%)
  MPWMAP                             00000005          00001840    (0.2%)
  PRCMAP                             00000001          00000080    (0.0%)

.
.
.

Total space used: 002825C0 (2631104.) bytes out of 009BA000 (10199040.) bytes
  in 0000184C (6220.) packets

Total space utilization: 25.8%

.
.
.
```

This example shows the Nonpaged Pool portion of the default SHOW POOL display.

2.
```
SDA> SHOW POOL/TYPE=IPC/HEADER 8156E140:815912C0

Non-Paged Dynamic Storage Pool
------------------------------

Dump of packets allocated from Non-Paged Pool
---------------------------------------------

   Packet type/subtype     Start    Length   RAD
 Header contents
-------------------------  -------- -------- ---
 -----------------------------------------------------
IPC_TDB                    8156E140 00000040  00   81591180 057B0040
 00000040 81591180  ..Y.@...@.{...Y.
IPC_LIST                   815838C0 00009840  00   004C0200 087B9840
 0057A740 8158D100  .ÑX.@§W.@.{...L.
IPC_LIST                   8158D100 00001840  00   00040400 087B1840
 00570F00 8158E940  @éX...W.@.{.....
IPC_LIST                   8158E940 00002840  00   00140200 087B2840
 0056F6C0 81591180  ..Y.ÀöV.@({.....
IPC_TPCB                   81591180 00000080  00   00000000 067B0080
 0056CE80 81591200  ..Y..ÎV...{.....
IPC                        81591200 000000C0  00   00000000 007B00C0
 0056CE00 815912C0  À.Y..ÎV.À.{.....

Summary of Non-Paged Pool contents
----------------------------------

    Packet type/subtype        Packet count      Packet bytes    Percent
---------------------------  ----------------  ----------------
 --------
IPC                          00000006          0000DA40
 (100.0%)
  IPC                                00000001          000000C0
 (0.3%)
  IPC_TDB                            00000001          00000040
 (0.1%)
  IPC_TPCB                           00000001          00000080
 (0.2%)
  IPC_LIST                           00000003          0000D8C0
 (99.3%)

Total space used: 0000DA40 (55872.) bytes out of 00023180 (143744.)
 bytes
  in 00000006 (6.) packets

Total space utilization: 38.9%
```

This example shows how you can specify a pool packet type and a range of addresses.

3.
```
SDA> SHOW POOL/STATISTICS

Non-Paged Pool statistics for RAD 00
------------------------------------
```

```
        On-RAD deallocations (all RADs):                          1221036
        Total deallocations (all RADs):                           1347991
        Percentage of on-RAD deallocations:                         90.6%

Variable list statistics
------------------------

        Number of packets on variable list:                             7
        Total bytes on variable list:                             3613376
        Smallest packet on variable list:                             256
        Largest packet on variable list:                          3598016
        Bytes allocated from variable list:                       2140480
        Times pool expanded:                                            0

Lookaside list statistics
-------------------------

                      List   Packets     Packets    Operation
 Allocation  Allocation
  Listhead address    size   (approx)    (actual)   sequence #
 attempts    failures    Deallocs
  -----------------   ----  ----------  ----------  ----------
 ----------  ----------  ----------
  FFFFFFFF.81008870     64          5           5       10057
 10549          492       10062
  FFFFFFFF.81008878    128         21          21         366
 4881        4515          387
  FFFFFFFF.81008880    192         33          33       27376
 27542          166       27409
  FFFFFFFF.81008888    256          4           4        8367
 8476         118         8362

    .
    .
    .
```

This example shows the Nonpaged Pool portion of the SHOW POOL/STATISTICS display.

4.

```
SDA> SHOW POOL/RING_BUFFER

Pool History Ring-Buffer
------------------------
                             (2048 entries: Most recent first)

     Packet       Size    Type/Subtype                Caller's PC                    Operation       IPL CPU       Time
----------------- ---- ------------------ ------------------------------------ ------------------- --- --- ----------------
FFFFFFFF.81C65F40  320 SECURITY_PSB       80283A9C NSA_STD$FREE_PSB_C+0024C    DEALLO_POOL_NPP      0   8  009F1E47.549449F0
FFFFFFFF.81C44E00  192 SECURITY_PXB_ARRAY 80283A30 NSA_STD$FREE_PSB_C+001E0    DEALLO_POOL_NPP      0   8  009F1E47.549449F0
FFFFFFFF.81C45A40   64 ACB                8014A09C SCH$INIT_C+00F18            DEALLO_POOL_NPP_SIZ  2   8  009F1E47.549449F0
FFFFFFFF.81C44E00  140 SECURITY_PXB_ARRAY 80283B8C NSA$GET_PSB_C+0005C         ALLO_POOL_NPP        0   8  009F1E47.549449F0
FFFFFFFF.81C65F40  320 SECURITY_PSB       80283B70 NSA$GET_PSB_C+00040         ALLO_POOL_NPP        0   8  009F1E47.549449F0
FFFFFFFF.81C45A40   64 ACB                801281F8 PROCESS_MANAGEMENT_MON+001F ALLO_POOL_NPP        2   8  009F1E47.549449F0
FFFFFFFF.81C52380  576 IRP                8014A09C SCH$INIT_C+00F18            DEALLO_POOL_NPP_SIZ  2   8  009F1E47.549449F0
FFFFFFFF.81C65F40  320 SECURITY_PSB       80283A9C NSA_STD$FREE_PSB_C+0024C    DEALLO_POOL_NPP      2   8  009F1E47.549449F0
FFFFFFFF.81C44E00  192 SECURITY_PXB_ARRAY 80283A30 NSA_STD$FREE_PSB_C+001E0    DEALLO_POOL_NPP      2   8  009F1E47.549449F0
FFFFFFFF.81C47400  256 BUFIO              800F6270 IOC_STD$WAKACP_C+00650      DEALLO_POOL_NPP_SIZ  2   8  009F1E47.549449F0
.
.
.
```

This example shows the output of the SHOW POOL/RING_BUFFER display.

5.

```
SDA> SHOW POOL/PAGED/STATISTICS

Paged Pool statistics
---------------------

Variable list statistics
```

```
------------------------
        Number of packets on variable list:                      30
        Total bytes on variable list:                       4778288
        Smallest packet on variable list:                        16
        Largest packet on variable list:                    4777440

Lookaside list statistics
-------------------------
                        List                     Operation
  Listhead address      size     Packets         sequence #
  -----------------     ----    ----------      ----------
         ...
  FFFFFFFF.882119D0       80              0               1
         ...
```

This example shows the output of paged pool statistics when the system parameter PAGED_LAL_SIZE has been set to a nonzero value.

4.62. SHOW PORTS

Displays those portions of the port descriptor table (PDT) that are port independent.

Format

SHOW PORTS [/qualifier[,...]]

Parameters

None.

Qualifiers

/ADDRESS=*pdt-address*

Displays the specified port descriptor table (PDT). You can find the *pdt-address* for any active connection on the system in the **PDT summary page** display of the SHOW PORTS command. This command also defines the symbol PE_PDT. The connection descriptor table (CDT) addresses are also stored in many individual data structures related to System Communications Services (SCS) connections, for instance, in the path block displays of the SHOW CLUSTER/SCS command.

/BUS=*bus-address*

Displays bus (LAN device) structure data.

/CHANNEL=*channel-address*

Displays channel (CH) data.

/DEVICE

Displays the network path description for a channel.

/MESSAGE

Displays the message data associated with a virtual circuit (VC).

/NODE=*node*

Shows only the virtual circuit block associated with the specific node. When you use the /NODE qualifier, you must also specify the address of the PDT using the /ADDRESS qualifier.

/VC=*vc-address*

Displays the virtual circuit data.

Description

The SHOW PORTS command provides port-independent information from the port descriptor table (PDT) for those CI ports with full System Communications Services (SCS) connections. This information is used by all SCS port drivers.

The SHOW PORTS command also defines symbols for PEDRIVER based on the cluster configuration. These symbols include the following information:

- Virtual circuit (VC) control blocks for each of the remote systems
- Bus data structure for each of the local LAN adapters
- Some of the data structures used by both PEDRIVER and the LAN drivers

The following symbols are defined automatically:

- VC_nodename---Example: VC_NODE1, address of the local node's virtual circuit to node NODE1.
- CH_nodename---The preferred channel for the virtual circuit. For example, CH_NODE1, address of the local node's preferred channel to node NODE1.
- BUS_busname---Example: BUS_ETA, address of the local node's bus structure associated with LAN adapter ETA0.
- PE_PDT---Address of PEDRIVER's port descriptor table.
- MGMT_VCRP_busname---Example: MGMT_VCRP_ETA, address of the management VCRP for bus ETA.
- HELLO_VCRP_busname---Example: HELLO_VCRP_ETA, address of the HELLO message VCRP for bus ETA.
- VCIB_busname---Example: VCIB_ETA, address of the VCIB for bus ETA.
- UCB_LAVC_busname---Example: UCB_LAVC_ETA, address of the LAN device's UCB used for the local-area OpenVMS Cluster protocol.
- UCB0_LAVC_busname---Example: UCB0_LAVC_ETA, address of the LAN device's template UCB.
- LDC_LAVC_busname---Example: LDC_LAVC_ETA, address of the LDC structure associated with LAN device ETA.
- LSB_LAVC_busname---Example: LSB_LAVC_ETA, address of the LSB structure associated with LAN device ETA.

These symbols equate to system addresses for the corresponding data structures. You can use these symbols, or an address, in SHOW PORTS qualifiers that require an address, as in the following:

```
SDA> SHOW PORTS/BUS=BUS_ETA
```

The SHOW PORTS command produces several displays. The initial display, the **PDT summary page**, lists the PDT address, port type, device name, and driver name for each PDT. Subsequent displays provide information taken from each PDT listed on the summary page.

You can use the /ADDRESS qualifier to the SHOW PORTS command to produce more detailed information about a specific port. The first display of the SHOW PORTS/ADDRESS command duplicates the last display of the SHOW PORTS command, listing information stored in the port's PDT. Subsequent displays list information about the port blocks and virtual circuits associated with the port.

Examples

1.
```
SDA> SHOW PORTS
OpenVMS Cluster data structures
--------------------------

                  --- PDT Summary Page ---

 PDT Address          Type         Device          Driver Name
 -----------          ----         -------         -----------

  80E2A180             pn          PNA0            SYS$PNDRIVER
  80EC3C70             pe          PEA0            SYS$PEDRIVER

                  --- Port Descriptor Table (PDT) 80E2A180 ---

Type: 09 pn
Characteristics: 0000

Msg Header Size          104  Flags                0000  Message Sends
 3648575
Max Xfer Bcnt       00100000  Counter CDRP     00000000  Message Recvs
 4026887
Poller Sweep              21  Load Vector      80E2DFCC  Mess Sends NoFP
 3020422
Fork Block W.Q.     80E2A270  Load Class             60  Mess Recvs NoFP
 3398732
UCB Address         80E23380  Connection W.Q. 80E4BF94  Datagram Sends
       0
ADP Address         80E1BF00  Yellow Q.        80E2A2E0  Datagram Recvs
       0
Max VC timeout            16  Red Q.           80E2A2E8  Portlock
 80E1ED80
SCS Version                2  Disabled Q.      80FABB74  Res Bundle Size
     208
                              Port Map         00000001

                  --- Port Descriptor Table (PDT) 80EC3C70 ---

Type: 03 pe
Characteristics: 0000

Msg Header Size           32  Flags                0000  Message Sends
  863497
Max Xfer Bcnt       FFFFFFFF  Counter CDRP     00000000  Message Recvs
  886284
```

```
Poller Sweep              30  Load Vector     80EDBF8C  Mess Sends NoFP
  863497
Fork Block W.Q.     80EC3D60  Load Class            10  Mess Recvs NoFP
  886284
UCB Address         80EC33C0  Connection W.Q. 80EFF5D4  Datagram Sends
       0
ADP Address         00000000  Yellow Q.       80EC3DD0  Datagram Recvs
       0
Max VC timeout            16  Red Q.          80EC3DD8  Portlock
 00000000
SCS Version                2  Disabled Q.     812E72B4  Res Bundle Size
       0
                              Port Map        00000000
```

This example illustrates the default output of the SHOW PORTS command.

2.
```
SDA> SHOW PORTS/ADDRESS=80EC3C70
OpenVMS Cluster data structures
--------------------------

                  --- Port Descriptor Table (PDT) 80EC3C70 ---

Type: 03 pe
Characteristics: 0000

Msg Header Size           32  Flags               0000  Message Sends
  864796
Max Xfer Bcnt       FFFFFFFF  Counter CDRP    00000000  Message Recvs
  887086
Poller Sweep              30  Load Vector     80EDBF8C  Mess Sends NoFP
  864796
Fork Block W.Q.     80EC3D60  Load Class            10  Mess Recvs NoFP
  887086
UCB Address         80EC33C0  Connection W.Q. 80EFF5D4  Datagram Sends
       0
ADP Address         00000000  Yellow Q.       80EC3DD0  Datagram Recvs
       0
Max VC timeout            16  Red Q.          80EC3DD8  Portlock
 00000000
SCS Version                2  Disabled Q.     812E72B4  Res Bundle Size
       0
                              Port Map        00000000
                              Port Map        00000000

                 --- Port Block 80EC4540 ---

Status: 0001 authorize
VC Count: 20
Secs Since Last Zeroed: 77020

SBUF Size              824     LBUF Size         5042     Fork Count
 1943885
SBUF Count              28     LBUF Count           1     Refork Count
      0
SBUF Max               768     LBUF Max           384     Last Refork
 00000000
SBUF Quo                28     LBUF Quo             1     SCS Messages
 1154378
```

```
SBUF Miss            1871     LBUF Miss         3408     VC Queue Cnt
 361349
SBUF Allocs       1676801     LBUF Allocs      28596     TQE Received
 770201
SBUFs In Use            2     LBUFs In Use         0     Timer Done
 770201
Peak SBUF In Use      101     Peak LBUF In Use    10     RWAITQ Count
  30288
SBUF Queue Empty        0     LBUF Queue Empty     0     LDL Buf/Msg
  32868
TR SBUF Queue Empty     0     Ticks/Second        10     ACK Delay
 1000000
No SBUF for ACK         0     Listen Timeout       8     Hello Interval
     30

Bus Addr  Bus     LAN Address    Error Count Last Error   Time of Last
 Error
--------  ---  ----------------- ----------- ----------
 -----------------------
80EC4C00  LCL  00-00-00-00-00-00           0
80EC5400  EXA  08-00-2B-17-CF-92           0
80EC5F40  FXA  08-00-2B-29-E1-40           0

                 --- Virtual Circuit (VC) Summary ---

VC Addr     Node    SCS ID  Lcl ID    Status Summary        Last Event
 Time
--------  --------  ------  ------  -----------------
 -----------------------
80E566C0  ARUSHA     19617  223/DF  open,path           8-FEB-2001
 16:01:57.58
80E98840  ETOSHA     19699  222/DE  open,path           8-FEB-2001
 16:01:58.41
80E98A80  VMS        19578  221/DD  open,path           8-FEB-2001
 16:01:58.11
   .
   .
   .
```

This example illustrates the output produced by the SHOW PORTS command for the PDT at address 80EC3C70.

4.63. SHOW PROCESS

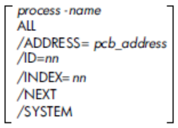
Displays the software and hardware context of any process in the system. If the process is suspended (ANALYZE/SYSTEM), then some displays may be incomplete or unavailable. If the process was outswapped at the time of the system crash, or not included in a selective dump (ANALYZE/CRASH_DUMP), then some displays may be incomplete or unavailable. Please see descriptions of the individual qualifiers for details not included in the syntax definition.

Format

SHOW PROCESS

SHOW PROCESS

Select which process to show:



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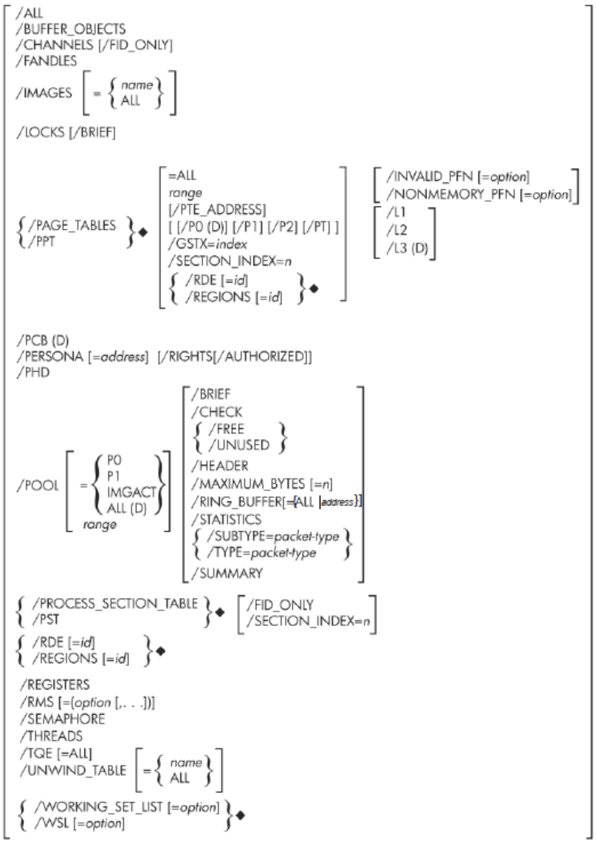
Select what to show about a process (see next page):



◆ indicates that stacked entries in braces are functionally equivalent.

Parameters

ALL

Information is to be displayed about all processes that exist in the system.

process-name

Name of the process for which information is to be displayed. Use of the **process-name** parameter or one of the /ADDRESS, /ID, /INDEX, /NEXT, or /SYSTEM qualifiers causes the SHOW PROCESS command to perform an implicit SET PROCESS command, making the indicated process the current process for subsequent SDA commands.

When you analyze a crash dump from a multiprocessing system, changing process context may require a switch of CPU context as well. When you issue a SET PROCESS command, SDA automatically changes its CPU context to that of the CPU on which that process is, or was most recently, current. You can determine the names of the processes in the system by issuing a SHOW SUMMARY command.

The **process-name** can contain up to 15 uppercase letters, numerals, the underscore (_), dollar sign, colon (:), and some other printable characters. If it contains any other characters (including lowercase letters), you may need to enclose the **process-name** in quotation marks (" ").

Qualifiers

/ADDRESS=*pcb-address*

Specifies the process control block (PCB) address of a process in order to display information about the process.

/ALL

Displays all information shown by the following qualifiers:

/BUFFER_OBJECTS

/CHANNELS

/FANDLES

/IMAGES=ALL

/LOCKS

/PAGE_TABLES=ALL

/PCB

/PERSONA/RIGHTS

/PHD

/POOL/HEADER/RING_BUFFER/STATISTICS

/PROCESS_SECTION_TABLE

/REGIONS

/REGISTERS

/RMS

/SEMAPHORE

/THREADS

/TQE

/UNWIND_TABLE (Integrity servers only.)

/WORKING_SET_LIST

/AUTHORIZED

Used with the /PERSONA/RIGHTS qualifiers. See the /PERSONA/RIGHTS/AUTHORIZED description for the use of the /AUTHORIZED qualifier.

/BRIEF

When used with the /LOCKS qualifier, causes SDA to display each lock owned by the current process in brief format, that is, one line for each lock. When used with the /POOL qualifier, causes SDA to display only general information about process pool and its addresses.

/BUFFER_OBJECTS

Displays all the buffer objects that a process has created.

/CHANNELS

Displays information about the I/O channels assigned to the process.

/CHECK

Checks all free process pool packets for POOLCHECK-style corruption in exactly the same way that the system does when generating a POOLCHECK crash dump.

/FANDLES

Displays the data on the process' fast I/O handles.

/FID_ONLY

When used with /CHANNEL or /PROCESS_SECTION_TABLE (/PST), causes SDA to not attempt to translate the FID (File ID) to a file name when invoked with ANALYZE/SYSTEM.

/FREE

When used with /POOL, displays the entire contents, both allocated and free, of the specified region or regions of pool. Use the /FREE qualifier with a range to show all of the used and free pool in the given range.

/GSTX=*index*

When used with the /PAGE_TABLES qualifier, displays only page table entries for the specific global section.

/HEADER

When used with /POOL, displays only the first 16 bytes of each data packet found within the specified region or regions of pool.

/IMAGES [= {*name*|ALL}]

For all images in use by this process, displays the address of the image control block, the start and end addresses of the image, the activation code, the protected and shareable flags, the image name, and the major and minor IDs of the image. The /IMAGES=ALL qualifier also displays the base, end, image offset, section type, and global pointer for all images (Integrity servers) or for all installed resident images (Alpha) in use by this process. The /IMAGE=*name* qualifier displays this information for just the specified images; *name* may contain wildcards.

See the *VSI OpenVMS Linker Utility Manual* and the Install utility chapter in the *VSI OpenVMS System Management Utilities Reference Manual* for more information on images installed using the /RESIDENT qualifier.

/ID=*nn*

/INDEX=*nn*

Specifies the process for which information is to be displayed by its index into the system's list of software process control blocks (PCBs), or by its process identification (ID). /ID and /INDEX can be used interchangeably. You can supply the following values for *nn*:

- The process index itself.
- The process identification (PID) or extended PID longword, from which SDA extracts the correct index. You can specify the PID or extended PID of any thread of a process with multiple kernel threads. Any thread-specific data displayed by SHOW PROCESS will be for the given thread.

To obtain these values for any given process, issue the SDA command SHOW SUMMARY/THREADS.

/INVALID_PFN [=*option*]

The /INVALID_PFN qualifier, which is valid only on platforms that supply an I/O memory map, causes SDA to display only page table entries that map to PFNs that are not in the system's private memory or in Galaxy-shared memory, and which are not I/O access pages. Use of /INVALID_PFN implies /PAGE_TABLES.

The /INVALID_PFN qualifier allows two optional keywords, READONLY and WRITABLE. If neither keyword is given, all relevant pages are displayed. If you specify READONLY, only pages marked for no write access are displayed. If you specify WRITABLE, only pages that allow write access are displayed. For example, SHOW PROCESS ALL/PAGE_TABLE=ALL/INVALID_PFN=WRITABLE would display all process pages (for all processes) whose protection allows write, but which map to PFNs that do not belong to this system.

/L1

/L2

/L3 (D)

Used with the /PAGE_TABLES qualifier to specify the level for which page table entries are to be displayed. You can specify only one level. /L3 is the default.

/LOCKS [/BRIEF]

Displays the lock management locks owned by the current process.

When specified with /BRIEF, produces a display similar in format to that produced by the SHOW LOCKS command; that is, it causes SDA to display each lock owned by the current process in brief format with one line for each lock. Table 4.3 contains additional information.

/MAXIMUM_BYTES [=*n*]

When used with /POOL, displays only the first n bytes of a pool packet; if you specify /MAXIMUM_BYTES without a value, the default is 64 bytes.

/NEXT

Locates the next valid process in the system's process list and selects that process. If there are no further valid processes in the system's process list, SDA returns an error.

/NONMEMORY_PFN [=*option*]

The /NONMEMORY_PFN qualifier causes SDA to display only page table entries that are in neither the system's private memory nor in Galaxy-shared memory. Use of /NONMEMORY_PFN implies /PAGE_TABLES.

The /NONMEMORY_PFN qualifier allows two optional keywords, READONLY and WRITABLE. If neither keyword is given, all relevant pages are displayed. If you specify READONLY, only pages marked for no write access are displayed. If you specify WRITABLE, only pages that allow write access are displayed. For example, SHOW PROCESS ALL/PAGE_TABLE=ALL/NONMEMORY_PFN=WRITABLE would display all process pages (for all processes) whose protection allows write, but which map to PFNs that are in neither the system's private memory nor Galaxy-shared memory.

/P0 (D)

/P1

/P2

/PT

When used with the /PAGE_TABLES qualifier, /P0, /P1, /P2, and /PT specify one or more regions for which page table entries should be displayed. You can specify any or none of these values. The default is /P0.

/PAGE_TABLES

Displays the page tables of the process P0 (process), P1 (control), P2, or PT (page table) region, or, optionally, page table entries for a **range** of addresses. You can use /PAGE_TABLES=ALL to display page tables of all four regions. With /L*n*, the page table entries at the level specified by /L1, /L2, or /L3 (the default) are displayed.

With /RDE=*id* or /REGIONS=*id*, SDA displays the page tables for the address range of the specified address region. When you do not specify an ID, the page tables are displayed for all the process-permanent and user-defined regions.

If /PTE_ADDRESS is given, the range is expressed using the following syntax:

m	Displays the single page table entry at address *m*
m:n	Displays the page table entries from address *m* to address *n*
m;n	Displays *n* bytes of page table entries starting at address *m*

If /PTE_ADDRESS is not given, then range is expressed using the following syntax:

m	Displays the single page table entry that corresponds to virtual address *m*
m:n	Displays the page table entries that correspond to the range of virtual addresses from *m* to *n*
m;n	Displays the page table entries that correspond to a range of *n* bytes starting at virtual address *m*

See Section 2.8 for information on page protections and access.

The /GSTX=*index* qualifier causes SDA to display only the page table entries for the pages in the specified global section.

The /SECTION_INDEX=*n* qualifier causes SDA to display only the page table entries for the pages in the specified process section.

/PCB

Displays the information contained in the process control block (PCB). This is the default behavior of the SHOW PROCESS command.

/PERSONA [=*address*]

Displays all persona security blocks (PSBs) held in the PERSONA ARRAY of the process, and then lists selected information contained in each initially listed PSB. The selected information includes the contents of the following cells inside the PSB:

Flags

Reference count

Execution mode

Audit status

Account name

UIC

Privileges

Rights enabled mask

If you specify a PSB address, this information is provided for that specific PSB only.

If you also specify /RIGHTS, SDA expands the display to provide additional selected information, including all the rights and their attributes currently held and active for each persona security block (PSB) specified with the /PERSONA qualifier.

If you specify /RIGHTS/AUTHORIZED, SDA also displays additional selected information, including all the rights and their attributes authorized for each persona security block (PSB) specified with the /PERSONA qualifier.

/PHD

Lists the information included in the process header (PHD).

/POOL [= {P0 | P1 | IMGACT | ALL (D)} | range]

Displays the dynamic storage pool in the process' P0 (process) region, the P1 (control) region, or the image activator's reserved pages, or optionally, a range of addresses. The default action is to display all dynamic storage pools.

You can express a **range** using the following syntax:

m:n	Displays the process pool in the range of virtual addresses from *m* to *n*.

m;n	Displays process pool in a range of *n* bytes, starting at virtual address *m*.

/PPT

See the description of /PAGE_TABLES, which is functionally equivalent to /PPT.

/PROCESS_SECTION_TABLE [/SECTION_INDEX=*id*][/FID_ONLY]

Lists the information contained in the process section table (PST). The /SECTION_INDEX=*id* qualifier used with /PROCESS_SECTION_TABLE displays the process section table entry for the specified section.

/PST

Is a synonym for /PROCESS_SECTION_TABLE.

/PT

When used with the /PAGE_TABLES qualifier, displays the page table entries for the page table space of the process. By default, P0 space is displayed.

/PTE_ADDRESS

When used with the /PAGE_TABLES qualifier, specifies that the range is of PTE addresses instead of the virtual addresses mapped by the PTE.

/RDE [=*id*]

/REGIONS [=*id*]

Lists the information contained in the process region table for the specified region. If you do not specify a region, the entire table is displayed, including the process-permanent regions. /RDE and /REGIONS are functionally equivalent. When used with /PAGE_TABLES, this qualifier causes SDA to display the page tables for only the specified region or, by default, for all regions.

/REGISTERS

Lists the hardware context of the process, as reflected in the process registers stored in the hardware privileged context block (HWPCB), in its kernel stack, and possibly, in its PHD.

/RIGHTS

Used with the /PERSONA qualifier. See the /PERSONA/RIGHTS description for use of the /RIGHTS qualifier.

/RING_BUFFER [={ALL | *address*}]

Displays the contents of the process-pool history ring buffer. Entries are displayed in reverse chronological order (most recent to least recent). If you specify /RING_BUFFER without the ALL keyword or an address, SDA displays all unmatched current allocations and deallocations. Use /RING_BUFFER=ALL to display matched allocations and deallocations and any non-current entries not yet overwritten. Use /RING_BUFFER=*address* to limit the display to only allocations and deallocations of blocks that contain the given address (including matched allocations and deallocations).

/RMS [= (*option*[,...])]

Displays certain specified RMS data structures for each image I/O or process-permanent I/O file the process has open. To display RMS data structures for process-permanent files, specify the PIO option to this qualifier. Other guidelines for specifying this qualifier include the following:

- If you specify only one option, you can omit the parentheses.
- You can add additional structures to those already set by the SET RMS command by beginning the list of options with an asterisk (*).
- You can exclude a structure from those set by the SET RMS command by specifying its keyword option preceded by NO (for example, NOPIO).

SDA determines the structures to be displayed according to either of the following methods:

- If you provide the name of a structure or structures in the **option** parameter, SHOW PROCESS/ RMS displays information from only the specified structures. (See Table 4.2 in the SET RMS command description for a list of keywords that you can supply as options.)
- If you do not specify an **option**, SHOW PROCESS/RMS displays the current list of options as shown by the SHOW RMS command and set by the SET RMS command.

/SECTION_INDEX=*n*

When used with the /PAGE_TABLES qualifier, displays the page table for the range of pages in the specified process section. You can also specify one of the qualifiers /L1, /L2, or /L3.

When used with the /PROCESS_SECTION_TABLE qualifier, displays the PST for the specified process section.

The /SECTION_INDEX=*n* qualifier is ignored if you do not specify either the /PAGE_TABLES or the /PROCESS_SECTION_TABLE qualifier.

/SEMAPHORE

Displays the Inner Mode Semaphore for a multithreaded process.

/STATISTICS

When used with /POOL, displays statistics on the free list(s) in process pool.

/SUBTYPE=*packet-type*

When used with /POOL, displays only packets of the specified subtype. Pool packet types found in the process pool can include logical names (LNM) and image control blocks (IMCB). /SUBTYPE is functionally equivalent to /TYPE.

/SUMMARY

When used with /POOL, displays only an allocation summary for each packet type.

/SYSTEM

Displays the system's process control block. The system PCB and process header (PHD) parallel the data structures that describe processes. They contain the system working set, global section table, global page table, and other systemwide data.

/THREADS

Displays the software and hardware context of all the threads associated with the current process.

/TQE [=ALL]

Displays all timer queue entries associated with the current process. If specified as /TQE, a one-line summary is output for each TQE. If specified as /TQE=ALL, a detailed display of each TQE is output. See Table 4-32 for an explanation of TQE types in the one-line summary.

/TYPE=*packet-type*

When used with /POOL, displays only packets of the specified type. Pool packet types found in the process pool can include logical names (LNM) and image control blocks (IMCB). /TYPE is functionally equivalent to /SUBTYPE.

/UNUSED

When used with /POOL, displays only free packets.

/UNWIND_TABLE [= {ALL | *name*}]

Valid for Intergrity server systems only.

If specified without a keyword, displays the master unwind table for the process. SHOW PROCESS/UNWIND=ALL displays the details of every process unwind descriptor. SHOW PROCESS/UNWIND=*name* displays the details of every unwind descriptor for the named image or images implied by a wildcard. To look at unwind data for a specific PC in process space, use SHOW UNWIND *address*.

If some or all unwind data for an image is not included in the system dump (for example, if it was not in the working set of the process at the time of the system crash), a SHOW PROCESS/UNWIND command can fail with a %SDA-W-NOREAD error because the unwind data is inaccessible. Collecting unwind data using the SDA commands COLLECT and COPY/COLLECT will not correct this because the collected unwind data is used only by SHOW UNWIND *address* and SHOW CALL.

/WORKING_SET_LIST [={PPT|PROCESS|LOCKED|GLOBAL|MODIFIED|*n*}]

Displays the contents of the requested entries of the working set list for the process. If you do not specify an option, all working set list entries are displayed. This qualifier is functionally equivalent to /WSL.

The table shows the options available with SHOW PROCESS/WORKING_SET_LIST.

Table 4.16. Options for the /WORKING_SET_LIST Qualifier

Options	Results
PPT	Displays process page table pages
PROCESS	Displays process-private pages
LOCKED	Displays pages locked into the process' working set
GLOBAL	Displays global pages currently in the working set of the process

Options	Results
MODIFIED	Displays working set list entries marked modified
n	Displays a specific working set list entry, where *n* is the working set list index (WSLX) of the entry of interest

/WSL

See /WORKING_SET_LIST, which is functionally equivalent to /WSL.

Description

The SHOW PROCESS command displays information about the process specified by **process-name**, the process specified in the /ID or /INDEX qualifier, the next process in the system's process list, the system process, or all processes. The SHOW PROCESS command performs an implicit SET PROCESS command under certain uses of its qualifiers and parameters, as noted previously. By default, the SHOW PROCESS command produces information about the SDA current process, as defined in Section 2.5.

The default of the SHOW PROCESS command provides information taken from the software process control block (PCB) and the kernel threads block (KTB) of the SDA current thread. This is the first display provided by the /ALL qualifier and the only display provided by the /PCB qualifier. This information describes the following characteristics of the process:

- Software context
- Condition-handling information
- Information on interprocess communication
- Information on counts, quotas, and resource usage

Among the displayed information are the process PID, EPID, priority, job information block (JIB) address, and process header (PHD) address. SHOW PROCESS also describes the resources owned by the process, such as event flags and mutexes. The "State" field records the current scheduling state for the thread, and indicates the CPU ID of any thread whose state is CUR. See Table 4.26 for a list of all possible states.

The /THREADS qualifier (also part of SHOW PROCESS/ALL), displays information from the KTBs of all threads in the process, instead of only the SDA current thread.

The SHOW PROCESS/ALL command displays additional process-specific information, also provided by several of the individual qualifiers to the command.

The **process registers** display, also produced by the /REGISTERS qualifier, describes the process hardware context, as reflected in its registers. The registers displayed are those of the SDA current thread, or of all threads if either the /THREADS or the /ALL qualifier have been specified.

A process hardware context is stored in the following locations:

- If the process is currently executing on a processor in the system (that is, in the CUR scheduling state), its hardware context is contained in that processor's registers. (That is, the process registers and the processor's registers contain identical values, as illustrated by a SHOW CPU command for that processor or a SHOW CRASH command, if the process was current at the time of the system failure.)

- If the process is not executing, its privileged hardware context is stored in the part of the PHD known as the HWPCB. Its integer register context is stored on its kernel stack. Its floating-point registers are stored in its PHD.

The **process registers** display first lists those registers stored in the HWPCB, kernel stack, and PHD ("Saved process registers"). If the process to be displayed is currently executing on a processor in the system, the display then lists the processor's registers ("Active registers for the current process"). In each section, the display lists the registers in groups.

For Alpha:

- Integer registers (R0 through R29)
- Special-purpose registers (PC and PS)
- Stack pointers (KSP, ESP, SSP, and USP)
- Page table base register (PTBR)
- AST enable and summary registers (ASTEN and ASTSR)
- Address space number register (ASN)

For Integrity servers:

- Integer registers (R1 through R11, R13 through R31). Note that R1 is displayed as GP (Global Pointer) and R12 is omitted.
- Special-purpose registers (PC, PSR, ISR). Note: The PC is the combination of the IP and the slot number from the PSR.
- Stack pointers (KSP, ESP, SSP, and USP)
- Register stack pointers (KBSP, EBSP, SBSP, and UBSP)
- Page table base register (PTBR0)
- AST enable and summary registers (ASTEN and ASTSR)
- Address space number registers (ASN0)
- Floating point registers (F2 through F31, possibly F32 through F127)

The **semaphore** display, also produced by the /SEMAPHORE qualifier, provides information on the inner-mode semaphore used to synchronize kernel threads. The PC history log, recorded if the system parameter SYSTEM_CHECK is enabled, is also displayed.

The **process header** display, also produced by the /PHD qualifier, provides information taken from the PHD, which is swapped into memory when the process becomes part of the balance set. Each item listed in the display reflects a quantity, count, or limit for the process use of the following resources:

- Process memory
- The pager
- The scheduler
- Asynchronous system traps
- I/O activity

- CPU activity

The **working set information** and **working set list** displays, also produced by the /WORKING_SET_LIST qualifier, describe those virtual pages that the process can access without a page fault. After a brief description of the size, scope, and characteristics of the working set list itself, SDA displays information for each entry in the working set list as shown in the table below.

Table 4.17. Working Set List Entry Information in the SHOW PROCESS Display

Column	Contents
INDEX	Index into the working set list at which information for this entry can be found
ADDRESS	Virtual address of the page that this entry describes
STATUS	Four columns that list the following status information: • Page status of VALID • Type of physical page (See Table 4.8) • Indication of whether the page has been modified • Indication of whether the page is locked into the working set

When SDA locates either one or more unused working set entries, or entries that do not match the specified option, it issues the following message:

```
---- n entries not displayed
```

The **process section table information** and **process section table** displays, also produced by the /PROCESS_SECTION_TABLE or /PST qualifier, list each entry in the process section table (PST) and display the offsets to, and the indexes of, the first free entry and last used entry.

SDA displays the information listed in the table below for each PST entry.

Table 4.18. Process Section Table Entry Information in the SHOW PROCESS Display

Part	Definition
INDEX	Index number of the entry. Entries in the process section table begin at the highest location in the table, and the table expands toward lower addresses.
ADDRESS	Address of the process section table entry.
SECTION ADDRESS	Virtual address that marks the beginning of the first page of the section described by this entry.
CCB	Address of the channel control block on which the section file is open.
PAGELETS	Length of the process section. This is in units of pagelets, except for a PFN-mapped section in which the units are pages.

Part	Definition
VBN	Virtual block number. The number of the file's virtual block that is mapped into the section's first page.
WINDOW	Address of the window control block on which the section file is open.
REFCNT	Number of pages of this section that are currently mapped.
FLINK	Forward link. The pointer to the next entry in the PST list.
BLINK	Backward link. The pointer to the previous entry in the PST list.
FLAGS	Flags that describe the access that processes have to the process section.

In addition, for each process section that has an associated file, the device and/or file name is displayed. For details of this display, see Table 4.20.

The **regions** display, also produced by the either of the /RDE or /REGIONS qualifiers, shows the contents of the region descriptors. This includes the three default regions (P0, P1, P2), plus any others created by the process. A single region will be displayed if you specify its identifier. The information displayed for each region includes the RDE address, the address range of the region, its identifiers and protection, and links to other RDEs.

If you use the /PAGE_TABLE or /PPT qualifier with /RDE or /REGION, the page table for the region is also displayed, as described below.

The **P0 page table**, **P1 page table**, **P2 page table**, and **PT page table** displays, also produced by the /PAGE_TABLES qualifier, display listings of the process page table entries in the same format as that produced by the SHOW PAGE_TABLE command (see Tables Table 4.4 through Table 4.9).

The **RMS** display, also produced by the /RMS qualifier, provides information on the RMS internal data structures for all RMS-accessed open files. The data structures displayed depend on the current setting of RMS options, as described under the SET RMS command and Table 4.2.

The **locks** display, also produced by the /LOCKS qualifier, provides information on the locks held by the process. For a full description of the information displayed for process locks, see the SHOW LOCKS command and Table 4.3. You can also specify the /BRIEF qualifier, which provides single-line summary of each process lock; however, no other qualifiers from SHOW LOCKS apply to SHOW PROCESS/LOCKS.

The **process active channels** display, also produced by the /CHANNEL qualifier, displays the information in Table 4.19 for each I/O channel assigned to the process.

Table 4.19. Process Active Channels in the SHOW PROCESS Display

Column	Contents
Channel	Number of the channel.
CCB	The address of the channel control block (CCB).
Window	Address of the window control block (WCB) for the file if the device is a file-oriented device; zero otherwise.

Column	Contents
Status	Status of the device: "Busy" if the device has an I/O operation outstanding; "Dpnd" if the device is deaccess pending; blank otherwise.
Device/file accessed	Name of the device and, if applicable, name of the file being accessed on that device.

The information listed under the heading "Device/file accessed" varies from channel to channel and from process to process. SDA displays certain information according to the conditions listed in the table below.

Table 4.20. Process I/O Channel Information in the SHOW PROCESS Display

Information Displayed1	Type of Channel
dcuu:	SDA displays this information for devices that are not file structured, such as terminals, and for processes that do not open files in the normal way.
dcuu: *filespec*	SDA displays this information only if you are examining a running system, and only if your process has enough privilege to translate the *file-id* into the *filespec*, or if you are examining a dump for which file identification data 2 has been collected.
dcuu:(*file-id*)	The *file-id* no longer points to a valid *filespec*, as when you look at a dump that does not have file identification data 2; or the process in which you are running SDA does not have enough privilege to translate the *file-id* into the corresponding *filespec*.
(section file)	The file in question is mapped into the process' memory.

The **images** display, also produced by the /IMAGES qualifier, describes the activated images in the process. SDA displays the information listed in the table below for each image, plus a summary line giving the total image and total page counts.

Table 4.21. Image Information in the SHOW PROCESS Display

Item	Description
Image Name	The name of the image.
Link Time	The date and time the image was linked. These items are only displayed with SHOW PROCESS/IMAGE=ALL or SHOW PROCESS/ALL.
Section Type	For shareable images, the data for each image section is displayed on a separate line. For privileged shareable images, data for the change mode vector is also displayed on a separate line. These items are only displayed with SHOW PROCESS/IMAGE=ALL or SHOW PROCESS/ALL.

Item	Description
Start	Start address of the image in process memory. For resident shareable images, this is the start address of the process-space portion of the image. Alpha only.
End	End address of the image in process memory. For resident shareable images, this is the end address of the process-space portion of the image. Alpha only.
Type	The image type and/or activation method, plus "PROT" for protected images and "SHR" for shareable images.
File ID	The File ID for the image file. No attempt is made to translate this to a filename. These items are only displayed with SHOW PROCESS/IMAGE=ALL or SHOW PROCESS/ALL.
IMCB	The address of the Image Management Control Block.
GP	The Global Pointer for the image. Integrity servers only.
Sym Vect	The address of the image's symbol vector, if any. These items are only displayed with SHOW PROCESS/IMAGE=ALL or SHOW PROCESS/ALL.
Maj, Minor ID	The major and minor revision IDs for the image. These items are only displayed with SHOW PROCESS/IMAGE=ALL or SHOW PROCESS/ALL. Alpha only.
Maj, Min ID, Match	The major and minor revision IDs for the image, plus the match control bits. These items are only displayed with SHOW PROCESS/IMAGE=ALL or SHOW PROCESS/ALL. Integrity servers only.
Base	For Alpha shareable images and all Integrity server images, the base address of each image section and/or the change mode vector. These items are only displayed with SHOW PROCESS/IMAGE=ALL or SHOW PROCESS/ALL.
End	For Alpha shareable images and all Integrity server images, the end address of each image section and/or the change mode vector. These items are only displayed with SHOW PROCESS/IMAGE=ALL or SHOW PROCESS/ALL.
ImageOff	For Alpha shareable images and all Integrity server images, the virtual offset within the image file for each image section. These items are only displayed with SHOW PROCESS/IMAGE=ALL or SHOW PROCESS/ALL.

The **buffer objects** display, also produced by the /BUFFER_OBJECTS qualifier, describes the buffer objects in use by the process. Information displayed by SDA for each buffer object includes its address, access mode, size, flags, plus the base virtual address of the object in process space and system space.

The **fast I/O handles** display, also produced by the /FANDLES qualifier, describes the fast I/O handles used by the process. Information displayed by SDA includes the address and size of the fast I/O handle vector header, then the address, corresponding IRP, state, and buffer object handles for each fast I/O handle, plus information on free vector entries.

The **persona** display, also produced by the /PERSONA qualifier, describes the Persona status block data structures. The default output of /PERSONA consists of summary information for all personae in use by the process (the PSB address, flags, user name) and information for each persona (privilege masks, UIC, and so on). When you specify /PERSONA/RIGHTS (as in SHOW PROCESS/ALL), all the rights currently held and active for each persona are also displayed. When you specify /PERSONA/RIGHTS/AUTHORIZED, all the rights authorized for each persona are displayed instead.

The **pool** display, also produced by the /POOL qualifier, describes the P0, P1 and IMGACT process pools. The default output of /POOL is the entire contents of each used block of pool. When you specify /POOL/HEADER (as in SHOW PROCESS/ALL), only the first 16 bytes of each used pool block is displayed. By default, all process pools are displayed. You can limit this using /POOL=P0, /POOL=P1 or /POOL=IMGACT. See the description of the SHOW POOL command for explanations of other qualifiers.

The **Timer Queue Entry (TQE)** display, also produced by the /TQE qualifier, describes all timer queue entries that affect the process. The default display (as in SHOW PROCESS/ALL) is a one-line summary of each TQE. If you specify /TQE=ALL, a detailed display of each TQE is given. No other qualifiers from the SHOW TQE command apply to SHOW PROCESS/TQE.

Examples

```
SDA>  SHOW PROCESS
Process index: 0028   Name: SYSTEM   Extended PID: 000000E8
-----------------------------------------------------------
Process status:          02040001  RES,PHDRES,INTER
        status2:         00000000

PCB address              81444A40    JIB address              81443600
PHD address              821AA000    Swapfile disk address    00000000
KTB vector address       81444D2C    HWPCB address            821AA080
Callback vector address  00000000    Termination mailbox          0000
Master internal PID      00030028    Subprocess count                0
Creator extended PID     00000000    Creator internal PID     00000000
Previous CPU Id          00000000    Current CPU Id           00000000
Previous ASNSEQ  0000000000000003    Previous ASN     0000000000000017
Initial process priority        4    # open files remaining        100/100
Delete pending count            0    Direct I/O count/limit        150/150
UIC                [00001,000004]    Buffered I/O count/limit      149/150
Abs time of last event   01F1A51D    BUFIO byte count/limit
 99424/99808
# of threads                    1    ASTs remaining                248/250
Swapped copy of LEFC0    00000000    Timer entries remaining        20/20
Swapped copy of LEFC1    00000000    Active page table count         0
Global cluster 2 pointer 00000000    Process WS page count          43
Global cluster 3 pointer 00000000    Global WS page count           28

Thread index: 0000
```

```
------------------
Current capabilities:    System: 0000000C  QUORUM,RUN
                         User:   00000000
Permanent capabilities:  System: 0000000C  QUORUM,RUN
                         User:   00000000
Current affinities:      00000000
Permanent affinities:    00000000
Thread status:           02040001
       status2:          00000000

KTB address              81444A40    HWPCB address             821AA080
PKTA address             7FFEFF98    Callback vector address   00000000
Internal PID             00030028    Callback error            00000000
Extended PID             000000E8    Current CPU id            00000000
State                       LEF      Flags                     00000000
Base priority                 4      Current priority                 5
Waiting EF cluster            0      Event flag wait mask      DFFFFFFF
CPU since last quantum     FFF8      Mutex count                      0
ASTs active                NONE
```

The SHOW PROCESS command displays information taken from the software PCB of SYSTEM, the SDA current process. According to the State field in the display, process SYSTEM is in Local Event Flag Wait.

```
SDA> SHOW PROCESS/BUFFER_OBJECTS/FANDLES

Process index: 0022   Name: NODEA_RTA1:   Extended PID: 00000062
-----------------------------------------------------------------


                           Process Buffer Objects
                           ----------------------

ADDRESS  ACMODE SEQUENCE  REFCNT    PID     PAGCNT      BASE PVA
 BASE SVA
-------- ------ -------- -------- -------- -------- -----------------
 -----------------
8151AE00 User   00000011 00000031 00010022 00000001 00000000.00084000
 FFFFFFFF.7DE68000 S2_WINDOW
814A6CC0 User   00000012 00000009 00010022 00000001 00000000.80000000
 FFFFFFFF.7DE66000 S2_WINDOW
814FBA00 User   00000013 00000009 00010022 00000001 00000000.80000000
 FFFFFFFF.FFFFFFFF NOSVA
81512200 User   00000014 00000009 00010022 00000001 00000000.80028000
 FFFFFFFF.7DE64000 S2_WINDOW
8151A8C0 User   00000015 00000009 00010022 00000001 00000000.80028000
 FFFFFFFF.FFFFFFFF NOSVA
81438580 User   00000016 00000009 00010022 00000001 FFFFFEFB.FF800000
 FFFFFFFF.7DE62000 S2_WINDOW
81464480 User   00000017 00000009 00010022 00000001 FFFFFEFB.FF800000
 FFFFFFFF.FFFFFFFF NOSVA
81416F00 Kernel 00000018 00000001 00010022 00000001 00000000.7FF76000
 FFFFFFFF.8120C000 NOQUOTA



                  Fandle Vector Header
```

```
                  --------------------

Address   Maxfix  Real_Size CCB buffer handle
-------- -------- --------- -----------------
7FF68290 00000043  00000880 00000018.81416F00


                         Fandles
                         -------

Address     IRP   fastio_done  Orgfun   Data bo handle     IOSA bo handle
      DBYLEN
-------- -------- ----------- -------- ----------------- -----------------
 -----------------
7FF682B0 815CEF40     set     00020031 00000016.81438580 00000011.8151AE00
 00000000.00002000
7FF682D0 815CE4C0     set     00020030 00000016.81438580 00000011.8151AE00
 00000000.00002000
7FF682F0 815CE200     set     00000031 00000016.81438580 00000011.8151AE00
 00000000.00002000
7FF68310 815D4B80     set     00000030 00000016.81438580 00000011.8151AE00
 00000000.00002000
7FF68330 815D65C0     set     00020031 00000015.8151A8C0 00000011.8151AE00
 00000000.00002000
7FF68350 815D6880     set     00020030 00000015.8151A8C0 00000011.8151AE00
 00000000.00002000

   .
   .
   .

7FF68810 815D6B40     set     00020031 00000013.814FBA00 00000011.8151AE00
 00000000.00002000
7FF68830 815D5880     set     00020030 00000013.814FBA00 00000011.8151AE00
 00000000.00002000

                      -----    00000013 free FVEs (IRP = 00000000)
    VA   7FF68850

    -to- 7FF68A90

7FF68AB0 815D9840     set     00020031 00000017.81464480 00000011.8151AE00
 00000000.00002000
7FF68AD0 815CD040     set     00020030 00000017.81464480 00000011.8151AE00
 00000000.00002000
7FF68AF0 815CB480     set     00000031 00000017.81464480 00000011.8151AE00
 00000000.00002000)
```

The SHOW PROCESS/BUFFER_OBJECTS/FANDLES command displays all the buffered objects and fast I/O handles that a process has created.

```
SDA> SHOW PROCESS JOB_CONTROL/TQE
Process index: 000C   Name: JOB_CONTROL   Extended PID: 0000004C
----------------------------------------------------------------

                            Timer queue entries
                            -------------------
```

```
  TQE
address                  Expiration Time                  Type
--------   -----------------------------------------   ------
81504080   00A05ABD.895F93C5 27-NOV-2001 11:17:17.37   TSD---
815026C0   00A05AC3.80D0E000 27-NOV-2001 12:00:00.00   TSA---
81502180   00A0C160.635594EF  7-APR-2002 02:00:00.12   TSA---
```

This example shows the timer queue entries for the process JOB_CONTROL. See Table 4.27 for an explanation of the Type codes.

```
SDA> SHOW PROCESS /IMAGE




Process index: 0005   Name: SA_STARTUP_DCL   Extended PID: 00000025
-------------------------------------------------------------------)

                     Process activated images
                     ------------------------

         Image Name             Type       IMCB          GP
---------------------------- ------------ -------- -----------------
SDA                           MAIN         7FE86EB0 00000000.00230000
SDA$SHARE                     GLBL         7FE86190 00000000.00636000
SMGSHR                        GLBL         7FE87830 00000000.00706000
...

Total images = 17                         Pages allocated = 2165
```

This example includes the GP (global pointer) for all images in the process.

```
SDA> SHOW PROCESS/IMAGE=SDA

Process index: 0005   Name: SA_STARTUP_DCL    Extended PID: 00000025
--------------------------------------------------------------------

                            Process activated images
                            ------------------------

   Image Name/Link Time/Section Type    Type/File Id   IMCB   Sym Vect
 Maj,Min ID,Match
--------------------------------------- ------------ -------- --------
 ---------------- *** see below ***
SDA                                     MAIN         7FE86EB0
 231F,85F10A8C,01
 17-MAY-2004 10:55:33.89                (1346,1,0)
                                   Code
                       Data (read only)
                             Short data
                                  Fixup

*** Rightmost columns from above output moved here ***

      Base              End        ImageOff
----------------- ----------------- --------
             GP = 00000000.00230000
```

```
00000000.00010000 00000000.0001022F 00010000
00000000.00020000 00000000.000200EF 00020000
00000000.00030000 00000000.00030077 00030000
00000000.80000000 00000000.800003FF 80000000
```

This example includes the GP (global pointer) for the SDA image.

4.64. SHOW RAD

Displays the settings and explanations of the RAD_SUPPORT system parameter fields, and the assignment of CPUs and memory to the Resource Affinity Domains (RADs). This command is only useful on platforms that support RADs. By default, the SHOW RAD command displays the settings of the RAD_SUPPORT system parameter fields.

Format

SHOW RAD [number | /ALL | /PXML]

Parameter

number

Displays information on CPUs and memory for the specified RAD.

Qualifiers

/ALL

Displays settings of the RAD_SUPPORT parameter fields and the CPU and memory assignments for all RADs.

/PXML (Integrity servers only)

SDA displays the proximity database derived from the Advanced Configuration and Power Interface (ACPI) tables. The proximity database is used to set up the RAD data structures.

Examples

1.
```
SDA> SHOW RAD
Resource Affinity Domains
-------------------------

        RAD information header address: FFFFFFFF.81032340
        Maximum RAD count:                       00000008
        RAD containing SYS$BASE_IMAGE:           00000000
        RAD support flags:                       0000004F

         3          2 2          1 1
         1          4 3          6 5          8 7          0
        +-----------+-----------+-----------+-----------+
        |..|..| skip|ss|gg|ww|pp|..|..|..|..|.p|fs|cr|ae|
        +-----------+-----------+-----------+-----------+
        |..|..|    0| 0| 0| 0| 0|..|..|..|..|.1|00|11|11|
        +-----------+-----------+-----------+-----------+

        Bit 0 = 1:          RAD support is enabled
```

```
    Bit 1 = 1:          Soft RAD affinity support is enabled
                        (Default scheduler skip count of 16 attempts)

    Bit 2 = 1:          System-space replication support is enabled

    Bit 3 = 1:          Copy on soft fault is enabled

    Bit 4 = 0:          Default RAD-based page allocation in use

                        Allocation Type               RAD choice
                        ---------------               ----------
                        Process-private pagefault     Home
                        Process creation or inswap    Random
                        Global pagefault              Random
                        System-space page allocation  Current

    Bit 5 = 0:          RAD debug feature is disabled

    Bit 6 = 1:          Per-RAD non-paged pool is enabled
```

This example shows the settings of the RAD_SUPPORT system parameter fields.

2.
```
SDA> SHOW RAD 2
Resource Affinity Domain 0002
-----------------------------

CPU sets:

  Active      08 10 11
  Active      08 10 11
  Configure   08 09 10 11
  Potential   08 10 11

PFN ranges:

  Start PFN   End PFN     PFN count   Flags
  ---------   --------    ---------   -----
  01000000    0107FFE7    0007FFE8    000A  OpenVMS Base
  0107FFE8    0107FFFF    00000018    0009  Console Base

SYSPTBR:      01002A01

RAD data:     B817C000
```

This example shows information on the CPUs and memory for RAD 2.

4.65. SHOW RESOURCES

Displays information about all resources in the system or about a resource associated with a specific lock.

Format

SHOW RESOURCES [/ADDRESS=n

| /ALL (d)

| /BRIEF

| /CACHED

| /CONTENTION [=ALL][/FULL]

| /LOCKID=lock-id

| /LIST

| /NAME=name

| /OWNED

| /STATUS=(keyword[,...])]

Parameters

None.

Qualifiers

/ADDRESS=*n*

Displays information from the resource block at the specified address.

/ALL

Displays information from all resource blocks (RSBs) in the system. This is the default behavior of the SHOW RESOURCES command.

/BRIEF

Displays a single line of information for each resource.

/CACHED

Displays resource blocks that are no longer valid. The memory for these resources is saved so that later requests for resources can use them.

/CONTENTION [=ALL]

Displays only resources that have at least one lock on either the waiting or conversion queue. Unless you specify the ALL keyword, resources with locks on the waiting or conversion queues that are not participating in deadlock searches are ignored. (Locks not participating in deadlock searches are requested with either the LCK$M_NODLCKWT or LCK$M_NODLCKBLK flags.) By default, a single line summary is displayed for each resource, followed by a single line summary for each lock on the resource. Use /FULL to obtain a detailed display for each resource that is in contention.

/FULL

When used with /CONTENTION [=ALL], causes SDA to display details of each resource that is in contention instead of a single line summary.

/LIST

Displays summary information for each resource, followed by a list of all locks associated with the resource.

/LOCKID=*lock-id*

Displays information on the resource associated with the lock with the specified *lock-id*.

/NAME=*name*

Displays information about the specific resource. Name may be the actual name of the resource, if it only contains uppercase letters, numerals, the underscore (_), dollar sign, colon (:), and some other printable characters, as for example, /NAME=MY_LOCK. If it contains other printable characters (including lowercase letters), you may need to enclose the name in quotation marks (""), as for example, /NAME="My_Lock/47". If it contains nonprintable characters, the name may be specified as a comma-separated list comprised of strings and hexadecimal numbers, as for example, /NAME=("My_Lock",0C00,"/47") would specify the name "My_Lock<NUL><FF>/47". The hexadecimal number can be no more than 8 digits (4 bytes) in length. Nonprintable sequences or more than 4 bytes must be split into multiple hexadecimal numbers. The maximum length of a resource name is 32 characters.

/OWNED

Displays only owned resources.

/STATUS=(keyword[,...])

Displays only resources that have the specified status bits set in the RSB$L_STATUS field. If you specify only one keyword, you can omit the parentheses. Status keywords are as follows:

Keyword	Meaning
2PC_IP	Indicates a two-phase convert operation in progress
BRL	Indicates byte range resource
CHK_BTR	Checks for better master
CVTFULRNG	Indicates full-range requests in convert queue
CVTSUBRNG	Indicates sub-range requests in convert queue
DIRENTRY	Indicates directory entry during failover
DIR_IP	Creates directory entry
DIR_RQD	Indicates directory entry required
INVPEND	Checks for value block invalidation
RBLD_ACT	Indicates lock rebuild active for this tree
RBLD_IP	Indicates rebuild operation in progress
RBLD_RQD	Indicates rebuild required for this resource tree
RM_ACCEPT	Accepts new master
RM_DEFLECT	Deflects remote interest
RM_FORCE	Forces tree move
RM_FREEZE	Freeze resource tree on this node
RM_INTEREST	Remaster due to master having no interest
RM_IP	Indicates resource remaster in progress
RM_PEND	Indicates a pending resource remaster operation

Keyword	Meaning
RM_RBLD	Indicates to always rebuild resource tree
RM_WAIT	Blocks local activity
VALCUR	Indicates value block is current
VALINVLD	Indicates value block invalid
WTFULRNG	Indicates full-range requests in wait queue
WTSUBRNG	Indicates a sub-range requests in wait queue
XVAL_VALID	Indicates last value block was long block

Description

The SHOW RESOURCES command displays the information listed in Table 4.22 either for each resource in the system or for the specific resource associated with the specified lock-id, address, or name.

Table 4.22. Resource Information in the SHOW RESOURCES Display

Field (in order of display)	Contents
RSB	Address of the resource block (RSB) that describes this resource.
GGMODE	Indication of the most restrictive mode in which a lock on this resource has been granted. Table 4.23 shows the values and their meanings. For information on conflicting and incompatible lock modes, see the *VSI OpenVMS System Services Reference Manual*.
Status	The contents of the resource block status field.
Parent RSB	Address of the RSB that is the parent of this RSB. This field is 00000000 if the RSB itself is a parent block.
CGMODE	Indication of the most restrictive lock mode to which a lock on this resource is waiting to be converted. This does not include the mode for which the lock at the head of the conversion queue is waiting. See Table 4.23.
Sub-RSB count	Number of RSBs of which this RSB is the parent. This field is 0 if the RSB has no sub-RSBs.
FGMODE	Indication of the full-range grant mode. See Table 4.23.
Lock Count	The total count of all locks on the resource.
RQSEQNM	Sequence number of the request.
BLKAST count	Number of locks on this resource that have requested a blocking AST.
CSID	Cluster system identification number (CSID) and name of the node that owns the resource.
Resource	Dump of the name of this resource, as stored at the end of the RSB. The first two columns are the

Field (in order of display)	Contents
	hexadecimal representation of the name, with the least significant byte represented by the rightmost two digits in the rightmost column. The third column contains the ASCII representation of the name, the least significant byte being represented by the leftmost character in the column. Periods in this column represent values that correspond to nonprinting ASCII characters.
Valblk	Hexadecimal and ASCII dump of the first 16 bytes of the value block associated with this resource. See Extended Value Block later in this table for the display of the rest of the value block.
Length	Length in bytes of the resource name.
x mode	Processor mode of the namespace in which this RSB resides (Group, Kernel, User).
owner	Owner of the resource. Certain resources, owned by the operating system, list "System" as the owner. Locks owned by a group have the number (in octal) of the owning group in this field.
Seqnum	Sequence number associated with the resource's value block. If the number indicates that the value block is not valid, the words "Not valid" appear to the right of the number.
Extended Valblk	If any of the last 48 bytes of the value block (see Valblk earlier in this table) are non-zero, then the entire 64-byte value block is displayed as hexadecimal and ASCII dumps. Otherwise this display is omitted. The display appears only when value block contents are non-zero, without regard to the state of the RSB$M_XVAL_VALID flag.
Granted queue	List of locks on this resource that have been granted. For each lock in the list, SDA displays the number of the lock and the lock mode in which the lock was granted.
Conversion queue	List of locks waiting to be converted from one mode to another. For each lock in the list, SDA displays the number of the lock, the mode in which the lock was granted, and the mode to which the lock is to be converted.
Waiting queue	List of locks waiting to be granted. For each lock in the list, SDA displays the number of the lock and the mode requested for that lock.

Table 4.23. Lock Modes on Resources

Value1	Meaning
NL	Null mode
CR	Concurrent-read mode

Value1	Meaning
CW	Concurrent-write mode
PR	Protected-read mode
PW	Protected-write mode
EX	Exclusive mode

Values are shown in order from the least restrictive mode to the most restrictive.

Examples

1. ```
SDA> SHOW RESOURCES
Resource Database

RSB: FFFFFFFF.7FEECE40 GGMODE: PW Status: VALID   XVALID
Parent RSB: 00000000.00000000 CGMODE: PW
Sub-RSB count: 0   FGMODE: PW
Lock Count: 1   RQSEQNM: 0000
BLKAST count: 0   CSID: 00000000 (SAND41)

Resource: 00000000 0043524A JRC..... Valblk: 5F73695F
 73696854
 Length   3   00000000 00000000 ....   6F5F7473
 65745F61
 User mode   00000000 00000000 ....   This_is_a_test_o
 Group   001   00000000 00000000 .... Seqnum: 00000001

Extended Valblk: 6F5F7473 65745F61 5F73695F 73696854 This_is_a_test_o
                    565F6465 646E6574 78455F65 68745F66 f_the_Extended_V
                    00000000 00006B63 6F6C425F 65756C61 alue_Block......
                    00000000 00000000 00000000 00000000 ....

Granted queue (Lock ID / Gr mode / Range):
 1500082F PW 00000000-FFFFFFFF

Conversion queue (Lock ID / Gr mode / Range -> Rq mode / Range):
     *** EMPTY QUEUE ***

Waiting queue (Lock ID / Rq mode / Range):
     *** EMPTY QUEUE ***

SDA> SHOW RESOURCES
Resource Database

RSB: FFFFFFFF.7FEECE40 GGMODE: PW Status: VALID
Parent RSB: 00000000.00000000 CGMODE: PW
Sub-RSB count: 0   FGMODE: PW
Lock Count: 1   RQSEQNM: 0002
BLKAST count: 0   CSID: 00000000 (SAND41)

Resource: 00000000 0043524A JRC..... Valblk: 5F74726F
 68735F41
 Length   3   00000000 00000000   00000000
 00656E6F
 User mode   00000000 00000000 ....   A_short_one.....
```
```

```
 Group   001       00000000 00000000  ........  Seqnum: 00000003

Extended Valblk:   00000000 00656E6F 5F74726F 68735F41  A_short_one.....
                   565F6465 646E6574 78455F65 68745F66  f_the_Extended_V
                   00000000 00006B63 6F6C425F 65756C61  alue_Block......
                   00000000 00000000 00000000 00000000  ................

Granted queue (Lock ID / Gr mode / Range):
 3900080C  PW 00000000-FFFFFFFF

Conversion queue (Lock ID / Gr mode / Range -> Rq mode / Range):
     *** EMPTY QUEUE ***

Waiting queue (Lock ID / Rq mode / Range):
     *** EMPTY QUEUE ***
```

These examples for Alpha and Integrity server systems show two cases:

- output from a program writing a longer block
- output where the last writer wrote a short value block (XVALID not set), but because a previous writer wrote non-zero data to the high portion of the block and these data are still present, the data in the Extended Value Block are shown.

2.
```
SDA> SHOW RESOURCE/CONTENTION

Resource Contention Information:
--------------------------------
   RSB Address      Parent RSB Addr           Resource Name           LKB Address      PID     Node   Lockid  GR RQ  Queue
----------------- ----------------- ------------------------------ ----------------- -------- ------ -------- -- -- -------
FFFFFFFF.7FAAC550 FFFFFFFF.7FB47A50 P.......
                                                                   FFFFFFFF.7FAEC350 00010027 SWORKS 04001158 PW    Granted
                                                                   FFFFFFFF.7FB34550 00000000 CMOS   08000E46 CR    Granted
                                                                   FFFFFFFF.7FA93250 00000000 CMOS   030015A3 CR    Granted
                                                                   FFFFFFFF.7FB3EA50 00000000 CMOS   09000DC0 CR    Granted
                                                                   FFFFFFFF.7FAE7B50 00000000 CMOS   080011C6 CR    Granted
                                                                   FFFFFFFF.7FA36050 00010023 SWORKS 060019F3 CR    Granted
                                                                   FFFFFFFF.7FA7BE50 00000000 CMOS   020016A1 NL    Granted
                                                                   FFFFFFFF.7FAAC650 00000000 SWORKS 010014AC NL    Granted
                                                                   FFFFFFFF.7FA62C50 00010028 SWORKS 020017C1 CR PW Convert
                                                                   FFFFFFFF.7FAF9950 00010024 SWORKS 040010E5 CR PW Convert
                                                                   FFFFFFFF.7FA33C50 00000000 CMOS   02001A36    PW Waiting
                                                                   FFFFFFFF.7FB14550 00000000 CMOS   0F00010E    PW Waiting

FFFFFFFF.7FB39050 FFFFFFFF.7FB47A50 P...ŏ...
                                                                   FFFFFFFF.7FB3CC50 00010024 SWORKS 0B000DDC PW    Granted
                                                                   FFFFFFFF.7FAC0E50 00010023 SWORKS 03001400 CR    Granted
                                                                   FFFFFFFF.7FA74950 00000000 CMOS   030016DE CR    Granted
                                                                   FFFFFFFF.7FA4C050 00010026 SWORKS 020018CE CR    Granted
                                                                   FFFFFFFF.7FAC5050 00010022 SWORKS 070013C3 CR    Granted
                                                                   FFFFFFFF.7FB38450 00010025 SWORKS 09000E0E CR    Granted
                                                                   FFFFFFFF.7FACD450 00010028 SWORKS 0700134E CR    Granted
                                                                   FFFFFFFF.7FAD2250 00000000 CMOS   080012DF CR    Granted
                                                                   FFFFFFFF.7FAE0750 00000000 CMOS   0100120F NL    Granted
                                                                   FFFFFFFF.7FB37B50 00000000 SWORKS 01000E3D NL    Granted
                                                                   FFFFFFFF.7FB14A50 00010027 SWORKS 2500011C CR PR Convert
                                                                   FFFFFFFF.7FAD4950 00000000 CMOS   070012CA CR PR Convert
                                                                   FFFFFFFF.7FAC9550 00000000 CMOS   0900138D CR PR Convert
                                                                   FFFFFFFF.7FB03250 00000000 CMOS   0C001069 CR PR Convert
                                                                   FFFFFFFF.7FD70C50 00000000 CMOS   080005AF CR PR Convert

FFFFFFFF.7FD7A250 00000000.00000000 †...T...&.à!....
                                                                   FFFFFFFF.7FDC5650 00010026 SWORKS 1A00084C PW    Granted
                                                                   FFFFFFFF.7FDF4950 00010020 SWORKS 010009A1    PW Waiting


FFFFFFFF.7FD9A250 00000000.00000000 †...T...$.à!....
                                                                   FFFFFFFF.7FD07550 00010024 SWORKS 2E0004EB PW    Granted
                                                                   FFFFFFFF.7FDF4A50 00010020 SWORKS 010009A2    PW Waiting

FFFFFFFF.7FD36450 FFFFFFFF.7FD0EC50 QMAN$JBC_ALIVE_01
                                                                   FFFFFFFF.7FD27050 00000000 CMOS   1A0002CA EX    Granted
                                                                   FFFFFFFF.7FD7B450 00000000 CMOS   050007D4    CR Waiting
```

This example of the SHOW RESOURCES/CONTENTION command shows all the resources for which there is contention, and which are to be included in deadlock searches.

3.
```
SDA> SHOW RESOURCES/LIST

Resource Database
-----------------
   RSB Address      Parent RSB Addr           Resource Name              LKB Address       PID      Node   Lockid  GR RQ  Queue
----------------- ----------------- ------------------------------ ----------------- -------- ------ -------- -- -- -------
FFFFFFFE.DD058180 00000000.00000000 F11B$b$217$DKC200:                                        QTV11
                                                                   FFFFFFFE.DD04E580 00000000 MHERTZ 02000DDF CR    Granted

FFFFFFFE.DCF6F080 00000000.00000000 F11B$v$22$DKB12:                                          QTV11
                                                                   FFFFFFFE.DD063180 00000000 MHERTZ 0200122D CR    Granted

FFFFFFFE.DCFAC680 00000000.00000000 SYS$_$70$DKA302:                                          QTV11
                                                                   FFFFFFFE.DCF21180 00000000 MHERTZ 03001130 CR    Granted

FFFFFFFE.DCFBA580 FFFFFFFE.DCEFBC80 F11B$s.#..                                                BACH
                                                                   FFFFFFFE.DD032380 00000000 MHERTZ 0D000C9F NL    Granted

FFFFFFFE.DD00E380 00000000.00000000 CACHE$cmRAVEN_BACKUPù...                                  MHERTZ
                                                                   FFFFFFFE.DCF54A80 00000000 B8OVEN 03000280 PR    Granted
                                                                   FFFFFFFE.DCEF8780 00000000 QTV9   12000C51 PR    Granted
                                                                   FFFFFFFE.DD029880 00000000 KHERTZ 07000A6B PR    Granted
                                                                   FFFFFFFE.DD002780 00000000 MHERTZ 16000829 PR    Granted

FFFFFFFE.DD060A80 00000000.00000000 SYS$_DSA71:                                               QTV11
                                                                   FFFFFFFE.DCF91580 00000000 MHERTZ 1A00115D CR    Granted

FFFFFFFE.DCF22B80 00000000.00000000 CACHE$cmB_PICCHUBCK Ú...                                  WHAMOO

FFFFFFFE.DCF57E80 00000000.00000000 $DSA7779_$SEQCMD                                          QTV9
                                                                   FFFFFFFE.DCF37D80 00000000 MHERTZ 0300011C PR    Granted

FFFFFFFE.DCFDD780 00000000.00000000 CACHE$cmPAGE_SWAP   Ü...                                  QTV11
                                                                   FFFFFFFE.DCFD3880 00000000 MHERTZ 0D00062A PR    Granted


         .
         .
         .

FFFFFFFE.DCFA6480 00000000.00000000 VCC$v$1$DUA126:                                           QTV11
                                                                   FFFFFFFE.DD053980 00000000 MHERTZ 23000E09 PR    Granted

FFFFFFFE.DCF9BA80 00000000.00000000 $DSA7778_$WATCHR                                          EBJB17
                                                                   FFFFFFFE.DCFFA280 00000000 MHERTZ 02000AF3    EX Waiting

FFFFFFFE.DCF50380 00000000.00000000 F11B$aRAVEN_BACKUPö...                                    KHERTZ
                                                                   FFFFFFFE.DCEED980 00000000 MHERTZ 01000025 PR    Granted
```

This example shows the output from the SHOW RESOURCES/LIST command.

4.66. SHOW RMD

Displays information contained in the reserved memory descriptors. Reserved memory is used within the system by memory-resident global sections.

Format

`SHOW RMD [/qualifiers]`

Parameters

None.

Qualifiers

/ADDRESS=*n*

Displays a specific reserved memory descriptor entry, given its address.

/ALL

Displays information in all the reserved memory descriptors. This qualifier is the default.

Description

The SHOW RMD command displays information that resides in the reserved memory descriptors. The table below shows the fields and their meanings.

Table 4.24. RMD Fields

Field	Meaning
Address	Gives the address of the reserved memory descriptor.
Name	Gives the name of the reserved memory descriptor.
Group	Gives the UIC group that owns the reserved memory. This is given as -S- for system global reserved memory.
RAD	Gives the required RAD for the reserved memory. Displays "Any" if no RAD specified.
PFN	Gives starting page number of the reserved memory.
Count	Gives the number of pages reserved.
In_Use (Error)	Gives the number of pages in use. If an error occurred when the reserved memory was being allocated, the error condition code is displayed in parentheses. A second line, giving the text of the error, is also displayed in this case.
Zero_PFN	Gives the next page number to be zeroed.
Flags	Gives the settings of flags for specified reserved memory descriptor as a hexadecimal number, then displays key flag bits by name. The names may use multiple lines in the display.

Examples

1. ```
SDA> SHOW RMD

Reserved Memory Descriptor List

                                                                 In_Use
Address Name   Group RAD   PFN   Count   (Error)
 Zero_PFN Flags
-------- ------------------- ----- ---- -------- --------   --------
 -------- ------------------------------
814199C0 LARGE   00022 Any 00000000 000004E2   00000000
 00000000 000000E0 Group Page_Tables

               GBLSec
81419940 LARGE   00022 Any 00000000 00138800 (0000244C)
 00000000 000001A0 Error Group GBLSec
         Error = %SYSTEM-F-INSFLPGS, insufficient Fluid Pages available
81419AC0 SMALL   00011 0001 00000180 00000001   00000000
 00000180 000000E1 Alloc Group

               Page_Tables GBLSec
81419A40 SMALL   00011 0001 00000E00 00000080   00000000
 00000E00 000000A1 Alloc Group GBLSec
```

   This example shows the default output of a SHOW RMD command.
```

4.67. SHOW RMS

Displays the RMS data structures selected by the SET RMS command to be included in the default display of the SHOW PROCESS/RMS command.

Format

SHOW RMS

Parameters

None.

Qualifiers

None.

Description

The SHOW RMS command lists the names of the data structures selected for the default display of the SHOW PROCESS/RMS command.

For a description of the significance of the options listed in the SHOW RMS display, see the description of the SET RMS command and Table 4.2.

For an illustration of the information displayed by the SHOW PROCESS/RMS command, see the examples included in the description of the SHOW PROCESS command.

Examples

1. ```
   SDA>  SHOW RMS

   RMS Display Options:
    IFB,IRB,IDX,BDB,BDBSUM,ASB,CCB,WCB,FCB,FAB,RAB,NAM,
   XAB,RLB,BLB,BLBSUM,GBD,GBH,FWA,GBDSUM,JFB,NWA,RU,DRC,SFSB,GBSB
   Display RMS structures for all IFI values.
   ```

   The SHOW RMS command displays the full set of options available for display by the SHOW PROCESS/RMS command. SDA, by default, selects the full set of RMS options at the beginning of an analysis.

2. ```
   SDA>  SET RMS=(IFAB=1,CCB,WCB)
   SDA>  SHOW RMS

   RMS Display Options:  IFB,CCB,WCB
   Display RMS structures only for IFI = 0001
   ```

   The SET RMS command establishes the IFB, CCB, and WCB as the structures to be displayed, and only for the file whose internal File Identifer has the value 1, when the SHOW PROCESS/RMS command is issued. The SHOW RMS command verifies this selection of RMS options.

4.68. SHOW RSPID

Displays information about response IDs (RSPIDs) of all System Communications Services (SCS) connections or, optionally, about a specific SCS connection.

Format

`SHOW RSPID [/CONNECTION=cdt-address ]`

Parameters

None.

Qualifier

/CONNECTION=*cdt-address*

Displays RSPID information for the specific SCS connection whose connection descriptor table (CDT) address is provided in *cdt-address*. You can find the *cdt-address* for any active connection on the system in the **CDT summary page** display of the SHOW CONNECTIONS command. CDT addresses are also stored in many individual data structures related to SCS connections. These data structures include class driver request packets (CDRPs) and unit control blocks (UCBs) for class drivers that use SCS and cluster system blocks (CSBs) for the connection manager.

Description

Whenever a local system application (SYSAP) requires a response from a remote SYSAP, a unique number, called an RSPID, is assigned to the response by the local system. The RSPID is transmitted in the original request (as a means of identification), and the remote SYSAP returns the same RSPID in its response to the original request.

The SHOW RSPID command displays information taken from the response descriptor table (RDT), which lists the currently open local requests that require responses from SYSAPs at a remote node. For each RSPID, SDA displays the following information:

- RSPID value
- Address of the class driver request packet (CDRP), which generally represents the original request
- Address of the CDT that is using the RSPID
- Name of the local process using the RSPID
- Remote node from which a response is required (and has not yet been received)

Examples

1.
```
SDA> SHOW RSPID
    --- Summary of Response Descriptor Table (RDT) 805E6F18 ---
RSPID      CDRP Address     CDT Address     Local Process Name
 Remote Node
-----      ------------     -----------     ------------------
 -----------
```

```
39D00000     8062CC80       805E8710      VMS$VMScluster
 VANDQ1
EE210001     80637260       805E8C90      VMS$DISK_CL_DRVR
 ROMRDR
EE240002     806382E0       805E8DF0      VMS$DISK_CL_DRVR
 VANDQ1
EE440003     806393E0       805E8F50      VMS$TAPE_CL_DRVR
 VANDQ1
5DB90004     80636BC0       805E8870      VMS$VMScluster
 ROMRDR
5C260005     80664040       805E8870      VMS$VMScluster
 ROMRDR
38F80006     80664A80       805E8710      VMS$VMScluster
 VANDQ1
```

This example shows the default output for the SHOW RSPID command.

2.
```
SDA>  SHOW RSPID/CONNECTION=805E8F50
    --- Summary of Response Descriptor Table (RDT) 805E6F18 ---
RSPID      CDRP Address     CDT Address     Local Process Name
 Remote Node
-----      ------------     -----------     ------------------
 -----------
EE440003     806393E0        805E8F50      VMS$TAPE_CL_DRVR
 VANDQ1
```

This example shows the output for a SHOW RSPID/CONNECTION command.

4.69. SHOW SHM_CPP

Displays information about the shared memory common property partitions (CPPs). The default display shows a single-page summary that includes a single line for each CPP.

Format

SHOW SHM_CPP [/qualifiers]

Parameters

None.

Qualifiers

/ADDRESS=*n*

Displays a detailed page of information about an individual shared memory CPP given the address of the SHM_CPP structure.

/ALL

Displays a detailed page of information about each shared memory CPP.

/IDENT=*n*

Displays a detailed page of information about an individual shared memory CPP.

/PFN [=(*option*[,*option*,...])]

Displays PFN data in addition to the basic SHM_CPP. The default is to display all lists (free, bad, untested), plus the PFN database pages and the complete range of PFNs in the CPP.

You can limit which lists are displayed by specifying one or more keywords from the following table. If you specify multiple keywords, enclose them in parentheses and separate keywords with a comma.

ALL_FRAGMENTS	Displays the complete range of PFNs in the CPP.
BAD	Displays only the bad page list.
FREE	Displays only the free page list.
PFNDB	Displays the PFNs containing the PFN database.
UNTESTED	Displays only the untested page list.

If you specify /PFN without /ALL, /IDENT, or /ADDRESS, the system displays the PFN lists from the last shared memory CPP accessed.

Examples

1.
```
SDA> SHOW SHM_CPP
Summary of Shared Memory Common Property Partitions
---------------------------------------------------

Base address of SHM_CPP array:             FFFFFFFF.7F2BA140
Maximum number of SHM_CPP entries:                  00000007
Size of each SHM_CPP:                               00000240
Maximum fragment count per SHM_CPP:                 00000010

Valid CPP count:                                    00000001

 ID   SHM_CPP address     MinPFN   MaxPFN    Page count  Free pages
 Flags
---- -----------------   -------- --------    --------    --------
 --------
  -- SHM_CPP IDs 0000 to 0002: VALID flag clear --

0003 FFFFFFFF.7F2BA800   00060000 0007FFFF    00020000    0001FCF7
 00000001  VALID

  -- SHM_CPP IDs 0004 to 0006: VALID flag clear --
```

This example shows the default output for the SHOW SHM_CPP command.

2.
```
SDA> SHOW SHM_CPP/IDENT=3
Shared Memory CPP 0003
----------------------

SHM_CPP address:         FFFFFFFF.7F2BA800

  Version:                         00000001   Flags:
 00000001  VALID
  Size:                   00000000.000000C0   Page count:
 00020000
  Actual fragment count:           00000001   Minimum PFN:
 00060000
```

```
  Maximum fragment count:         00000010   Maximum PFN:
 0007FFFF

  Length of free page list:       0001FCF7
  Length of bad page list:        00000000
  Length of untested page list:   00000000

PMAP array for PFN database pages

    PMAP    Start PFN   PFN count
    -----    --------    --------
       0.    00060053    00000280

PMAP array for all fragments

    PMAP    Start PFN   PFN count
    -----    --------    --------
       0.    00060000    00020000

GLock address:           FFFFFFFF.7F2BA8C0   Handle:
 80000000.00010D19

  GLock name:            SHM_CPP00000003     Flags:
    00
  Owner count:                         00   Owner node:
    00
  Node sequence:                     0000   Owner:
 000000
  IPL:                                 08   Previous IPL:
    00
  Wait bitmask:          00000000.00000000   Timeout:
 00249F00
  Thread ID:             00000000.00000000

Connected GNode bitmask: FFFFFFFF.7F2BA900

  Valid bits:                     00000004   State:
 00000000.00000000
  Unit count:                         0001   Unit size:
 QUADWORD

  Unit bitmask:
      ........ ........ ........ .......7   00000000
Ranges of free pages

    Range   Start PFN   PFN count
    -----    --------    --------
       1.    000602F6    00000002
       2.    0006030B    0001FCF5
```

This example shows the details for a single SHM_CPP.

4.70. SHOW SHM_REG

Displays information about shared memory regions. The default display shows a single page summary that includes a single line for each region.

Format

SHOW SHM_REG [/qualifiers] [name]

Parameter

name

Detailed page of information about the named region.

Qualifiers

/ADDRESS=*n*

Displays a detailed page of information about an individual region given the address of the SHM_REG structure.

/ALL

Displays a detailed page of information about each region.

/IDENT=*n*

Displays a detailed page of information about the specified region.

Examples

1.
```
SDA> SHOW SHM_REG

    Summary of Shared Memory Regions
    --------------------------------
Base address of SHM_REG array:      FFFFFFFF.7F2BB140
Maximum number of SHM_REG entries:           00000040
Size of each SHM_REG:                        00000208
Base address of SHM_DESC array:     FFFFFFFF.7F2DC000

Valid region count:                          00000009

 ID   SHM_REG address                Region Tag         SysVA / GSTX
 Flags
---- ----------------- ------------------------------ -----------------
 --------
0000 FFFFFFFF.7F2BB140 SYS$GALAXY_MANAGEMENT_DATABASE FFFFFFFF.7F234000
 00000001  VALID
0001 FFFFFFFF.7F2BB348 SYS$SHARED_MEMORY_PFN_DATABASE FFFFFFFE.00000000
 00000001  VALID
0002 FFFFFFFF.7F2BB550 SMCI$SECTION_PBA_04001             -<None>-
 00000001  VALID
0003 FFFFFFFF.7F2BB758 GLX$CPU$BALANCER$SYSGBL                 0000013F
 00000005  VALID SHARED_CONTEXT_VALID
0004 FFFFFFFF.7F2BB960 SMCI$CHANNEL_PBA_0_1           FFFFFFFF.8F3AE000
 00000001  VALID
0005 FFFFFFFF.7F2BBB68 SMCI$CHANNEL_PBA_0_2           FFFFFFFF.8FAEE000
 00000001  VALID
0006 FFFFFFFF.7F2BBD70 SMCI$CHANNEL_PBA_1_2           -<Not Attached>-
 00000001  VALID
```

```
0007 FFFFFFFF.7F2BBF78 LAN$SHM_REG                   FFFFFFFF.7F20C000
 00000009  VALID ATTACH_DETACH
0008 FFFFFFFF.7F2BC180 GLX$CPU_BAL_GLOCK  $000006             00000140
 00000005  VALID SHARED_CONTEXT_VALID

  -- SHM_REG IDs 0009 to 003F: never used --
```

This example shows the summary of all shared memory regions in the system.

2.
```
SDA> SHOW SHM_REG SMCI$CHANNEL_PBA_0_1
   --------------------------------------

SHM_REG address:        FFFFFFFF.7F2BB960

  Version:                       00000001   Flags:
 00000001  VALID
  Index/Sequence:            0004/00000003   Size:
 00000000.00000120

  Region tag:           SMCI$CHANNEL_PBA_0_1
  Creation time:        31-MAR-1999 14:11:11.37

SHM_DESC address:       FFFFFFFF.7F2DC200

  Version:                       00000001   Flags:
 00000005  ATTACHED SYS_VA_VALID
  System VA:            FFFFFFFF.8F3AE000   Virtual size:
 00000000.00274000
  I/O ref count:        00000000.00000000
  Index/Sequence:            0004/00000003   Context:
 FFFFFFFF.80F42480
  Callback:             FFFFFFFF.8F38E5C0   SYS$PBDRIVER+185C0

MMAP address:           FFFFFFFF.7F2BB9E0

  Level count:                       0001   Flags:
  0001  VALID
  Top page count:                00000001   Virtual size:
 00000000.00274000
  PFN list page count:           00000001   First PFN:
 000602D4
  Data page count:               00000009

GLock address:          FFFFFFFF.7F2BBA80   Handle:
 80000000.00010F51

  GLock name:           SHM_REG00000004     Flags:
    00
  Owner count:                         00   Owner node:
    00
  Node sequence:                     0000   Owner:
 000000
  IPL:                                 08   Previous IPL:
    00
  Wait bitmask:         00000000.00000000   Timeout:
 002DC6C0
  Thread ID:            00000000.00000000
```

```
   Attached GNode bitmask:  FFFFFFFF.7F2BBAC0

     Valid bits:                     00000004   State:
    00000000.00000012  AUTO_LOCK SET_COUNT
     Unit count:                         0001   Unit size:
    QUADWORD
     Lock IPL:                             08   Saved IPL:
    00000008
     Count of bits set:              00000002

     Unit bitmask:
          ........ ........ ........ .......3   00000000

   I/O in progress bitmask: FFFFFFFF.7F2BBAF8

     Valid bits:                     00000004   State:
    00000000.00000012  AUTO_LOCK SET_COUNT
     Unit count:                         0001   Unit size:
    QUADWORD
     Lock IPL:                             08   Saved IPL:
    00000000
     Count of bits set:              00000000

     Unit bitmask:
          ........ ........ ........ .......0   00000000

   SHM_CPP bitmask:         FFFFFFFF.7F2BBB30

     Valid bits:                     00000007   State:
    00000000.00000000
     Unit count:                         0001   Unit size:
    QUADWORD

     Unit bitmask:
          ........ ........ ........ ......08   00000000 )
```

This example shows the details for a single shared memory region.

4.71. SHOW SPINLOCKS

Displays the multiprocessing synchronization data structures.

Format

SHOW SPINLOCKS {[name]|/ADDRESS=expression|/INDEX=expression}

[{/BRIEF | /COUNTS | /FULL}]

[/CACHED_PCB | /DEVICE | /DYNAMIC | /MAILBOX

| /MISCELLANEOUS | /OWNED | /PCB | /PORT

| /PSHARED | /STATIC]

Parameters

name

Name of the spinlock to be displayed. Device spinlock names are of the form node$lock, where node indicates the OpenVMS Cluster node name and lock indicates the device and controller identification (for example, HAETAR$DUA). If there is no OpenVMS Cluster node name, the dollar sign ($) is also skipped (for example, DUA).

Qualifiers

/ADDRESS=*expression*

Displays the spinlock at the address specified in *expression*. You can use the /ADDRESS qualifier to display a specific device, mailbox, PCB, cached PCB, or process-shared spinlock; however, the name of the spinlock may be listed as "Unknown" in the display.

/BRIEF

Produces a condensed display of the spinlock information displayed by default by the SHOW SPINLOCKS command, including the following: address, spinlock name or device name, IPL or device IPL, rank, ownership depth, and CPU ID of the owner CPU. If the system under analysis was executing with full-checking multiprocessing enabled (according to the setting of the MULTIPROCESSING or SYSTEM_CHECK system parameter), then the number of waiting CPUs and interlock status are also displayed.

/CACHED_PCB

Displays all PCB-specific spinlocks associated with PCBs of deleted processes.

/COUNTS

Produces a display of Spin, Wait, and Acquire counts for each spinlock (only if full-checking multiprocessing is enabled).

/DYNAMIC

Displays information for all dynamic spinlocks in the system (device, port, mailbox, PCB, cached PCB, process-shared, and miscellaneous spinlocks).

/FULL

Displays full descriptive and diagnostic information for each displayed spinlock.

/INDEX=*expression*

Displays the static spinlock whose index is specified in expression. You can only use the /INDEX qualifier to display a named static spinlock.

/MAILBOX

Displays all mailbox-specific spinlocks.

/MISCELLANEOUS

Display all spinlocks that are not included in existing groups such as mailbox and PCB spinlocks. Miscellaneous spinlocks include the XFC, PEDRIVER, TCP/IP, and various other spinlocks. The list of miscellaneous spinlocks varies from system to system.

/OWNED

Displays information for all spinlocks owned by a CPU. If no processors own any spinlocks, SDA displays the following message:

```
%SDA-I-NOSPLOWNED, all requested spinlocks are unowned
```

/PCB

Displays all PCB-specific spinlocks.

/PORT

Displays all port spinlocks.

/PSHARED

Displays all process-shared (Pthreads) spinlocks.

/STATIC

Displays information for all static spinlocks in the system.

Description

The SHOW SPINLOCKS command displays status and diagnostic information about the multiprocessing synchronization structures known as **spinlocks**.

A **static spinlock** is a spinlock whose data structure is permanently assembled into the system. Static spinlocks are accessed as indexes into a vector of longword addresses called the **spinlock vector**, the address of which is contained in SMP$AR_SPNLKVEC. The table below lists the static spinlocks.

A **dynamic spinlock** is a spinlock that is created based on the configuration of a particular system. One such dynamic spinlock is the device lock SYSMAN creates when configuring a particular device. This device lock synchronizes access to the device's registers and certain UCB fields. The system creates a dynamic spinlock by allocating space from nonpaged pool, rather than assembling the lock into the system as it does in creating a static spinlock. Other types of dynamic spinlocks are: port spinlocks, mailbox spinlocks, PCB, cached PCB, process-shared, and miscellaneous spinlocks.

See the *Writing OpenVMS Alpha Device Drivers in C* for a full discussion of the role of spinlocks in maintaining synchronization of kernel-mode activities in a multiprocessing environment.

Name	Description
QUEUEAST	Spinlock for queuing ASTs at IPL 6
FILSYS	Spinlock on file system structures
LCKMGR	Spinlock on all lock manager structures
IOLOCK8/SCS	Spinlock for executing a driver fork process at IPL 8
TX_SYNCH	Transaction processing spinlock
TIMER	Spinlock for adding and deleting timer queue entries and searching the timer queue
PORT	Template structure for dynamic spinlocks for ports with multiple devices

Name	Description
IO_MISC	Miscellaneous short-term I/O spinlocks
MMG	Spinlock on memory management, PFN database, swapper, modified page writer, and creation of per-CPU database structures
SCHED	Spinlock on some process data structures and the scheduler database.
IOLOCK9	Spinlock for executing a driver fork process at IPL 9
IOLOCK10	Spinlock for executing a driver fork process at IPL 10
IOLOCK11	Spinlock for executing a driver fork process at IPL 11
MAILBOX	Spinlock for sending messages to the permanent system (OPCOM, JOBCTL, and so on) mailboxes
POOL	Spinlock on nonpaged pool database
PERFMON	Spinlock for I/O performance monitoring
INVALIDATE	Spinlock for system space translation buffer (TB) invalidation
HWCLK	Spinlock on hardware clock database, including the quadword containing the due time of the first timer queue entry (EXE$GQ_1ST_TIME) and the quadword containing the system time (EXE $GQ_SYSTIME)
MEGA	Spinlock for serializing access to fork-wait queue
EMB/MCHECK	Spinlock for allocating and releasing error-logging buffers and synchronizing certain machine error handling

For each spinlock in the system, SHOW SPINLOCKS provides the following information:

- Name of the spinlock (or device name for the device lock)
- Address of the spinlock data structure (SPL)
- The owning CPU's CPU ID
- IPL at which allocation of the lock is synchronized on a local processor
- Number of nested acquisitions of the spinlock by the processor owning the spinlock (Ownership Depth)
- Rank of the spinlock
- Timeout interval for spinlock acquisition (in terms of 10 milliseconds)
- Shared array (shared spinlock context block pointer)
- Number of processors waiting to obtain the spinlock

- Interlock (synchronization mutex used when full-checking multiprocessing is enabled)

The last two items (CPUs waiting and Interlock) are only displayed if full-checking multiprocessing is enabled.

SHOW SPINLOCKS/BRIEF produces a condensed display of this same information, excluding the share array and timeout interval.

SHOW SPINLOCKS/COUNTS displays only the Spin, Wait, and Acquire counts for each spinlock.

If the system under analysis was executing with full-checking multiprocessing enabled, SHOW SPINLOCKS/FULL adds to the spinlock display the Spin, Wait, and Acquire counts and the last sixteen PCs at which the lock was acquired or released. If applicable, SDA also displays the PC of the last release of multiple, nested acquisitions of the lock.

If no spinlock name, address, or index is given, then information is displayed for all applicable spinlocks.

Examples

1.
```
SDA> SHOW SPINLOCKS
System static spinlock structures
---------------------------------
EMB                                        Address        810AE300
Owner CPU ID         None                  IPL            0000001F
Ownership Depth    FFFFFFFF                Rank           00000000
Timeout Interval   000186A0                Share Array    00000000
CPUs Waiting       00000000                Interlock        Free

MCHECK                                     Address        810AE300
Owner CPU ID         None                  IPL            0000001F
Ownership Depth    FFFFFFFF                Rank           00000000
Timeout Interval   000186A0                Share Array    00000000
CPUs Waiting       00000000                Interlock        Free

MEGA                                       Address        810AE400
Owner CPU ID         None                  IPL            0000001F
Ownership Depth    FFFFFFFF                Rank           00000002
Timeout Interval   000186A0                Share Array    00000000
CPUs Waiting       00000000                Interlock        Free

HWCLK                                      Address        810AE500
Owner CPU ID         None                  IPL            00000016
Ownership Depth    FFFFFFFF                Rank           00000004
Timeout Interval   000186A0                Share Array    00000000
CPUs Waiting       00000000                Interlock        Free

    .
    .
    .

System dynamic spinlock structures
----------------------------------
QTV14$OPA                                  Address        8103FB00
Owner CPU ID         None                  DIPL           00000015
Ownership Depth    FFFFFFFF                Rank           FFFFFFFF
Timeout Interval   000186A0                Share Array    00000000
CPUs Waiting       00000000                Interlock        Free
```

```
QTV14$MBA                             Address        810AE900
Owner CPU ID          None           IPL            0000000B
Ownership Depth    FFFFFFFF           Rank           0000000C
Timeout Interval   000186A0           Share Array    00000000
CPUs Waiting       00000000           Interlock        Free

QTV14$NLA                             Address        810AE900
Owner CPU ID          None           IPL            0000000B
Ownership Depth    FFFFFFFF           Rank           0000000C
Timeout Interval   000186A0           Share Array    00000000
CPUs Waiting       00000000           Interlock        Free

QTV14$PKA                             Address        814AA100
Owner CPU ID          None           DIPL           00000015
Ownership Depth    FFFFFFFF           Rank           FFFFFFFF
Timeout Interval   000186A0           Share Array    00000000
CPUs Waiting       00000000           Interlock        Free
   .
   .
   .
```

This excerpt illustrates the default output of the SHOW SPINLOCKS command.

2.
```
SDA> SHOW SPINLOCKS/BRIEF
System static spinlock structures
---------------------------------

          Spinlock                           Owner     CPUs
Address     Name       IPL    Rank     Depth    CPU     Waiting Interlock
-------- ------------ ---- -------- -------- -------- -------- ---------
810AE300 EMB          001F 00000000 FFFFFFFF   None   00000000   Free
810AE300 MCHECK       001F 00000000 FFFFFFFF   None   00000000   Free
810AE400 MEGA         001F 00000002 FFFFFFFF   None   00000000   Free
810AE500 HWCLK        0016 00000004 FFFFFFFF   None   00000000   Free
810AE600 INVALIDATE   0015 00000006 FFFFFFFF   None   00000000   Free
810AE700 PERFMON      000F 00000008 FFFFFFFF   None   00000000   Free
810AE800 POOL         000B 0000000A FFFFFFFF   None   00000000   Free
810AE900 MAILBOX      000B 0000000C FFFFFFFF   None   00000000   Free
810AEA00 IOLOCK11     000B 0000000E FFFFFFFF   None   00000000   Free
810AEB00 IOLOCK10     000A 0000000F FFFFFFFF   None   00000000   Free
810AEC00 IOLOCK9      0009 00000010 FFFFFFFF   None   00000000   Free
810AED00 SCHED        0008 00000012 00000000 00000000 00000001   Free
810AEE00 MMG          0008 00000014 FFFFFFFF   None   00000000   Free
810AEF00 IO_MISC      0008 00000016 FFFFFFFF   None   00000000   Free
810AF000 PORT         0008 00000017 FFFFFFFF   None   00000000   Free
810AF100 TIMER        0008 00000018 00000000 00000000 00000000   Free
810AF200 TX_SYNCH     0008 00000019 FFFFFFFF   None   00000000   Free
810AF300 SCS          0008 0000001A FFFFFFFF   None   00000000   Free
810AF400 LCKMGR       0008 0000001B FFFFFFFF   None   00000000   Free
810AF500 FILSYS       0008 0000001C FFFFFFFF   None   00000000   Free
810AF600 QUEUEAST     0006 0000001E FFFFFFFF   None   00000000   Free


System dynamic spinlock structures
----------------------------------
```

```
             Device                               Owner     CPUs
Address       Name      DIPL   Rank     Depth    CPU     Waiting Interlock
-------- ------------ ---- -------- -------- -------- -------- ---------
8103FB00 QTV14$OPA    0015 FFFFFFFF FFFFFFFF   None   00000000   Free
810AE900 QTV14$MBA    000B 0000000C FFFFFFFF   None   00000000   Free
810AE900 QTV14$NLA    000B 0000000C FFFFFFFF   None   00000000   Free
814AA100 QTV14$PKA    0015 FFFFFFFF FFFFFFFF   None   00000000   Free

   .
   .
   .
```

This excerpt illustrates the condensed form of the display produced in the first example.

3.

```
SDA> SHOW SPINLOCKS/FULL SCHED
System static spinlock structures
---------------------------------
SCHED                                  Address        810AED00
Owner CPU ID       00000000            IPL            00000008
Ownership Depth    00000000            Rank           00000012
Timeout Interval   002DC6C0            Share Array    00000000
CPUs Waiting       00000001            Interlock        Free

Spins              00000000.0458E8DC   Busy waits     00252E8D
Acquires           00000000.01279BE0

Spinlock SPL$C_SCHED was last acquired or released from:
(Most recently)                 8004AD00 EXE$SWTIMER_FORK_C+00170
       .                        8004B1D4 EXE$SWTIMER_FORK_C+00644
       .                        8004AD00 EXE$SWTIMER_FORK_C+00170
       .                        8004B1D4 EXE$SWTIMER_FORK_C+00644
       .                        8004AD00 EXE$SWTIMER_FORK_C+00170
       .                        8004B1D4 EXE$SWTIMER_FORK_C+00644
       .                        8004AD00 EXE$SWTIMER_FORK_C+00170
       .                        8004B1D4 EXE$SWTIMER_FORK_C+00644
       .                        8004AD00 EXE$SWTIMER_FORK_C+00170
       .                        80136A2C SCH$INTERRUPT+0070C
       .                        80117580 SCH$IDLE_C+002A0
       .                        8004B230 EXE$SWTIMER_FORK_C+006A0
       .                        8004AFC4 EXE$SWTIMER_FORK_C+00434
       .                        80117360 SCH$IDLE_C+00080
       .                        8012E5F4 EXE$HIBER_INT_C+00074
(Least recently)                80132150 EXE$SCHDWK_C+00110

Last release of multiple acquisitions occurred at:
                                80262A54 EXE$CHECK_VERSION_C+009F4
```

This display shows the detailed information on the SCHED spinlock, including the PC history.

4.72. SHOW STACK

Displays the location and contents of the process stacks (of the SDA current process) and the system stack.

Format

SHOW STACK {range | /ALL | [/EXECUTIVE | /INTERRUPT | /KERNEL | /PHYSICAL | /

{/LONG | /QUAD (d)}

Parameters

range

Range of memory locations you want to display in stack format. You can express a range using the following syntax:

m:n	Range of addresses from *m* to *n*
m;n	Range of addresses starting at *m* and continuing for *n* bytes

Qualifiers

/ALL

Displays the locations and contents of the four process stacks for the SDA current process and the system stack.

/EXECUTIVE

Shows the executive stack for the SDA current process.

/INTERRUPT

Shows the system stack and is retained for compatibility with OpenVMS VAX. The interrupt stack does not exist on OpenVMS Alpha and OpenVMS Integrity servers.

/KERNEL

Shows the kernel stack for the SDA current process.

/LONG

Displays longword width stacks. If you do not specify this qualifier, SDA by default displays quadword width stacks.

/PHYSICAL

Treats the start and end addresses in the given range as physical addresses. This qualifier is only relevant when a range is specified. By default, SDA treats range addresses as virtual addresses.

/QUAD

Displays quadword width stacks. This is the default.

/SUMMARY

Displays a list of all known stack ranges and the current stack pointer for each range.

/SUPERVISOR

Shows the supervisor stack for the SDA current process.

/SYSTEM

Shows the system stack.

/USER

Shows the user stack for the SDA current process.

Description

The SHOW STACK command, by default, displays the stack that was in use when the system failed, or, in the analysis of a running system, the current operating stack. For a process that became the SDA current process as the result of a SET PROCESS command, the SHOW STACK command by default shows its current operating stack.

The various qualifiers to the command allow display of any of the four per-process stacks for the SDA current process, as well as the system stack for the SDA current CPU. In addition, any given range can be displayed in stack format.

You can define SDA process and CPU context by using the SET CPU, SHOW CPU, SHOW CRASH, SET PROCESS, and SHOW PROCESS commands as indicated in their command descriptions. A complete discussion of SDA context control appears in Section 2.5.

SDA provides the following information in each stack display:

Section	Contents
Identity of stack	SDA indicates whether the stack is a process stack (user, supervisor, executive, or kernel) or the system stack.
Stack pointer	The stack pointer identifies the top of the stack. The display indicates the stack pointer by the symbol **SP =>**.
Stack address	SDA lists all the addresses that the operating system has allocated to the stack. The stack addresses are listed in a column that increases in increments of 8 bytes (one quadword) unless you specify the /LONG qualifier, in which case addresses are listed in increments of 4 (one longword).
Stack contents	SDA lists the contents of the stack in a column to the right of the stack addresses.
Symbols	SDA attempts to display the contents of a location symbolically, using a symbol and an offset. If the stack is being displayed in quadword width and the location cannot be symbolized as a quadword, SDA attempts to symbolize the least significant longword and then the most significant longword. If the address cannot be symbolized, this column is left blank.
Canonical stack	When displaying the kernel stack of a noncurrent process in a crash dump, SDA identifies the stack locations used by the scheduler to store the register contents of the process.
Mechanism array Signal array Exception frame	When displaying the current stack in a FATALEXCPT, INVEXCEPTN, SSRVEXCEPT, or UNXSIGNAL bugcheck, SDA identifies the

Section	Contents
	stack locations used to store registers and other key data for these structures.

If a stack is empty, the display shows the following:

```
SP =>  (STACK IS EMPTY)
```

Examples

1.
```
SDA>  SHOW STACK
Current Operating Stack (SYSTEM):
                       FFFFFFFF.8244BD08  FFFFFFFF.800600FC  SCH
$REPORT_EVENT_C+000FC
                       FFFFFFFF.8244BD10  00000000.00000002
                       FFFFFFFF.8244BD18  00000000.00000005
                       FFFFFFFF.8244BD20  FFFFFFFF.8060C7C0
                SP =>  FFFFFFFF.8244BD28  FFFFFFFF.8244BEE8
                       FFFFFFFF.8244BD30  FFFFFFFF.80018960  EXE
$HWCLKINT_C+00260
                       FFFFFFFF.8244BD38  00000000.000001B8
                       FFFFFFFF.8244BD40  00000000.00000050
                       FFFFFFFF.8244BD48  00000000.00000210  UCB$N_RSID
+00002
                       FFFFFFFF.8244BD50  00000000.00000000
                       FFFFFFFF.8244BD58  00000000.00000000
                       FFFFFFFF.8244BD60  FFFFFFFF.804045D0  SCH
$GQ_IDLE_CPUS
                       FFFFFFFF.8244BD68  FFFFFFFF.8041A340  EXE
$GL_FKWAITFL+00020
                       FFFFFFFF.8244BD70  00000000.00000250  UCB
$T_MSGDATA+00034
                       FFFFFFFF.8244BD78  00000000.00000001
CHF$IS_MCH_ARGS        FFFFFFFF.8244BD80  00000000.0000002B
CHF$PH_MCH_FRAME       FFFFFFFF.8244BD88  FFFFFFFF.8244BFB0
CHF$IS_MCH_DEPTH       FFFFFFFF.8244BD90  80000000.FFFFFFFD  G
CHF$PH_MCH_DADDR       FFFFFFFF.8244BD98  00000000.00001600  CTL
$C_CLIDATASZ+00060
CHF$PH_MCH_ESF_ADDR    FFFFFFFF.8244BDA0  FFFFFFFF.8244BF40
CHF$PH_MCH_SIG_ADDR    FFFFFFFF.8244BDA8  FFFFFFFF.8244BEE8
CHF$IH_MCH_SAVR0       FFFFFFFF.8244BDB0  FFFFFFFF.8041FB00  SMP
$RELEASEL+00640
CHF$IH_MCH_SAVR1       FFFFFFFF.8244BDB8  00000000.00000000
CHF$IH_MCH_SAVR16      FFFFFFFF.8244BDC0  00000000.0000000D
CHF$IH_MCH_SAVR17      FFFFFFFF.8244BDC8  0000FFF0.00007E04
CHF$IH_MCH_SAVR18      FFFFFFFF.8244BDD0  00000000.00000000
CHF$IH_MCH_SAVR19      FFFFFFFF.8244BDD8  00000000.00000001
CHF$IH_MCH_SAVR20      FFFFFFFF.8244BDE0  00000000.00000000
CHF$IH_MCH_SAVR21      FFFFFFFF.8244BDE8  FFFFFFFF.805AE4B6  SISR+0006E
CHF$IH_MCH_SAVR22      FFFFFFFF.8244BDF0  00000000.00000001
CHF$IH_MCH_SAVR23      FFFFFFFF.8244BDF8  00000000.00000010
CHF$IH_MCH_SAVR24      FFFFFFFF.8244BE00  00000000.00000008
CHF$IH_MCH_SAVR25      FFFFFFFF.8244BE08  00000000.00000010
CHF$IH_MCH_SAVR26      FFFFFFFF.8244BE10  00000000.00000001
CHF$IH_MCH_SAVR27      FFFFFFFF.8244BE18  00000000.00000000
CHF$IH_MCH_SAVR28      FFFFFFFF.8244BE20  FFFFFFFF.804045D0  SCH
$GQ_IDLE_CPUS
```

```
                          FFFFFFFF.8244BE28  30000000.00000300  UCB
$L_PI_SVA
                          FFFFFFFF.8244BE30  FFFFFFFF.80040F6C  EXE
$REFLECT_C+00950
                          FFFFFFFF.8244BE38  18000000.00000300  UCB
$L_PI_SVA
                          FFFFFFFF.8244BE40  FFFFFFFF.804267A0  EXE
$CONTSIGNAL+00228
                          FFFFFFFF.8244BE48  00000000.7FFD00A8  PIO
$GW_IIOIMPA
                          FFFFFFFF.8244BE50  00000003.00000000
                          FFFFFFFF.8244BE58  FFFFFFFF.8003FC20  EXE
$CONNECT_SERVICES_C+00920
                          FFFFFFFF.8244BE60  FFFFFFFF.8041FB00  SMP
$RELEASEL+00640
                          FFFFFFFF.8244BE68  00000000.00000000
                          FFFFFFFF.8244BE70  FFFFFFFF.8042CD50  SCH
$WAIT_PROC+00060
                          FFFFFFFF.8244BE78  00000000.0000000D
                          FFFFFFFF.8244BE80  0000FFF0.00007E04
                          FFFFFFFF.8244BE88  00000000.00000000
                          FFFFFFFF.8244BE90  00000000.00000001
                          FFFFFFFF.8244BE98  00000000.00000000
                          FFFFFFFF.8244BEA0  FFFFFFFF.805AE4B6  SISR+0006E
                          FFFFFFFF.8244BEA8  00000000.00000001
                          FFFFFFFF.8244BEB0  00000000.00000010
                          FFFFFFFF.8244BEB8  00000000.00000008
                          FFFFFFFF.8244BEC0  00000000.00000010
                          FFFFFFFF.8244BEC8  00000000.00000001
                          FFFFFFFF.8244BED0  00000000.00000000
                          FFFFFFFF.8244BED8  FFFFFFFF.804045D0  SCH
$GQ_IDLE_CPUS
                          FFFFFFFF.8244BEE0  00000000.00000001
CHF$L_SIG_ARGS            FFFFFFFF.8244BEE8  0000000C.00000005
CHF$L_SIG_ARG1            FFFFFFFF.8244BEF0  FFFFFFFC.00010000  SYS
$K_VERSION_08
                          FFFFFFFF.8244BEF8  00000300.FFFFFFFC  UCB
$L_PI_SVA
                          FFFFFFFF.8244BF00  00000002.00000001
                          FFFFFFFF.8244BF08  00000000.0000000C
                          FFFFFFFF.8244BF10  00000000.00000000
                          FFFFFFFF.8244BF18  00000000.FFFFFFFC
                          FFFFFFFF.8244BF20  00000008.00000000
                          FFFFFFFF.8244BF28  00000000.00000001
                          FFFFFFFF.8244BF30  00000008.00000000
                          FFFFFFFF.8244BF38  00000000.FFFFFFFC
INTSTK$Q_R2               FFFFFFFF.8244BF40  FFFFFFFF.80404668  SCH
$GL_ACTIVE_PRIORITY
INTSTK$Q_R3               FFFFFFFF.8244BF48  FFFFFFFF.8042F280  SCH
$WAIT_KERNEL_MODE
INTSTK$Q_R4               FFFFFFFF.8244BF50  FFFFFFFF.80615F00
INTSTK$Q_R5               FFFFFFFF.8244BF58  00000000.00000000
INTSTK$Q_R6               FFFFFFFF.8244BF60  FFFFFFFF.805AE000
INTSTK$Q_R7               FFFFFFFF.8244BF68  00000000.00000000
INTSTK$Q_PC               FFFFFFFF.8244BF70  00000000.FFFFFFFC
INTSTK$Q_PS               FFFFFFFF.8244BF78  30000000.00000300  UCB
$L_PI_SVA
```

```
                       FFFFFFFF.8244BF80  FFFFFFFF.80404668  SCH
$GL_ACTIVE_PRIORITY
                       FFFFFFFF.8244BF88  00000000.7FFD00A8  PIO
$GW_IIOIMPA
                       FFFFFFFF.8244BF90  00000000.00000000
                       FFFFFFFF.8244BF98  FFFFFFFF.8042CD50  SCH
$WAIT_PROC+00060
                       FFFFFFFF.8244BFA0  00000000.00000044
                       FFFFFFFF.8244BFA8  FFFFFFFF.80403C30  SMP
$GL_FLAGS
Prev SP (8244BFB0) =>  FFFFFFFF.8244BFB0  FFFFFFFF.8042CD50  SCH
$WAIT_PROC+00060
                       FFFFFFFF.8244BFB8  00000000.00000000
                       FFFFFFFF.8244BFC0  FFFFFFFF.805EE040
                       FFFFFFFF.8244BFC8  FFFFFFFF.8006DB54
 PROCESS_MANAGEMENT_NPRO+0DB54
                       FFFFFFFF.8244BFD0  FFFFFFFF.80404668  SCH
$GL_ACTIVE_PRIORITY
                       FFFFFFFF.8244BFD8  FFFFFFFF.80615F00
                       FFFFFFFF.8244BFE0  FFFFFFFF.8041B220  SCH
$RESOURCE_WAIT
                       FFFFFFFF.8244BFE8  00000000.00000044
                       FFFFFFFF.8244BFF0  FFFFFFFF.80403C30  SMP
$GL_FLAGS
                       FFFFFFFF.8244BFF8  00000000.7FF95E00
```

The SHOW STACK command displays a system stack on an OpenVMS Alpha system. The data shown before the stack pointer may not be valid. The mechanism array, signal array, and exception frame symbols displayed on the left appear only for INVEXCEPTN, FATALEXCPT, UNXSIGNAL, and SSRVEXCEPT bugchecks.

2.

```
SDA> SHOW STACK/SUMMARY
Stack Ranges
------------

Memory Stack:

     Stack         Stack Base          Stack Limit        Stack Pointer
      Notes
  -----------   -----------------   -----------------
 -----------------   ---------
  Kernel        00000000.7FF44000   00000000.7FF2C000
 00000000.7FF43EB0   Current
  Executive     00000000.7FF68000   00000000.7FF58000
 00000000.7FF68000
  Supervisor    00000000.7FFAC000   00000000.7FFA8000
 00000000.7FFAC000
  User          00000000.3FFE2000   00000000.3FFCA000
 00000000.3FFE1FB0   KPstack
  User          00000000.3FFFE000   00000000.3FFE6000
 00000000.3FFFDDB0   KPstack
  User          00000000.7AC9E000   00000000.7AC9A000
 00000000.7AC9D830
  System        FFFFFFFF.86970000   FFFFFFFF.86958000
 FFFFFFFF.8696FFC0


Register Stack:
```

```
     Stack         Stack Base          Stack Limit        Stack Pointer
      Notes
   -----------   -----------------   -----------------
  -----------------   ---------
   Kernel        00000000.7FF12000   00000000.7FF2A000
  00000000.7FF12250   Current
   Executive     00000000.7FF46000   00000000.7FF56000
  00000000.7FF46000
   Supervisor    00000000.7FF6A000   00000000.7FF8A000
  00000000.7FF6A000
   User          000007FD.BFF3C000   000007FD.BFF54000
  000007FD.BFF3C160   KPstack
   User          000007FD.BFF58000   000007FD.BFF70000
  000007FD.BFF58108   KPstack
   User          000007FD.C0000000   000007FD.C0002000
  000007FD.C0000268
   System        FFFFF802.0F236000   FFFFF802.0F24E000
  FFFFF802.0F236278
```

This example shows the stack ranges for a process on an OpenVMS Integrity server system.

4.73. SHOW SUMMARY

Displays a list of all active processes and the values of the parameters used in swapping and scheduling these processes.

Format

SHOW SUMMARY [/IMAGE | /PAGES | /PROCESS_NAME=*process_name*

| /TOTALS | /THREAD | /USER=username]

Parameters

None.

Qualifiers

/IMAGE

Causes SDA to display, if possible, the name of the image being executed within each process.

/PAGES

Outputs an additional line for each process, displaying the number of process-private pages and the number of global pages in the process's working set.

/PROCESS_NAME=*process_name*

Displays only processes with the specified process name. You can use wildcards in *process_name*, in which case SDA displays all matching processes. The default action is for SDA to display data for all processes, regardless of process name.

/TOTALS

At the end of the list of active processes, SDA will output two sets of totals:

- The total number of process-private and global pages in the working sets of all processes. The totals for resident and non-resident processes are displayed separately.
- The total number of processes (or, if /THREADS was also specified, the total number of kernel threads) in each scheduling state. The totals for resident and non-resident processes or kernel threads are displayed separately.

/THREAD

Displays information on all the kernel threads associated with the current process.

/USER=*username*

Displays only the processes of the specified user. You can use wildcards in *username*, in which case SDA displays processes of all matching users. The default action is for SDA to display data for all processes, regardless of user name.

Description

The SHOW SUMMARY command displays the information in the table below for each active process in the system.

Table 4.25. Process Information in the SHOW SUMMARY Display

Column	Contents
Extended PID	The 32-bit number that uniquely identifies the process or thread.
Indx	Index of this process into the PCB array. When SHOW SUMMARY/THREAD is used, for all threads of a process other than the initial thread, displays the thread number.
Process name	Name assigned to the process. When SHOW SUMMARY/THREAD is used, this column is blank for all threads other than the initial thread.
Username	Name of the user who created the process. When SHOW SUMMARY/THREAD is used, this column is blank for all threads other than the initial thread.
State	Current state of the process. Table 4.26 shows the 14 states and their meanings.
Pri	Current scheduling priority of the process.
PCB/KTB	Address of the process control block or address of the kernel thread block.
PHD	Address of the process header. When SHOW SUMMARY/THREAD is used, this column is blank for all threads other than the initial thread.
Wkset	Number (in decimal) of pages currently in the process working set. When SHOW SUMMARY/THREAD is used, this column is blank for all threads other than the initial thread.

Table 4.26. Current State Information

State	Meaning
COM	Computable and resident in memory
COMO	Computable, but outswapped
CUR *nnn*	Currently executing on CPU ID *nnn*
CEF	Waiting for a common event flag
LEF	Waiting for a local event flag
LEFO	Outswapped and waiting for a local event flag
HIB	Hibernating
HIBO	Hibernating and outswapped
SUSP	Suspended
SUSPO	Suspended and outswapped
PFW	Waiting for a page that is not in memory (page-fault wait)
FPG	Waiting to add a page to its working set (free-page wait)
COLPG	Waiting for a page collision to be resolved (collided-page wait); this usually occurs when several processes cause page faults on the same shared page
MWAIT	Miscellaneous wait
RWxxx	Waiting for system resource *xxx*. These states represent additional interpretation by SDA of one of the 14 scheduler states.
TBS	Waiting "To Be Scheduled" by class scheduler. These states represent additional interpretation by SDA of one of the 14 scheduler states.
TBSO	Waiting "To Be Scheduled" and outswapped. These states represent additional interpretation by SDA of one of the 14 scheduler states.
TBSP	"To Be Scheduled" state is pending. These states represent additional interpretation by SDA of one of the 14 scheduler states.
TBSPO	"To Be Scheduled" state is pending and outswapped. These states represent additional interpretation by SDA of one of the 14 scheduler states.
WTBYT	Waiting for BYTCNT quota. These states represent additional interpretation by SDA of one of the 14 scheduler states.
WTTQE	Waiting for TQCNT quota. These states represent additional interpretation by SDA of one of the 14 scheduler states.

Examples

1.
```
SDA>  SHOW SUMMARY
Current process summary
-----------------------
 Extended Indx Process name    Username    State   Pri PCB/KTB    PHD
 Wkset
-- PID -- ---- --------------- ----------- ------- --- -------- --------
 ------
 00000041 0001 SWAPPER                      HIB     16 80C641D0 80C63E00
   0
 00000045 0005 IPCACP          SYSTEM       HIB     10 80DC0780 81266000
  39
 00000046 0006 ERRFMT          SYSTEM       HIB      8 80DC2240 8126C000
  57
 00000047 0007 OPCOM           SYSTEM       HIB      8 80DC3340 81272000
  31
 00000048 0008 AUDIT_SERVER    AUDIT$SERVER HIB     10 80D61280 81278000
 152
 00000049 0009 JOB_CONTROL     SYSTEM       HIB     10 80D620C0 8127E000
  50
 0000004A 000A SECURITY_SERVER SYSTEM       HIB     10 80DC58C0 81284000
 253
 0000004B 000B TP_SERVER       SYSTEM       HIB     10 80DC8900 8128A000
  75
 0000004C 000C NETACP          DECNET       HIB     10 80DBFE00 8125A000
  78
 0000004D 000D EVL             DECNET       HIB      6 80DCA080 81290000
  76
 0000004E 000E REMACP          SYSTEM       HIB      8 80DE4E00 81296000
  14
 00000050 0010 DECW$SERVER_0   SYSTEM       HIB      8 80DEF940 812A2000
 739
 00000051 0011 DECW$LOGINOUT   <login>      LEF      4 80DF0F00 812A8000
 273
 00000052 0012 SYSTEM          SYSTEM       LEF      9 80D772C0 81260000
  75
```

The SHOW SUMMARY command describes all active processes in the system at the time of the system failure. Note that there was no process in the CUR state at the time of the failure.

2.
```
SDA>  SHOW SUMMARY /IMAGE/PAGES/THREADS/TOTALS
Current process summary
-----------------------
Extended  Indx Process name    Username    State   Pri PCB/KTB    PHD
 Wkset
-- PID -- ---- --------------- ----------- ------- --- -------- --------
 ------
00000201 0001  SWAPPER         SYSTEM        HIB    16 8230CD48 8230C000
    4
          Process pages:      4      Global pages:      0
.
.
.
00000212 0012  ACME_SERVER     SYSTEM         HIB    8 83673540 87740000
  553
         Process pages:     505      Global pages:     48
```

```
         $30$DKB400:[SYS0.SYSCOMMON.][SYSEXE]ACME_SERVER.EXE
00000412    1                               HIB    10 83684DC0
.
.
.
00000224 0024  LATACP          SYSTEM        HIB    14 83760BC0 8775C000
  170
         Process pages:     170      Global pages:      0
         $30$DKB400:[SYS0.SYSCOMMON.][SYSEXE]LATACP.EXE
               Total Pages                  Process          Global
          ---------------------          -------------
 -------------
          Resident Processes                      4490
 842
          Nonresident Processes                      0
 0

                 Scheduling   Resident    Nonresident
                   State       Threads      Threads       Total
                  -------    -----------  -----------  -----------
                  LEF                  1            0            1
                  HIB                 20            0           20
                  CUR                  1            0            1
                  -------    -----------  -----------  -----------
                  Total               22            0           22
```

This example shows the output from SHOW SUMMARY when all the qualifiers (/image /pages / threads /totals) that display additional data are used.

4.74. SHOW SWIS (Integrity servers Only)

Displays the SWIS (SoftWare Interrupt Services) data structure addresses or the SWIS ring buffer.

Format

SHOW SWIS [/RING_BUFFER [/CPU=(m,n,...)]]

Qualifiers

/CPU=(m,n,...)

When used with /RING_BUFFER, displays only the entries for the specified CPUs. If you specify only one CPU, you can omit the parentheses.

/RING_BUFFER

Displays the SWIS ring buffer (also known as the SWIS log), with the most recent entry first, and assigns meaning to certain values, such as trap type and system service invoked. For best results, execute READ/EXEC or READ/IMAGE SYS$PUBLIC_VECTORS first so that the system service codes are recognized.

Examples

```
SDA> read/exec
```

```
SDA> define ssentry 8692B8F0
SDA> define intstk 8692B9F0
SDA> show swis/ring_buffer

SWIS ring buffer for all CPUs
-----------------------------

                   8192. entries: Most recent first

 Clock    Data 1    Data 2        Data 3       CPU  Ident   *** See below.
 ***
-------- --------  --------  ----------------- --- --------
2CEDAD3C 82D66400a 83814080  FFFFFFFF.86B04000  00 SWPCXout
2CEDA929 82D66400a 83814080  FFFFF802.0EE370A8  00 SWPCTXin
2CED9F16 0000001F  0000001F  FFFFFFFF.8046C270a 00 RaisIPL
2CED928F 8692B8F0a 00000000  FFFFFFFF.8046B760b 00 SSSwRet
2CED8FED 8692B8E0  00000000  0000002C.DC0351F2  00 RetKSrvc
2CED8B2E 8692B8F0a 06900660b FFFFFFFF.8046B760c 00 EntKSrvc
                                                   EntKSrvc
2CED72C1 8692B9F0a 00000000  FFFFFFFF.8692BFC0b 00 ExcpDsp2
2CED70B4 8692B9F0a 00000041b FFFFFFFF.80322F50c 00 ExcpDisp
                                                   ExcpDisp
2CED6E84 00000001  00000000  00000000.0001001Fa 00 GetDpth
2CED6822 00000016  0000001F  FFFFFFFF.80322EB0a 00 RSetIPL
2CED62F0 8692BCF0a 00000003  FFFFFFFF.8066C000b 00 IPDisp



                                 Symbolized value 'a'     Symbolized value
 'b' & 'c'
                             ---------------------------
 -----------------------------------

                             BUG$GQ_HWPCB
                             BUG$GQ_HWPCB
                             EXE$BUGCHECK_SWAPPED_C+000E0
                             SSENTRY                      EXE
$BUGCHECK_CONTINUE_C+003C0

                             SSENTRY                      SYS$RPCC_64_C
                                                          EXE
$BUGCHECK_CONTINUE_C+003C0
                             INTSTK                       INTSTK+005D
                             INTSTK                       Bugcheck
 Breakpoint Trap

 SYSTEM_SYNCHRONIZATION_MIN+42F50
                             LNM$C_DEL_OVERLAY+0001B
                             SYSTEM_SYNCHRONIZATION_MIN+42EB0
                             INTSTK+00300                 SCH$IDLE_C+00290
                                     .
                                     .
                                     .
```

The SHOW SWIS example displays the most recent entries in the SWIS log at the time of a system crash. Note the a, b, c alongside the data values. These indicate which column contains the symbolization for the value. 'a' is always in the first column; 'b' is in the second column, and 'c' is also in the second column on the next line. If some or all data values cannot be symbolized, the columns are left blank or there is no continuation line.

4.75. SHOW SYMBOL

Displays the hexadecimal value of a symbol and, if the value is equal to an address location, the contents of that location.

Format

SHOW SYMBOL [/ALL [/ALPHA|/VALUE]] [/BASE_ADDRESS=*n*] symbol-name

Parameter

symbol-name

Name of the symbol to be displayed. You must provide a **symbol-name**, unless you specify the /ALL qualifier. Symbols that include lowercase letters must be enclosed in quotation marks. **symbol-name** may include wildcards unless /ALL is also specified.

Qualifiers

/ALL

Displays information on all symbols whose names begin with the characters specified in **symbol-name**. If no symbol name is given, all symbols are displayed.

/ALPHA

When used with the /ALL qualifier, displays the symbols sorted only in alphabetical order. The default is to display the symbols twice, sorted alphabetically and then by value.

When used with a wildcard symbol name, displays the symbols in alphabetical order. This is the default action.

/BASE_ADDRESS=*n*

The given address is added to the value of each matching symbol to construct the address used when obtaining the contents of the symbol's location. By default, SDA uses the actual value of the symbol as the address to be used. See the description of SHOW SYMBOL for more information.

/VALUE

When used with the /ALL qualifier, displays the symbols sorted only in value order. The default is to display the symbols twice, sorted alphabetically and then by value.

When used with a wildcard symbol name, displays the symbols in value order.

Description

The SHOW SYMBOL command with the /ALL qualifier outputs all symbols whose names begin with the characters specified in **symbol-name** in both alphabetical order and in value order. If no **symbol-name** is given, all symbols are output.

The SHOW SYMBOL/ALL command is useful for determining the values of symbols that belong to a symbol set, as illustrated in the second example below.

The SHOW SYMBOL command without the /ALL qualifier allows for standard wildcards in the **symbol-name** parameter. By default, matching symbols are displayed only in alphabetical order. If you specify SHOW SYMBOL/VALUE, then matching symbols are output sorted by value. If you specify SHOW SYMBOL/ALPHA/VALUE, then matching symbols are displayed twice, sorted alphabetically and then by value.

The SHOW SYMBOL command without the /ALL qualifier and no wildcards in the **symbol-name** parameter outputs the value associated with the given symbol.

When displaying any symbol value, SDA also treats the value as an address (having added the value from /BASE_ADDRESS if specified) and attempts to obtain the contents of the location. If successful, the contents are also displayed.

Examples

1.
```
SDA>  SHOW SYMBOL G
G = FFFFFFFF.80000000 :  6BFA8001.201F0104
```

   The SHOW SYMBOL command evaluates the symbol G as FFFFFFFF.8000000016 and displays the contents of address FFFFFFFF.8000000016 as 6BFA8001.201F010416.

2.
```
SDA>  SHOW SYMBOL/ALL BUG
Symbols sorted by name
----------------------
BUG$L_BUGCHK_FLAGS           = FFFFFFFF.804031E8 : 00000000.00000001
BUG$L_FATAL_SPSAV            = FFFFFFFF.804031F0 : 00000000.00000001
BUG$REBOOT                   = FFFFFFFF.8042E320 : 00000000.00001808
BUG$REBOOT_C                 = FFFFFFFF.8004F4D0 : 47FB041D.47FD0600
   .
   .
   .
Symbols sorted by value
----------------------
BUG$REBOOT_C                 = FFFFFFFF.8004F4D0 :47FB041D.47FD0600
BUG$L_BUGCHK_FLAGS           = FFFFFFFF.804031E8 :00000000.00000001
BUG$L_FATAL_SPSAV            = FFFFFFFF.804031F0 :00000000.00000001
BUG$REBOOT                   = FFFFFFFF.8042E320 :00000000.00001808
   .
   .
   .
```

   This example shows the display produced by the SHOW SYMBOL/ALL command. SDA searches its symbol table for all symbols that begin with the string "BUG" and displays the symbols and their values. Although certain values equate to memory addresses, it is doubtful that the contents of those addresses are actually relevant to the symbol definitions in this instance.

4.76. SHOW TQE

Displays the entries in the timer queue. The default output is a summary display of all timer queue entries (TQEs) in chronological order.

Format

SHOW TQE [/ADDRESS=*n*] [/ALL] [/BACKLINK] [/PID=*n*] [/ROUTINE=*n*]

Parameters

None.

Qualifiers

/ADDRESS=*n*

Outputs a detailed display of the TQE at the specified address.

/ALL

Outputs a detailed display of all TQEs.

/BACKLINK

Outputs the display of TQEs, either detailed (/ALL) or brief (default), in reverse order, starting at the entry furthest into the future.

/PID=*n*

Limits the display to the TQEs that affect the process with the specified internal PID. The PID format required is the entire internal PID, including both the process index and the sequence number, and not the extended PID or process index alone, as used elsewhere in SDA. You can also display TQEs specific to a process using SHOW PROCESS/TQE.

/ROUTINE=*n*

Limits the display to the TQEs for which the specified address is the fork PC.

Description

The SHOW TQE command allows the timer queue to be displayed. By default a summary display of all TQEs is output in chronological order, beginning with the next entry to become current.

The /ADDRESS, /PID, and /ROUTINE qualifiers are mutually exclusive. The /ADDRESS and /BACKLINK qualifiers are mutually exclusive.

In the summary display, the TQE type is given as a six-character code, as shown in the table below.

Table 4.27. TQE Types in Summary TQE Display

Column	Symbol	Meaning
1	T	Timer ($SETIMR) entry
	S	System subroutine entry
	W	Scheduled wakeup ($SCHDWK) entry
2	S	Single-shot entry
	R	Repeated entry
3	D	Delta time
	A	Absolute time

Column	Symbol	Meaning
4	C	CPU time
	--	Elapsed time
5	E	Extended format (64-bit TQE)
	--	32-bit TQE
6	N	TQE not to be deallocated at AST completion
	--	TQE to be deallocated at AST completion

Examples

1. `SDA> SHOW TQE`

```
        Timer queue entries
        -------------------

        System time:    15-NOV-2001 15:09:06.92
        First TQE time: 15-NOV-2001 15:09:06.92

  TQE                                                               PID/
address                  Expiration Time                 Type     routine
--------   -----------------------------------------   ------    --------
815AB8C0   00A0516F.EF279B0F 15-NOV-2001 15:09:06.92   SSD---    835FCC48
   TCPIP$INTERNET_SERVICES+9EC48
812CB3C0   00A0516F.EF279B0F 15-NOV-2001 15:09:06.92   SRD---    812CCEC8
   SYS$PPPDRIVER+0EEC8
81514140   00A0516F.EF29FD5F 15-NOV-2001 15:09:06.94   TSD---    0001000F
   SECUURITY_SERVER
815C8040   00A0516F.EF2B2E87 15-NOV-2001 15:09:06.95   SRD---    81361BA0
   SYS$LTDRIVER+31BA0
8148CF98   00A0516F.EF2C52AD 15-NOV-2001 15:09:06.95   SRD---    812786B0
   LAN$CREATE_LAN+000B0
81318290   00A0516F.EF2FDC84 15-NOV-2001 15:09:06.98   SRD---    813187B8
   PWIPDRIVER+047B8
814FB080   00A0516F.EF3238D0 15-NOV-2001 15:09:06.99   TSD---    0001000F
   SECURITY_SERVER
8140FF40   00A0516F.EF32851A 15-NOV-2001 15:09:06.99   TSD---    0001000F
   SECURITY_SERVER
...

81503100   00A05177.0AED8000 15-NOV-2001 16:00:00.00   TSA---    0001000C
   JOB_CONTROL
815030C0   00A0C160.63CD14D9  7-APR-2002 02:00:00.91   TSA---    0001000C
   JOB_CONTROL
```

   This example shows the summary display of all TQEs.

2. `SDA> SHOW TQE/ADDRESS=898DA1A8`

```
Timer queue entry 898DA1A8
--------------------------
TQE address:                      898DA1A8   Type:
 00000005  SYSTEM_SUBROUTINE REPEAT
```

```
   Requestor process ID:         00000000   Access mode:
00000000

   Expiration time:     00A97229.C9E5FF60    6-JAN-2010 07:24:47.06
+20000
   Delta repeat time:   00000000.00030D40             0 00:00:00.02

   Fork PC:                      88520460   SYS$GHDRIVER+50260
   Fork R3:             898D9540.00000000
   Fork R4:             00000000.00000000
```

This example shows the detailed display for a single TQE.

4.77. SHOW TQEIDX

Displays the contents of the timer queue entry index (TQEIDX) structures. The default display is a summary of all TQEIDX structures.

Format

SHOW TQEIDX [/ADDRESS=address | /ALL]

Parameters

None.

Qualifiers

/ADDRESS=address

Causes SDA to output a detailed display of the contents of the TQEIDX at the specified address. Cannot be specified with /ALL.

/ALL

Causes SDA to output a detailed display of the contents of all TQEIDX structures. Cannot be specified with /ADDRESS.

Description

The SHOW TQEIDX command allows the timer queue entry index structures to be displayed. The default display is a summary of all TQEIDX structures. The /ADDRESS and /ALL qualifiers are mutually exclusive.

Examples

1.
```
SDA> show tqeidx

Timer queue index buckets
-------------------------

Time index buckets
------------------
```

```
 TQEIDX                                  Free
 address     Level       Parent       count        Maximum key
--------    --------    --------    --------    -----------------
872B6700    00000001    00000000    0000003C    FFFFFFFF.FFFFFFFF
875ED640    00000000    872B6700    00000005    00A39404.827C01CF
87312E80    00000000    872B6700    00000032    00A39A11.9DABF957
8726A300    00000000    872B6700    0000003D    FFFFFFFF.FFFFFFFF

Time index overflow list is empty

ID index buckets
----------------

 TQEIDX                                  Free
 address     Level       Parent       count        Maximum key
--------    --------    --------    --------    -----------------
872AF900    00000001    00000000    0000003D    FFFFFFFF.FFFFFFFF
86C29C80    00000000    872AF900    00000016    0002C000.83374030
872FD780    00000000    872AF900    0000001F    FFFFFFFF.FFFFFFFF

ID index overflow list is empty
```

This example shows the summary TQEIDX display.

4.78. SHOW UNWIND (Integrity servers Only)

Displays the master unwind table for system space (by default) or for a specified target.

Format

SHOW UNWIND [address | /ALL | /IMAGE=name]

Parameters

address

Address of the program counter (PC) (IIP) whose unwind data is to be displayed. The address can be in system space or process space.

Qualifiers

/ALL

Displays the details of every system unwind descriptor.

/IMAGE

Displays the details of every unwind descriptor for the specified system images (wildcards allowed).

Description

Displays the master unwind table for system space. This is the default. If /ALL is given, the details of every system unwind descriptor are displayed. If an address is given, the unwind descriptor for the program counter (PC) (IIP) is located and displayed. The address can be in system space or process space.

Also see SHOW PROCESS/UNWIND.

Examples

1. `SDA> show unwind`

```
   System Unwind Table
   -------------------

    Page Header VA          Entries           Region ID
   -----------------   -----------------  -----------------
   FFFFFFFF.7FFFC000   00000000.00000018  00000000.00000000
   FFFFFFFF.7FFFA000   00000000.00000018  00000000.00000000
   FFFFFFFF.7FFF8000   00000000.00000018  00000000.00000000
   FFFFFFFF.7FF44000   00000000.00000018  00000000.00000000
   FFFFFFFF.7F7A0000   00000000.00000018  00000000.00000000
   FFFFFFFF.7F56C000   00000000.00000006  00000000.00000000

   Image name                                 Code Base VA        UT Base
 VA      Unwind Info Base   Flags
                 MUTE VA          Mode       Code End VA          UT
 Size              GP
   -------------------------------------  -----------------
 -----------------  -----------------  ----------

   EXCEPTION_MON                            FFFFFFFF.80480000
 FFFFFFFF.82D53800  FFFFFFFF.82D53800
            FFFFFFFF.7FFFC020   00000000  FFFFFFFF.8055CDCF
 00000000.00002AD8  FFFFFFFF.82F6F400

   EXCEPTION_MON                            FFFFFFFF.86AB0000
 FFFFFFFF.86AB4000  FFFFFFFF.86AB4000  Obsolete
            FFFFFFFF.7FFFC170   00000000  FFFFFFFF.86AB207F
 00000000.00000060  FFFFFFFF.82F6F400

   IO_ROUTINES_MON                          FFFFFFFF.80560000
 FFFFFFFF.82D78600  FFFFFFFF.82D78600
            FFFFFFFF.7FFFC2C0   00000000  FFFFFFFF.8064A7AF
 00000000.00004B00  FFFFFFFF.82FA2800

   IO_ROUTINES_MON                          FFFFFFFF.86AB6000
 FFFFFFFF.86AB8000  FFFFFFFF.86AB8000  Obsolete
            FFFFFFFF.7FFFC410   00000000  FFFFFFFF.86AB73AF
 00000000.000000A8  FFFFFFFF.82FA2800

   SYSDEVICE                                FFFFFFFF.80650000
 FFFFFFFF.82DA7A00  FFFFFFFF.82DA7A00
            FFFFFFFF.7FFFC560   00000000  FFFFFFFF.8065E90F
 00000000.00000240  FFFFFFFF.82FA9400
```

   This example shows the master unwind table for the system, the pages that are being read and the images whose unwind data is present.

2. `SDA> show unwind 00000000.00020130`

```
Unwind Table Entry for 00000000.00020130
---------------------------------------
Image name: X

MUTE VA:            000007FD.BFFC62C0   Mode:
 00000001
Code Base VA:       00000000.00020000   Code End VA:
 00000000.000201FF
UT Base VA:         00000000.00030000   UT Size:
 00000000.00000030
Unwind Info Base:   00000000.00030000   GP:
 00000000.00240000
Flags:                           0000


Unwind Descriptor:  00000000.00030090   PC range =
 00000000.00020130:00000000.000201DF

 Unwind Descriptor flags:    No handler present, No OSSD present

 Unwind descriptor records:  R1 Region Header: Short Prologue, PC range
 = 00000000.00020130:00000000.00020131
                                P7: MEM_STACK_V PC=00000000.00020131
                                P3: PSP_GR      R41
                                P3: PFS_GR      R40

                             R1 Region Header: Short Body, PC range =
 00000000.00020132:00000000.000201B0
                                B1: Short Label_State LABEL=00000001
                                B2: Short Epilogue ECOUNT=00000000
 PC=00000000.000201A0

                             R1 Region Header: Short Body, PC range =
 00000000.000201B1:00000000.000201D1
                                B1: Short Copy_State LABEL=00000001
```

This example shows the unwind data for PC 20130, giving image name, location of unwind data and all unwind descriptors. For an explanation of the unwind descriptors, see the appendixes in the *VSI OpenVMS Calling Standard*.

4.79. SHOW VHPT (Integrity servers Only)

Displays data from the Virtual Hash Page Table.

Format

SHOW VHPT [/CPU = {*n*|*} [/ALL] [*range*]]

Parameters

range

The entry or range of entries to be displayed, expressed using the following syntax:

m	Displays the VHPT entry *m*
m:n	Displays the VHPT entries from *m* to *n*
m;n	Displays *n* VHPT entries starting at *m*

A range can be provided only if a single CPU is specified with the /CPU qualifier.

Qualifiers

/CPU = {*n*|*}

Indicates that the detailed contents of the VHPT for one or all CPUs is to be displayed. The default action is for a summary of VHPT information to be displayed.

/ALL

Displays all VHPTs for the specified CPUs. Without /ALL, only entries that have a valid tag are displayed.

Description

Displays contents of the Virtual Hash Page Table on an OpenVMS Integrity server system. By default, a summary of the VHPT entries is displayed. If CPUs are specified, details of individual VHPT entries are displayed for the CPUs. If a single CPU is specified, specific VHPT entries for that CPU are displayed.

In the detailed display, the columns are as follows:

Table 4.28. VHPT Fields

Column	Contents
Entry	VHPT Entry Number
Bits	One or more of the following flags: P---Present A---Accessed D---Dirty E---Exception deferral I---Tag invalid (only seen if /ALL is specified)
MA	One of the following memory attributes: WB---Write Back UC---Uncacheable UCE---Uncacheable Exported WC---Write Coalescing NaT---NaTPage
AR/PL	The access rights and privilege level of the page. Consists of a number (0-7) and a letter (K, E, S,

Column	Contents
	or U) that determines access to the page in each mode.
KESU	The access allowed to the page in each mode. This is an interpretation of the AR/PL values in the previous column. For an explanation of the access codes, refer to Section 2.8.
Physical address	The starting physical address for this VHPT entry.
Page size	The size of the page represented by this VHPT entry. Page sizes for VHPT entries range from 4KB to 4GB. Not all possible pages sizes are used by OpenVMS for Integrity servers.
Tag	The translation tag for the VHPT entry.
Quad4	Information recorded by OpenVMS for Integrity servers for debugging purposes. The contents of this quadword are subject to change.

Examples

1.
```
SDA>  SHOW VHPT
Virtual Hash Page Table Summary
-------------------------------

CPU 0000
--------

VHPT address:                     FFFFFFFF.7FFF0000
Translation registers:                     00000002
VHPT page size:                            0000000E

CPU 0001
--------

VHPT address:                     FFFFFFFF.7FF88000
Translation registers:                     00000002
VHPT page size:                            0000000E
```

This example shows the default behavior of the SHOW VHPT command.

2.
```
SDA>  SHOW VHPT /CPU=0
Virtual Hash Page Table for CPU 0000
------------------------------------

VHPT address:                FFFFFFFF.7FFF0000
Translation registers:                00000002
VHPT page size:                       0000000E

                                                Page
 Entry   Bits MA AR/PL KESU Physical Address  Size        Tag
   Quad4
-------- ---- -- ----- ---- ----------------- ---- -----------------
 -----------------
00000000 PADE WB  4 E  wr-- 00000000.09806000 4MB  0000FE7F.FFFC2C03
 FF000003.85806004
```

```
00000001 PADE WB  4 E  wr-- 00000000.09804000 4MB  0000FE7F.FFFC2C02
 FF000003.85805184
00000002 PADE WB  4 E  wr-- 00000000.09802000 4MB  0000FE7F.FFFC2C01
 FF000003.85803184
00000003 PADE WB  4 E  wr-- 00000000.09800000 4MB  0000FE7F.FFFC2C00
 FF000003.858008C4
00000004 PADE WB  2 K  w--- 00000000.03726000 8KB  0000FE7F.FFFA0007
 FF000003.4000FAB8
00000005 PADE WB  2 K  w--- 00000000.03724000 8KB  0000FE7F.FFFA0006
 FF000003.4000C478
00000006 PADE WB  2 K  w--- 00000000.03722000 8KB  0000FE7F.FFFA0005
 FF000003.4000A988
00000007 PADE WB  2 K  w--- 00000000.071DA000 8KB  0000FE7F.FFFA1804
 FF000003.43008000
00000008 PADE WB  2 K  w--- 00000000.0372E000 8KB  0000FE7F.FFFA000B
 FF000003.40017C30
00000009 PADE WB  4 E  wr-- 00000000.03356000 8KB  0000FE7F.FFFBFC0A
 FF000003.7F814CCC
0000000E PADE WB  3 U  WWWW 00000000.10E78000 8KB  7FFD7C80.000002F7
 00FFFAF9.005EE004
00000012 PADE WB  4 E  wr-- 00000000.03348000 8KB  0000FE7F.FFFBFC11
 FF000003.7F823B28
...
000003FD PADE WB  5 U  WRRR 00000000.00004000 8KB  0000FE7F.FFFBFFFE
 FF000003.7FFFC020
000003FE PADE WB  5 U  WRRR 00000000.00078000 8KB  0000FE7F.FFFBFFFD
 FF000003.7FFFA020
000003FF PADE WB  2 K  w--- 00000000.0717C000 8KB  0000FE7F.FFFA17FC
 FF000003.42FF8000
```

This example shows the detailed contents of all the VHPT entries for CPU 0 that have a valid tag.

4.80. SHOW WORKING_SET_LIST

Displays the system working set list without changing the current process context. You can specify SHOW WORKING_SET_LIST or SHOW WSL. The two commands are equivalent.

Format

SHOW WORKING_SET_LIST [/ALL (d) | /ENTRY=*n* | /GPT

| /LOCKED | /MODIFIED | /SYSTEM]

SHOW WSL [/ALL (d) | /ENTRY=*n* | /GPT

| /LOCKED | /MODIFIED | /SYSTEM]

Parameters

None.

Qualifiers

/ALL

Displays all working set list entries. This is the default.

/ENTRY=*n*

Displays a specific working set entry, where n is the working set list index (WSLX) of the entry of interest.

/GPT

Displays working set list entries only for global page table pages.

/LOCKED

Displays working set list entries only for pageable system pages that are locked in the system working set.

/MODIFIED

Displays working set list entries only for pageable system pages that are marked modified.

/SYSTEM

Displays working set list entries only for pageable system pages.

Description

The SHOW WORKING_SET_LIST command displays the contents of requested entries in the system working set list. The SHOW WORKING_SET_LIST command is equivalent to the SHOW PROCESS/SYSTEM/WORKING_SET_LIST command, but the SDA current process context returns to the prior process upon completion. See the SHOW PROCESS command and Table 4.17 for more information.

4.81. SHOW WSL

See SHOW WORKING_SET_LIST.

4.82. SPAWN

Creates a subprocess of the process currently running SDA, copying the context of the current process to the subprocess and, optionally, executing a specified command within the subprocess.

Format

```
SPAWN [/qualifier[,...]] [command]
```

Parameter

command

Name of the command that you want the subprocess to execute.

Qualifiers

/INPUT=*filespec*

Specifies an input file containing one or more command strings to be executed by the spawned subprocess. If you specify a command string with an input file, the command string is processed before the commands in the input file. When processing is complete, the subprocess is terminated.

/NOLOGICAL_NAMES

Specifies that the logical names of the parent process are not to be copied to the subprocess. The default behavior is that the logical names of the parent process are copied to the subprocess.

/NOSYMBOLS

Specifies that the DCL global and local symbols of the parent process are not to be passed to the subprocess. The default behavior is that these symbols are passed to the subprocess.

/NOTIFY

Specifies that a message is to be broadcast to SYS$OUTPUT when the subprocess either completes processing or aborts. The default behavior is that such a message is not sent to SYS$OUTPUT.

/NOWAIT

Specifies that the system is not to wait until the subprocess is completed before allowing more commands to be entered. This qualifier allows you to input new SDA commands while the spawned subprocess is running. If you specify /NOWAIT, use /OUTPUT to direct the output of the subprocess to a file to prevent more than one process from simultaneously using your terminal.

The default behavior is that the system waits until the subprocess is completed before allowing more SDA commands to be entered.

/OUTPUT=*filespec*

Specifies an output file to which the results of the SPAWN operation are written. To prevent output from the spawned subprocess from being displayed while you are specifying new commands, specify an output other than SYS$OUTPUT whenever you specify /NOWAIT. If you omit the /OUTPUT qualifier, output is written to the current SYS$OUTPUT device.

/PROCESS=*process-name*

Specifies the name of the subprocess to be created. The default name of the subprocess is *USERNAME_n*, where *USERNAME* is the user name of the parent process. The variable *n* represents the subprocess number.

Examples

1.
```
SDA>  SPAWN
$  MAIL
    .
    .
    .
$  DIR
    .
    .
    .
$  LO
   Process SYSTEM_1 logged out at 5-JAN-1993 15:42:23.59
SDA>
```

This example uses the SPAWN command to create a subprocess that issues DCL commands to invoke the Mail utility. The subprocess then lists the contents of a directory before logging out to return to the parent process executing SDA.

4.83. UNDEFINE

Removes the specified symbol from SDA's symbol table.

Format

`UNDEFINE symbol`

Parameter

symbol

The name of the symbol to be deleted from SDA's symbol table. A symbol name is required. Symbols that include lowercase letters must be enclosed in quotation marks.

Qualifiers

None.

4.84. VALIDATE PFN_LIST

Validates that the page counts on lists are correct.

Format

`VALIDATE PFN_LIST {/ALL (d) | [/BAD | /FREE | /MODIFIED | /PRIVATE | /UNTESTED | /`

Parameters

None.

Qualifiers

/ALL

Validates all the PFN lists: bad, free, modified, untested, zeroed free pages, and private pages.

/BAD

Validates the bad page list.

/FREE

Validates the free page list.

/MODIFIED

Validates the modified page list.

/PRIVATE

Validates all private page lists.

/UNTESTED

Validates the untested page list that was set up for deferred memory testing.

/ZERO

Validates the zeroed free page list.

Description

The VALIDATE PFN_LIST command validates the specified PFN list by counting the number of entries in the list and comparing that to the running count of entries for each list maintained by the system.

Examples

1. ```
   SDA> VALIDATE PFN_LIST
   Free page list validated: 1433 pages
           (excluding zeroed free page list with expected size 103 pages)
   Zeroed free page list validated: 103 pages
   Modified page list validated: 55 pages
   Bad page list validated: 0 pages
   Untested page list validated: 0 pages
   Private page list at 81486340 validated: 2 pages
   ```

   This example shows the default behavior of VALIDATE PFN_LIST, checking all lists.

2. ```
   SDA> VALIDATE PFN_LIST/FREE
   Free page list validated: 1433 pages
           (excluding zeroed free page list with expected size 103 pages)
   ```

   This example shows the validation of only the free list.

4.85. VALIDATE POOL

Checks all free pool packets for POOLCHECK-style corruption, using the same algorithm as the system pool allocation routines when generating a POOLCHECK bugcheck and system dump.

Format

VALIDATE POOL { /ALL (d) | /BAP | /NONPAGED | /PAGED } [/HEADER | /MAXIMUM_E

Parameters

None.

Qualifiers

/ALL

Checks free packets for all pool types (nonpaged pool, paged pool, and bus addressable pool). This is the default.

/BAP

Checks free packets in bus addressable pool.

/HEADER

Displays only the first 16 bytes of any corrupted free packets found.

/MAXIMUM_BYTES[=*n*]

Displays only the first n bytes of any corrupted free packets found. If you specify /MAXIMUM_BYTES without a value, the default is 64 bytes.

/NONPAGED

Checks free packets in nonpaged pool.

/PAGED

Checks free packets in paged pool.

/SUMMARY

Displays only a summary of corrupted pool packets found.

Description

The VALIDATE POOL command displays information about corrupted free pool packets. It is useful only if pool checking has been enabled using either the POOLCHECK or the SYSTEM_CHECK system parameters. (For information on these system parameters, refer to the *VSI OpenVMS System Management Utilities Reference Manual* or to the Sys_Parameters online help topic.)

Examples

1. ```
   SDA>  VALIDATE POOL
   Non-Paged Dynamic Storage Pool: no free packet corruption detected
   Paged Dynamic Storage Pool: no free packet corruption detected
   ```

   This example shows the default behavior of VALIDATE POOL, checking all dynamic storage pools.

2. ```
   SDA>  VALIDATE POOL/NONPAGED/HEADER

        Corrupt packets in Non-Paged Dynamic Storage Pool
        ------------------------------------------------


         Packet type/subtype                Start   Length                   Header contents
        -------------------------          -------  -------    -----------------------------------------------------
        [Free]          (poolcheck error)  81E34EC0 00049140   64646464 64646464 00049140 00000000  ....@...dddddddd

        Non -Paged Dynamic Storage Pool: 1 corrupted free packet found
   ```

   This example shows the validation of nonpaged pool only, and displays the header of the corrupted block found.

4.86. VALIDATE PROCESS

Performs validation of process data structures. Currently, the only validation available is to check free process pool packets for POOLCHECK-style corruption, using the same algorithm as the system pool allocation routines when generating a POOLCHECK bugcheck and system dump.

Format

VALIDATE PROCESS/POOL [= {P0 | P1 | IMGACT | ALL (d)}] [/ADDRESS=pcb-address

[/HEADER | /MAXIMUM_BYTES[=n] | /SUMMARY]

Parameters

ALL

Indicates that all processes in the system are to be validated.

process name

Name of the process to be validated. The process name can contain up to 15 uppercase letters, numerals, underscore (_), dollar sign ($), colon (:), and some other printable characters. If it contains any other characters (including lowercase letters), you might need to enclose the process name in quotation marks (" ").

Qualifiers

/ADDRESS = *pcb address*

Specifies the process control block (PCB) address of the process to be validated.

/HEADER

Displays only the first 16 bytes of any corrupted free packets found.

/ID = *nn*/INDEX = *nn*

Specifies the process to be validated by its index into the system's list of software process control blocks (PCBs), or by its process identification. You can supply the following values for *nn*:

- The process index itself.
- A process identification (PID) or extended PID longword, from which SDA extracts the correct index. The PID or extended PID of any thread of a process with multiple kernel threads can be specified. Any thread-specific data displayed by further commands is for the given thread.

To obtain these values for any given process, issue the SDA command SHOW SUMMARY/THREADS. The /ID=*nn* and /INDEX=*nn* qualifiers can be used interchangeably.

/MAXIMUM_BYTES[=*n*]

Displays only the first n bytes of any corrupted free packets found. If you specify /MAXIMUM_BYTES without a value, the default is 64 bytes.

/NEXT

Causes SDA to locate the next process in the process list and validate that process. If there are no further processes in the process list, SDA returns an error.

/POOL [= {P0 | P1 | IMGACT | ALL (d)}]

(Required) Causes process pool validation to be performed. Use of a keyword on the /POOL qualifier allows the user to specify which process pool is to be validated (P0, P1, Image Activator Pool, or ALL). Default: ALL

/SUMMARY

Displays only a summary of the corrupted pool packets found.

/SYSTEM

This qualifier is provided for compatibility with SET PROCESS/SYSTEM and SHOW PROCESS/SYSTEM. There is no pool associated with the system process that can be validated. SDA sets its current process context to the system process and outputs the text:

`Options ignored for System process: POOL`

Description

The VALIDATE PROCESS command validates the process indicated by one of the following: *process-name*, the process specified in the /ID or /INDEX qualifier, the next process in the system's process list, the system process, or all processes. The VALIDATE PROCESS command performs an implicit SET PROCESS command under certain uses of its qualifiers and parameters, as noted in Section 2.5. By default, the VALIDATE PROCESS command validates the SDA current process, as defined in Section 2.5.

Currently, the only validation available is to check free pool packets for POOLCHECK-style corruption. The command is useful only if pool checking has been enabled using either the POOLCHECK or the SYSTEM_CHECK system parameters. (For information on these system parameters, refer to the *VSI OpenVMS System Management Utilities Reference Manual* or to the Sys_Parameters online help topic.)

If a process is specified using *process-name*, /ADDRESS, /ID, /INDEX, /NEXT, or /SYSTEM, that process becomes the SDA current process for future commands.

Examples

```
SDA> VALIDATE PROCESS JOB_CONTROL/POOL/HEADER

Process index: 000C   Name: JOB_CONTROL       Extended PID: 0000020C
--------------------------------------------------------------------

Corrupt packets in P1 Dynamic Storage Pool
------------------------------------------

   Packet type/subtype              Start    Length                     Header contents
-------------------------         -------- --------   -----------------------------------------------------
[Free]           (poolcheck error)  7FEB6000 0006E000   00600003 027702A0 0006E000 00000000  .....`....w...`.

P1 Dynamic Storage Pool: 1 corrupted free packet found
Image Activator Dynamic Storage Pool: no free packet corruption detected
```

This example shows the default behavior of VALIDATE PROCESS/POOL, checking all process storage pools, and displaying only the header of the corrupted block found.

4.87. VALIDATE QUEUE

Validates the integrity of the specified queue by checking the pointers in the queue.

Format

`VALIDATE QUEUE [address]`

[/BACKLINK | /LIST | /PHYSICAL

| /QUADWORD | /SELF_RELATIVE | /SINGLY_LINKED]

Parameter

address

Address of an element in a queue.

If you specify the period (.) as the **address**, SDA uses the last evaluated expression as the queue element's address.

If you do not specify an **address**, the VALIDATE QUEUE command determines the address from the last issued VALIDATE QUEUE command in the current SDA session.

If you do not specify an **address**, and no queue has previously been specified, SDA displays the following error message:

```
%SDA-E-NOQUEUE, no queue has been specified for validation
```

Qualifiers

/BACKLINK

Allows doubly linked lists to be validated from the tail of the queue. If the queue is found to be broken when validated from the head of the queue, you can use /BACKLINK to narrow the list of corrupted entries.

/LIST

Displays the address of each element in the queue.

/PHYSICAL

Allows validation of queues whose header and links are physical addresses.

/QUADWORD

Allows the validate operation to occur on queues with linked lists of quadword addresses.

/SELF_RELATIVE

Specifies that the selected queue is a self-relative queue.

/SINGLY_LINKED

Allows validation of queues that have no backward pointers.

Description

The VALIDATE QUEUE command uses the forward and, optionally, backward pointers in each element of the queue to make sure that all such pointers are valid and that the integrity of the queue is intact. If the queue is intact, SDA displays the following message:

```
Queue is complete, total of n elements in the queue
```

In these messages, *n* represents the number of entries the VALIDATE QUEUE command has found in the queue.

If SDA discovers an error in the queue, it displays one of the following error messages:

```
Error in forward queue linkage at address nnnnnnnn after tracing x elements
Error comparing backward link to previous structure address (nnnnnnnn)
Error occurred in queue element at address oooooooo after tracing pppp
 elements
```

These messages can appear frequently when you use the VALIDATE QUEUE command within an SDA session that is analyzing a running system. In a running system, the composition of a queue can change while the command is tracing its links, thus producing an error message.

If there are no entries in the queue, SDA displays this message:

```
The queue is empty
```

Examples

1.
```
SDA>  VALIDATE QUEUE/SELF_RELATIVE IOC$GQ_POSTIQ
Queue is complete, total of 159 elements in the queue
```

   This example validates the self-relative queue IOC$GQ_POSTIQ. The validation is successful and the system determines that there are 159 IRPs in the list.

2.
```
SDA> VALIDATE QUEUE/QUADWORD FFFFFFFF80D0E6CO/LIST
Entry      Address             Flink                   Blink
-----      -------             ------                  -----
Header     FFFFFFFF80D0E6CO    FFFFFFFF80D03780
 FFFFFFFF80D0E800
    1.     FFFFFFFF80D0E790    FFFFFFFF80D0E7CO
 FFFFFFFF80D0E6C0
    2.     FFFFFFFF80D0E800    FFFFFFFF80D0E6C0
 FFFFFFFF80D0E7C0
Queue is complete, total of 3 elements in the queue
```

   This example shows the validation of quadword elements in a list.

3.
```
SDA> VALIDATE QUEUE/SINGLY_LINKED EXE$GL_NONPAGED+4
Queue is zero-terminated, total of 95 elements in the queue
```

   This example shows the validation of singly linked elements in the queue. The forward link of the final element is zero instead of being a pointer back to the queue header.

4.88. VALIDATE SHM_CPP

Validates all the shared memory common property partitions (CPPs) and the counts and ranges of attached PFNs; optionally, it can validate the contents of the database for each PFN.

Format

VALIDATE SHM_CPP [/qualifiers]

Parameters

None.

Qualifiers

/ADDRESS=*n*

Validates the counts and ranges for a single shared memory CPP given the address of the SHM_CPP structure.

/ALL

Validates all the shared memory CPPs. This is the default.

/IDENT=*n*

Validates the counts and ranges for a single shared memory CPP.

/PFN

Validates the PFN database contents for each attached PFN. The default is all lists (free, bad, untested) plus the PFN database pages and the complete range of PFNs in the CPP.

You can limit which lists are validated by specifying one or more keywords from the following table. If you specify multiple keywords, enclose them in parentheses and separate keywords with a comma.

ALL_FRAGMENTS	Validates the complete range of PFNs in the CPP.
BAD	Validates only the bad page list.
FREE	Validates only the free page list.
PFNDB	Validates the PFNs containing the PFN database.
UNTESTED	Validates only the untested page list.

If you specify the /PFN without /ALL, /IDENT, or /ADDRESS, the system validates the PFN lists from the last shared memory CPP.

Examples

```
SDA> VALIDATE SHM_CPP
Not validating SHM_CPP 0000 at FFFFFFFF.7F2BA140, VALID flag clear

Not validating SHM_CPP 0001 at FFFFFFFF.7F2BA380, VALID flag clear

Not validating SHM_CPP 0002 at FFFFFFFF.7F2BA5C0, VALID flag clear

Validating SHM_CPP 0003 at FFFFFFFF.7F2BA800 ...

    Validating counts and ranges in the free page list ...
    ... o.k.

    Not validating the bad page list, list is empty
```

```
    Not validating the untested page list, list is empty

Not validating SHM_CPP 0004 at FFFFFFFF.7F2BAA40, VALID flag clear

Not validating SHM_CPP 0005 at FFFFFFFF.7F2BAC80, VALID flag clear

Not validating SHM_CPP 0006 at FFFFFFFF.7F2BAEC0, VALID flag clear
```

This example shows the default output for the VALIDATE SHM_CPP command.

4.89. VALIDATE TQEIDX

Validates all the data structures associated with timer queue entry index (TQEIDX) structures.

Format

VALIDATE TQEIDX

Parameters

None.

Qualifiers

None.

Description

TQEs are linked together with index blocks that point to TQEs or to another level of index block. VALIDATE TQEIDX checks that all the index blocks are correctly linked together.

Examples

```
SDA> VALIDATE TQEIDX
Validating time index buckets...
    ... o.k.
Validating ID index buckets...
    ... o.k.
Validating 1st time...
    ... o.k.
Validating counts...
    ... o.k.
```

This example shows the output from a successful VALIDATE TQEIDX command.

4.90. WAIT

Causes SDA to wait for the specified length of time.

Format

WAIT [wait-time]

Parameter

wait-time

The wait time is given as a delta time: [[hh:]mm:]ss[.t[h]]. If omitted, the default wait time is one second.

Qualifiers

None.

Description

The WAIT command can be used in command procedures such as scripts collecting performance data. See Chapter 8 for a sample procedure.

Examples

```
SDA> WAIT 00:00:15
```

SDA waits 15 seconds before accepting the next command.

Chapter 5. SDA CLUE Extension

The SDA CLUE command invokes the Crash Log Utility Extractor, which captures specific crash dump information and, upon system reboot, preserves it in a file with the following naming scheme:

```
CLUE$nodename_ddmmyy_hhmm.LIS
```

You enter CLUE extension commands at the SDA prompt. For example:

```
SDA> CLUE CONFIG
```

You can get full help on CLUE by entering HELP CLUE at the SDA> prompt.

5.1. Overview of SDA CLUE Extension

SDA CLUE (Crash Log Utility Extractor) commands automate the analysis of crash dumps and maintain a history of all fatal bugchecks on either a standalone or cluster system. You can use SDA CLUE commands in conjunction with SDA to collect and decode additional dump file information not readily accessible through standard SDA commands. SDA CLUE extension commands can summarize information provided by certain standard SDA commands and provide additional detail for some SDA commands. For example, SDA CLUE extension commands can quickly provide detailed extended QIO processor (XQP) summaries. You can also use SDA CLUE commands interactively on a running system to help identify performance problems.

You can use all CLUE commands when analyzing crash dumps; the only CLUE commands that are not allowed when analyzing a running system are CLUE CRASH, CLUE ERRLOG, CLUE HISTORY, and CLUE STACK.

When you reboot the system after a system failure, you automatically invoke SDA by default. To facilitate better crash dump analysis, SDA CLUE commands automatically capture and archive summary dump file information in a CLUE listing file.

A startup command procedure initiates commands that do the following:

- Invoke SDA
- Issue an SDA CLUE HISTORY command
- Create a listing file called CLUE$*nodename_ddmmyy_hhmm.LIS*

The CLUE HISTORY command adds a one-line summary entry to a history file and saves the following output from SDA CLUE commands in the listing file:

- Crash dump summary information
- System configuration
- Stack decoder
- Page and swap files
- Memory management statistics
- Process DCL recall buffer

- Active XQP processes
- XQP cache header

The contents of this CLUE list file can help you analyze a system failure. If these files accumulate more space than the threshold allows (default is 5000 blocks), the oldest files are deleted until the threshold limit is reached. You can also customize this threshold using the CLUE$MAX_BLOCKS logical name.

For additional information on the contents of the CLUE listing file, see the reference section on CLUE HISTORY.

It is important to remember that CLUE$*nodename_ddmmyy_hhmm.LIS* contains only an overview of the crash dump and does not always contain enough information to determine the cause of the crash. The dump itself should always be saved using the procedures described in Section 2.2.2 and Section 2.2.4.

To inhibit the running of CLUE at system startup, define the logical CLUE$INHIBIT in the SYLOGICALS.COM file as /SYS TRUE.

5.2. Displaying Data with CLUE

To invoke a CLUE command, enter the command at the SDA prompt. For example:

```
SDA> CLUE CONFIG
```

5.3. Using CLUE with DOSD

DOSD (Dump Off System Disk) allows you to write the system dump file to a device other than the system disk. For SDA CLUE to be able to correctly find the dump file to be analyzed after a system crash, you need to perform the following steps:

1. Modify the command procedure SYS$MANAGER:SYCONFIG.COM to add the system logical name CLUE$DOSD_DEVICE to point to the device where the dump file resides. You need to supply only the physical or logical device name without a file specification.

2. Modify the command procedure SYS$MANAGER:SYCONFIG.COM to mount systemwide the device where the dump file resides. Otherwise, SDA CLUE cannot access and analyze the dump file.

In the following example, the dump file has been placed on device 3DUA25, which has the label DMP $DEV. You need to add the following commands to SYS$MANAGER:SYCONFIG.COM:

```
$ MOUNT/SYSTEM/NOASSIST $3$DUA25: DMP$DEV DMP$DEV
$ DEFINE/SYSTEM CLUE$DOSD_DEVICE DMP$DEV
```

5.4. SDA CLUE Extension Commands

The following pages describe the SDA CLUE extension commands.

5.4.1. CLUE CALL_FRAME (Alpha Only)

Displays key information, such as the PC of the caller, from the active call frames at the time of the crash.

Format

`CLUE CALL_FRAME [/CPU [cpu-id|ALL]`

`|/PROCESS [/ADDRESS=n|INDEX=n`

`|/IDENTIFICATION=n|process-name|ALL]]`

Parameters

ALL

When used with /CPU, it requests information about all CPUs in the system. When used with /PROCESS, it requests information about all processes that exist in the system.

cpu-id

When used with /CPU, it gives the number of the CPU for which information is to be displayed. Use of the cpu-id parameter causes the CLUE CALL_FRAME command to perform an implicit SET CPU command, making the indicated CPU the current CPU for subsequent SDA commands.

process-name

When used with /PROCESS, it gives the name of the process for which information is to be displayed. Use of the **process-name** parameter, the /ADDRESS qualifier, the /INDEX qualifier, or the /IDENTIFICATION qualifier causes the CLUE CALL_FRAME command to perform an implicit SET PROCESS command, making the indicated process the current process for subsequent SDA commands. You can determine the names of the processes in the system by issuing a SHOW SUMMARY command.

The **process-name** can contain up to 15 letters and numerals, including the underscore (_) and dollar sign ($). If it contains any other characters, you must enclose the **process-name** in quotation marks (" ").

Qualifiers

/ADDRESS=*n*

Specifies the PCB address of the desired process when used with CLUE CALL_FRAME/PROCESS.

/CPU [cpu-id|ALL]

Indicates that the call frame for a CPU is required. Specify the CPU by its number or use ALL to indicate all CPUs.

/IDENTIFICATION=*n*

Specifies the identification of the desired process when used with CLUE CALL_FRAME/PROCESS.

/INDEX=*n*

Specifies the index of the desired process when used with CLUE CALL_FRAME/PROCESS.

/PROCESS [process-name|ALL]

Indicates that the call frame for a process is required. The process should be specified with either one of the qualifiers /ADDRESS, /IDENTIFICATION, or /INDEX, or by its name, or by using ALL to indicate all processes.

Description

The CLUE CALL_FRAME command displays call chain information for a process or a CPU. The process context calls work on both the running system and dump file; the CPU context calls only on dump files.

If neither /CPU nor /PROCESS is specified, the parameter (CPU-id or process-name) is ignored and the call frame for the SDA current process is displayed.

Examples

1.
```
SDA> CLUE CALL/PROCESS IPCACP
Call Chain:   Process index: 000B   Process name: IPCACP  PCB: 8136EF00
-----------------------------------------------------------------------
Procedure Frame  Procedure Entry                          Return Address
---------------  ----------------------------------
 ---------------------------
7FFA1CA0  Null   800C8C90  SCH$WAIT_PROC_C
7FFA1D00  Stack  800D9250  SYS$HIBER_C                    0003045C
 IPCACP+0003045C
7FFA1D50  Stack  00030050  IPCACP+00030050                800D11C8  EXE
$CMKRNL_C+000D8
7FFA1E60  Null   800B6120  EXE$BLDPKTSWPR_C
7FFA1E78  Null   800B6120  EXE$BLDPKTSWPR_C
7FFA1EC0  Null   80248120  NSA$CHECK_PRIVILEGE_C
7FFA1F00  Null   80084640  EXE$CMODEXECX_C
7FFA1F70  Stack  800D10F0  EXE$CMKRNL_C                   80084CC8  EXE
$CMODKRNL_C+00198
7B01FAB0  Stack  00030010  IPCACP+00030010                83EA3454  SYS
$IMGSTA_C+00154
7B01FB10  Stack  83EA3300  SYS$IMGSTA_C                   83D99CC4  EXE
$PROC_IMGACT_C+00384
7B01FBA0  Stack  83D99BA0  EXE$PROC_IMGACT_C+00260        83D99B9C  EXE
$PROC_IMGACT_C+0025C
```

   In this example, the CLUE CALL_FRAME command displays the call frame from the process IPCACP.

2.
```
SDA> CLUE CALL/CPU ALL
Call Chain:  Process index: 0000  Process name: NULL  PCB: 827377C0
 (CPU 0)
-------------------------------------------------------------------
Procedure Frame  Procedure Entry                          Return Address
---------------  ----------------------------------
 ---------------------------
8F629D28  Null   80205E00  SYS$SCS+05E00
8F629D68  Null   8020A850  SCS$REC_MSGREC_C
8F629D98  Null   914A5340  SYS$PBDRIVER+07340
8F629DB8  Null   914A4FD0  SYS$PBDRIVER+06FD0
8F629DE0  Stack  914AACF0  SYS$PBDRIVER+0CCF0             914AE5CC  SYS
$PBDRIVER+105CC
```

```
8F629E50  Stack  914AE418  SYS$PBDRIVER+10418            800503B0
 EXE_STD$QUEUE_FORK_C+00350
8F629F88  Null   800E95F4  SCH$WAIT_ANY_MODE_C
8F629FD0  Stack  800D0F80  SCH$IDLE_C                    800E92D0  SCH
$INTERRUPT+00BB0
Call Chain:   Process index: 0000   Process name: NULL    PCB: 827377C0
  (CPU 2)
--------------------------------------------------------------------
Procedure Frame  Procedure Entry                          Return Address
---------------  --------------------------------         ---------
90FCBF88  Null   800E95F4  SCH$WAIT_ANY_MODE_C
90FCBFC8  Null   800E95F4  SCH$WAIT_ANY_MODE_C
90FCBFD0  Stack  800D0F80  SCH$IDLE_C                    800E92D0  SCH
$INTERRUPT+00BB0
Call Chain:   Process index: 0000   Process name: NULL    PCB: 827377C0
  (CPU 6)
--------------------------------------------------------------------
Procedure Frame  Procedure Entry                          Return Address
---------------  ------------------------------
 ---------------------------
90FCBF88  Null   800E95FA  SCH$WAIT_ANY_MORE_c
90FD9F88  Null   800E95F4  SCH$WAIT_ANY_MODE_C
90FD9FD0  Stack  800D0F80  SCH$IDLE_C                    800E92D0  SCH
$INTERRUPT+00BB0
```

In this example, CLUE/CPU ALL shows the call frame for all CPUs.

5.4.2. CLUE CLEANUP

Performs housekeeping operations to conserve disk space.

Format

CLUE CLEANUP

Parameters

None.

Qualifiers

None.

Description

CLUE CLEANUP performs housekeeping operations to conserve disk space. To avoid filling up the system disk with listing files generated by CLUE, CLUE CLEANUP is run during system startup to check the overall disk space used by all CLUE$*.LIS files.

If the CLUE$COLLECT:CLUE$*.LIS files occupy more space than the logical CLUE$MAX_BLOCKS allows, then the oldest files are deleted until the threshold is reached. If this logical name is not defined, a default value of 5,000 disk blocks is assumed. A value of zero disables housekeeping and no check on the disk space is performed.

Examples

1. `SDA>  CLUE CLEANUP`

```
%CLUE-I-CLEANUP, housekeeping started...
%CLUE-I-MAXBLOCK, maximum blocks allowed 5000 blocks
%CLUE-I-STAT, total of 4 CLUE files, 192 blocks.
```

In this example, the CLUE CLEANUP command displays that the total number of blocks of disk space used by CLUE files does not exceed the maximum number of blocks allowed. No files are deleted.

5.4.3. CLUE CONFIG

Displays the system, memory, and device configurations.

Format

CLUE CONFIG

Parameters

None.

Qualifiers

/ADAPTER

Displays only the part of the system configuration that contains information about the adapters and devices on the system.

/CPU

Displays only the part of the system configuration that contains information about the CPUs.

/MEMORY

Displays only the part of the system configuration that contains information about the layout of physical memory.

Description

CLUE CONFIG displays the system, memory, and device configurations. If no qualifier is specified, the entire system configuration is displayed (memory, CPUs, adapters, and devices), plus additional system information.

5.4.4. CLUE CRASH

Displays a crash dump summary.

Format

CLUE CRASH

Parameters

None.

Qualifiers

None.

Description

CLUE CRASH displays a crash dump summary, which includes the following items:

- Bugcheck type
- Current process and image
- Failing PC and PS
- Executive image section name and offset
- General registers
- Failing instructions
- Exception frame, signal and mechanism arrays (if available)
- CPU state information (spinlock related bugchecks only)

Examples

```
SDA>  CLUE CRASH
Crash Time:         30-AUG-1996 13:13:46.83
Bugcheck Type:      SSRVEXCEPT, Unexpected system service exception
Node:               SWPCTX  (Standalone)
CPU Type:           DEC 3000 Model 400
VMS Version:        X6AF-FT2
Current Process:    SYSTEM
Current Image:      $31$DKB0:[SYS0.][SYSMGR]X.EXE;1
Failing PC:         00000000.00030078    SYS$K_VERSION_01+00078
Failing PS:         00000000.00000003
Module:             X
Offset:             00030078

Boot Time:          30-AUG-1996 09:06:22.00
System Uptime:               0 04:07:24.83
Crash/Primary CPU: 00/00
System/CPU Type:    0402
Saved Processes:    18
Pagesize:           8 KByte (8192 bytes)
Physical Memory:    64 MByte (8192 PFNs, contiguous memory)
Dumpfile Pagelets: 98861 blocks
Dump Flags:         olddump,writecomp,errlogcomp,dump_style
Dump Type:          raw,selective
EXE$GL_FLAGS:       poolpging,init,bugdump
Paging Files:       1 Pagefile and 1 Swapfile installed

Stack Pointers:
KSP = 00000000.7FFA1C98   ESP = 00000000.7FFA6000   SSP = 00000000.7FFAC100
USP = 00000000.7AFFBAD0

General Registers:
R0  = 00000000.00000000   R1  = 00000000.7FFA1EB8   R2  = FFFFFFFF.80D0E6C0
R3  = FFFFFFFF.80C63460   R4  = FFFFFFFF.80D12740   R5  = 00000000.000000C8
R6  = 00000000.00030038   R7  = 00000000.7FFA1FC0   R8  = 00000000.7FFAC208
R9  = 00000000.7FFAC410   R10 = 00000000.7FFAD238   R11 = 00000000.7FFCE3E0
R12 = 00000000.00000000   R13 = FFFFFFFF.80C6EB60   R14 = 00000000.00000000
R15 = 00000000.009A79FD   R16 = 00000000.000003C4   R17 = 00000000.7FFA1D40
```

```
R18 = FFFFFFFF.80C05C38   R19 = 00000000.00000000   R20 = 00000000.7FFA1F50
R21 = 00000000.00000000   R22 = 00000000.00000001   R23 = 00000000.7FFF03C8
R24 = 00000000.7FFF0040   AI  = 00000000.00000003   RA  = FFFFFFFF.82A21080
PV  = FFFFFFFF.829CF010   R28 = FFFFFFFF.8004B6DC   FP  = 00000000.7FFA1CA0
PC  = FFFFFFFF.82A210B4   PS  = 18000000.00000000

Exception Frame:
R2  = 00000000.00000003   R3  = FFFFFFFF.80C63460   R4  = FFFFFFFF.80D12740
R5  = 00000000.000000C8   R6  = 00000000.00030038   R7  = 00000000.7FFA1FC0
PC  = 00000000.00030078   PS  = 00000000.00000003

Signal Array:                            64-bit Signal Array:
Arg Count    = 00000005                  Arg Count      =          00000005
Condition    = 0000000C                  Condition      = 00000000.0000000C
Argument #2  = 00010000                  Argument #2    = 00000000.00010000
Argument #3  = 00000000                  Argument #3    = 00000000.00000000
Argument #4  = 00030078                  Argument #4    = 00000000.00030078
Argument #5  = 00000003                  Argument #5    = 00000000.00000003

Mechanism Array:
Arguments    = 0000002C                  Establisher FP = 00000000.7AFFBAD0
Flags        = 00000000                  Exception FP   = 00000000.7FFA1F00
Depth        = FFFFFFFD                  Signal Array   = 00000000.7FFA1EB8
Handler Data = 00000000.00000000         Signal64 Array = 00000000.7FFA1ED0
R0  = 00000000.00020000   R1  = 00000000.00000000   R16 = 00000000.00020004
R17 = 00000000.00010050   R18 = FFFFFFFF.FFFFFFFF   R19 = 00000000.00000000
R20 = 00000000.7FFA1F50   R21 = 00000000.00000000   R22 = 00000000.00010050
R23 = 00000000.00000000   R24 = 00000000.00010051   R25 = 00000000.00000000
R26 = FFFFFFFF.8010ACA4   R27 = 00000000.00010050   R28 = 00000000.00000000

System Registers:
Page Table Base Register (PTBR)                         00000000.00001136
Processor Base Register (PRBR)                          FFFFFFFF.80D0E000
Privileged Context Block Base (PCBB)                    00000000.003FE080
System Control Block Base (SCBB)                        00000000.000001DC
Software Interrupt Summary Register (SISR)              00000000.00000000
Address Space Number (ASN)                              00000000.0000002F
AST Summary / AST Enable (ASTSR_ASTEN)                  00000000.0000000F
Floating-Point Enable (FEN)                             00000000.00000000
Interrupt Priority Level (IPL)                          00000000.00000000
Machine Check Error Summary (MCES)                      00000000.00000000
Virtual Page Table Base Register (VPTB)                 FFFFFFFC.00000000

Failing Instruction:
SYS$K_VERSION_01+00078:         LDL             R28,(R28)

Instruction Stream (last 20 instructions):
SYS$K_VERSION_01+00028:         LDQ             R16,#X0030(R13)
SYS$K_VERSION_01+0002C:         LDQ             R27,#X0048(R13)
SYS$K_VERSION_01+00030:         LDA             R17,(R28)
SYS$K_VERSION_01+00034:         JSR             R26,(R26)
SYS$K_VERSION_01+00038:         LDQ             R26,#X0038(R13)
SYS$K_VERSION_01+0003C:         BIS             R31,SP,SP
SYS$K_VERSION_01+00040:         BIS             R31,R26,R0
SYS$K_VERSION_01+00044:         BIS             R31,FP,SP
SYS$K_VERSION_01+00048:         LDQ             R28,#X0008(SP)
SYS$K_VERSION_01+0004C:         LDQ             R13,#X0010(SP)
SYS$K_VERSION_01+00050:         LDQ             FP,#X0018(SP)
```

```
SYS$K_VERSION_01+00054:         LDA             SP,#X0020(SP)
SYS$K_VERSION_01+00058:         RET             R31,(R28)
SYS$K_VERSION_01+0005C:         BIS             R31,R31,R31
SYS$K_VERSION_01+00060:         LDA             SP,#XFFE0(SP)
SYS$K_VERSION_01+00064:         STQ             FP,#X0018(SP)
SYS$K_VERSION_01+00068:         STQ             R27,(SP)
SYS$K_VERSION_01+0006C:         BIS             R31,SP,FP
SYS$K_VERSION_01+00070:         STQ             R26,#X0010(SP)
SYS$K_VERSION_01+00074:         LDA             R28,(R31)
SYS$K_VERSION_01+00078:         LDL             R28,(R28)
SYS$K_VERSION_01+0007C:         BEQ             R28,#X000007
SYS$K_VERSION_01+00080:         LDQ             R26,#XFFE8(R27)
SYS$K_VERSION_01+00084:         BIS             R31,R26,R0
SYS$K_VERSION_01+00088:         BIS             R31,FP,SP
```

5.4.5. CLUE ERRLOG

Extracts the error log buffers from the dump file and places them into the binary file called CLUE $ERRLOG.SYS.

Format

`CLUE ERRLOG [/OLD]`

Parameters

None.

Qualifier

/OLD

Dumps the errorlog buffers into a file using the old errorlog format. The default action, if /OLD is not specified, is to dump the errorlog buffers in the common event header format.

Description

CLUE ERRLOG extracts the error log buffers from the dump file and places them into the binary file called CLUE$ERRLOG.SYS.

These buffers contain messages not yet written to the error log file at the time of the failure. When you analyze a failure on the same system on which it occurred, you can run the Error Log utility on the actual error log file to see these error log messages. When analyzing a failure from another system, use the CLUE ERRLOG command to create a file containing the failing system's error log messages just prior to the failure. System failures are often triggered by hardware problems, so determining what, if any, hardware errors occurred prior to the failure can help you troubleshoot a failure.

You can define the logical CLUE$ERRLOG to any file specification if you want error log information written to a file other than CLUE$ERRLOG.SYS.

Note

You need at least DECevent V2.9 to analyze the new common event header (CEH) format file. The old format file can be analyzed by ANALYZE/ERROR or any version of DECevent.

Examples

```
SDA>  CLUE ERRLOG

Sequence  Date        Time
--------  ----------- -----------
     128  11-MAY-1994 00:39:31.30
     129  11-MAY-1994 00:39:32.12
     130  11-MAY-1994 00:39:44.83
     131  11-MAY-1994 00:44:38.97 * Crash Entry
```

In addition to writing the error log buffers into CLUE$ERRLOG.SYS, the CLUE ERRLOG command displays the sequence, date, and time of each error log buffer extracted from the dump file.

5.4.6. CLUE FRU

Outputs the Field Replacement Unit (FRU) table to a file for display by DECevent.

Format

`CLUE FRU`

Parameters

None.

Qualifiers

None.

Description

The FRU command extracts the FRU table into an output file (CLUE$FRU.SYS), which can then be displayed by DECevent. This command works on the running system, as well as on dump files.

5.4.7. CLUE HISTORY

Updates history file and generates crash dump summary output.

Format

`CLUE HISTORY [/qualifier]`

Parameters

None.

Qualifier

/OVERDRIVE

Allows execution of this command even if the dump file has already been analyzed (DMP $V_OLDDUMP bit set).

Description

This command updates the history file pointed to by the logical name CLUE$HISTORY with a one-line entry and the major crash dump summary information. If CLUE$HISTORY is not defined, a file CLUE $HISTORY.DAT in your default directory will be created.

In addition, a listing file with summary information about the system failure is created in the directory pointed to by CLUE$COLLECT. The file name is of the form CLUE$*node_ddmmyy_hhmm*.LIS where the timestamp (*hhmm*) corresponds to the system failure time and not the time when the file was created.

The listing file contains summary information collected from the following SDA commands:

- CLUE CRASH
- CLUE CONFIG
- CLUE MEMORY/FILES
- CLUE MEMORY/STATISTIC
- CLUE PROCESS/RECALL
- CLUE XQP/ACTIVE

Refer to the reference section for each of these commands to see examples of the displayed information.

The logical name CLUE$FLAG controls how much information is written to the listing file.

- Bit 0---Include crash dump summary
- Bit 1---Include system configuration
- Bit 2---Include stack decoding information
- Bit 3---Include page and swap file usage
- Bit 4---Include memory management statistics
- Bit 5---Include process DCL recall buffer
- Bit 6---Include active XQP process information
- Bit 7---Include XQP cache header

If this logical name is undefined, all bits are set by default internally and all information is written to the listing file. If the value is zero, no listing file is generated. The value has to be supplied in hexadecimal form (for example, DEFINE CLUE$FLAG 81 will include the crash dump summary and the XQP cache header information).

If the logical name CLUE$SITE_PROC points to a valid and existing file, it will be executed as the final step of the CLUE HISTORY command (for example, automatic saving of the dump file during system startup). If used, this file should contain only valid SDA commands.

Refer to Section 2.2.4 for more information on site-specific command files.

5.4.8. CLUE MCHK

This command is obsolete.

Format

CLUE MCHK

Parameters

None.

Qualifiers

None.

Description

The CLUE MCMK command has been withdrawn. Issuing the command produces the following output, explaining the correct way to obtain MACHINECHECK information from a crash dump.

```
Please use the following commands in order to extract the errorlog buffers
from the dumpfile header and analyze the machine check entry:

$ analyze/crash sys$system:sysdump.dmp
SDA> clue errlog
SDA> exit
$ diagnose clue$errlog
```

5.4.9. CLUE MEMORY

Displays memory- and pool-related information.

Format

CLUE MEMORY [/qualifier[,...]]

Parameters

None.

Qualifiers

/FILES

Displays information about page and swap file usage.

/FREE

Validates and displays dynamic nonpaged free packet list queue. (See also /FULL.)

/FULL

Ignored except when used with /FREE or /GH. When used with /FREE, the first 16 bytes of each entry on the free packet list is displayed. When used with /GH, a list of the images that use each granularity hint region is displayed.

/GH

Displays information about the granularity hint regions. (See also /FULL.)

/LAYOUT

Decodes and displays much of the system virtual address space layout.

/LOOKASIDE

Validates the lookaside list queue heads and counts the elements for each list.

/STATISTIC

Displays systemwide performance data such as page fault, I/O, pool, lock manager, MSCP, and file system cache.

Description

The CLUE MEMORY command displays memory- and pool-related information.

Examples

1.
```
SDA> CLUE MEMORY/FILES
Paging File Usage (blocks):
---------------------------

Swapfile (Index   1)                        Device                    DKA0:
   PFL Address      FFFFFFFF.81531340    UCB Address
 FFFFFFFF.814AAF00
   Free Blocks                  44288    Bitmap
 FFFFFFFF.815313E0
   Total Size (blocks)          44288    Flags
 inited,swap_file
   Total Write Count                0    Total Read Count
  0
   Smallest Chunk (pages)        2768    Largest Chunk (pages)
 2768
   Chunks GEQ 64 Pages              1    Chunks LT 64 Pages
  0

Pagefile (Index 254)                        Device                    DKA0:
   PFL Address      FFFFFFFF.8152E440    UCB Address
 FFFFFFFF.814AAF00
   Free Blocks                1056768    Bitmap
 FFFFFFFF.6FB16008
   Total Size (blocks)        1056768    Flags
 inited
   Total Write Count                0    Total Read Count
  0
   Smallest Chunk (pages)       66048    Largest Chunk (pages)
 66048
   Chunks GEQ 64 Pages              1    Chunks LT 64 Pages
  0

   Summary:  1 Pagefile and 1 Swapfile installed

   Total Size of all Swap Files:            44288 blocks
   Total Size of all Paging Files:        1056768 blocks
   Total Committed Paging File Usage:      344576 blocks
```

This example shows the display produced by the CLUE MEMORY/FILES command.

2.
```
SDA>  CLUE MEMORY/FREE/FULL
Non-Paged Dynamic Storage Pool - Variable Free Packet Queue:
------------------------------------------------------------
CLASSDR  FFFFFFFF.80D157C0 :    64646464 64646464 00000040 80D164C0
 ÀdÑ.@...dddddddd
CLASSDR  FFFFFFFF.80D164C0 :    64646464 64646464 00000080 80D17200
  .rÑ.....dddddddd
CLASSDR  FFFFFFFF.80D17200 :    64646464 64646464 00000080 80D21AC0
 À.Ò.....dddddddd
CLASSDR  FFFFFFFF.80D21AC0 :    64646464 64646464 00000080 80D228C0
 À(Ò.....dddddddd
VCC      FFFFFFFF.80D228C0 :    801CA5E8 026F0040 00000040 80D23E40
 @>Ò.@...@.o.è¥..
CLASSDR  FFFFFFFF.80D23E40 :    64646464 64646464 00000040 80D24040
 @@Ò.@...dddddddd
CLASSDR  FFFFFFFF.80D24040 :    64646464 64646464 00000040 80D26FC0
 ÀoÒ.@...dddddddd
CLASSDR  FFFFFFFF.80D26FC0 :    64646464 64646464 00000080 80D274C0
 ÀtÒ.....dddddddd
CLASSDR  FFFFFFFF.80D274C0 :    64646464 64646464 00000040 80D2E200
  .âÒ.@...dddddddd
CLASSDR  FFFFFFFF.80D2E200 :    64646464 64646464 00000080 80D2E440
 @äÒ.....dddddddd
CLASSDR  FFFFFFFF.80D2E440 :    64646464 64646464 00000040 80D2F000
  .Ò.@...dddddddd
CLASSDR  FFFFFFFF.80D2F000 :    64646464 64646464 00000080 80D2F400
  .ôÒ.....dddddddd
   .
   .
   .
CLASSDR  FFFFFFFF.80E91D40 :    64646464 64646464 00000500 80E983C0
 À.é.....dddddddd
CLASSDR  FFFFFFFF.80E983C0 :    64646464 64646464 00031C40 00000000
  ....@...dddddddd
Free Packet Queue, Status: Valid, 174 elements
   Largest free chunk:        00031C40 (hex)    203840 (dec)  bytes
   Total free dynamic space:  0003D740 (hex)    251712 (dec)  bytes
```

The CLUE MEMORY/FREE/FULL command validates and displays dynamic nonpaged free packet list queue.

3.
```
SDA>  CLUE MEMORY/GH/FULL
Granularity Hint Regions - Huge Pages:
--------------------------------------

Execlet Code Region
 Pages/Slices
   Base/End VA     FFFFFFFF.80000000 FFFFFFFF.80356000  Current Size
 427/   427
   Base/End PA     00000000.00400000 00000000.00756000  Free
  /     0
   Total Size      00000000.00356000            3.3 MB  In Use
  /   427
   Bitmap VA/Size  FFFFFFFF.80D17CC0 00000000.00000040  Initial Size
 512/   512
```

```
  Slice Size      00000000.00002000                    Released
85/    85
  Next free Slice 00000000.000001AB

  Image                                 Base                End
Length
  SYS$PUBLIC_VECTORS            FFFFFFFF.80000000  FFFFFFFF.80001A00
00001A00
  SYS$BASE_IMAGE                FFFFFFFF.80002000  FFFFFFFF.8000D400
0000B400
  SYS$CNBTDRIVER                FFFFFFFF.8000E000  FFFFFFFF.8000F000
00001000
  SYS$NISCA_BTDRIVER            FFFFFFFF.80010000  FFFFFFFF.8001FA00
0000FA00
  SYS$ESBTDRIVER                FFFFFFFF.80020000  FFFFFFFF.80022400
00002400
  SYS$OPDRIVER                  FFFFFFFF.80024000  FFFFFFFF.80027C00
00003C00
  SYSTEM_DEBUG                  FFFFFFFF.80028000  FFFFFFFF.80050200
00028200
  SYSTEM_PRIMITIVES             FFFFFFFF.80052000  FFFFFFFF.80089000
00037000
  SYSTEM_SYNCHRONIZATION        FFFFFFFF.8008A000  FFFFFFFF.80095400
0000B400
  ERRORLOG                      FFFFFFFF.80096000  FFFFFFFF.80099200
00003200
  SYS$CPU_ROUTINES_0402         FFFFFFFF.8009A000  FFFFFFFF.800A3A00
00009A00
  EXCEPTION_MON                 FFFFFFFF.800A4000  FFFFFFFF.800BC800
00018800
  IO_ROUTINES_MON               FFFFFFFF.800BE000  FFFFFFFF.800E2000
00024000
  SYSDEVICE                     FFFFFFFF.800E2000  FFFFFFFF.800E5C00
00003C00
  PROCESS_MANAGEMENT_MON        FFFFFFFF.800E6000  FFFFFFFF.8010B000
00025000
  SYS$VM                        FFFFFFFF.8010C000  FFFFFFFF.80167200
0005B200
  SHELL8K                       FFFFFFFF.80168000  FFFFFFFF.80169200
00001200
  LOCKING                       FFFFFFFF.8016A000  FFFFFFFF.8017BE00
00011E00
  MESSAGE_ROUTINES              FFFFFFFF.8017C000  FFFFFFFF.80182A00
00006A00
  LOGICAL_NAMES                 FFFFFFFF.80184000  FFFFFFFF.80186C00
00002C00
  F11BXQP                       FFFFFFFF.80188000  FFFFFFFF.80190400
00008400
  SYSLICENSE                    FFFFFFFF.80192000  FFFFFFFF.80192400
00000400
  IMAGE_MANAGEMENT              FFFFFFFF.80194000  FFFFFFFF.80197A00
00003A00
  SECURITY                      FFFFFFFF.80198000  FFFFFFFF.801A0E00
00008E00
  SYSGETSYI                     FFFFFFFF.801A2000  FFFFFFFF.801A3A00
00001A00
  SYS$TRANSACTION_SERVICES      FFFFFFFF.801A4000  FFFFFFFF.801C5000
00021000
```

```
  SYS$UTC_SERVICES                FFFFFFFF.801C6000  FFFFFFFF.801C7000
00001000
  SYS$VCC_MON                     FFFFFFFF.801C8000  FFFFFFFF.801D4E00
0000CE00
  SYS$IPC_SERVICES                FFFFFFFF.801D6000  FFFFFFFF.80214A00
0003EA00
  SYSLDR_DYN                      FFFFFFFF.80216000  FFFFFFFF.80219200
00003200
  SYS$MME_SERVICES                FFFFFFFF.8021A000  FFFFFFFF.8021B000
00001000
  SYS$TTDRIVER                    FFFFFFFF.8021C000  FFFFFFFF.8022FE00
00013E00
  SYS$PKCDRIVER                   FFFFFFFF.80230000  FFFFFFFF.80240400
00010400
  SYS$DKDRIVER                    FFFFFFFF.80242000  FFFFFFFF.80251600
0000F600
  RMS                             FFFFFFFF.80252000  FFFFFFFF.802C5E00
00073E00
  SYS$GXADRIVER                   FFFFFFFF.802C6000  FFFFFFFF.802CE000
00008000
  SYS$ECDRIVER                    FFFFFFFF.802CE000  FFFFFFFF.802D1000
00003000
  SYS$LAN                         FFFFFFFF.802D2000  FFFFFFFF.802D8E00
00006E00
  SYS$LAN_CSMACD                  FFFFFFFF.802DA000  FFFFFFFF.802E6600
0000C600
  SYS$MKDRIVER                    FFFFFFFF.802E8000  FFFFFFFF.802F1C00
00009C00
  SYS$YRDRIVER                    FFFFFFFF.802F2000  FFFFFFFF.802F9600
00007600
  SYS$SODRIVER                    FFFFFFFF.802FA000  FFFFFFFF.802FF000
00005000
  SYS$INDRIVER                    FFFFFFFF.80300000  FFFFFFFF.8030EA00
0000EA00
  NETDRIVER                       FFFFFFFF.80310000  FFFFFFFF.80310200
00000200
  NETDRIVER                       FFFFFFFF.80312000  FFFFFFFF.80329E00
00017E00
  SYS$IMDRIVER                    FFFFFFFF.8032A000  FFFFFFFF.8032EA00
00004A00
  SYS$IKDRIVER                    FFFFFFFF.80330000  FFFFFFFF.8033AC00
0000AC00
  NDDRIVER                        FFFFFFFF.8033C000  FFFFFFFF.8033F800
00003800
  SYS$WSDRIVER                    FFFFFFFF.80340000  FFFFFFFF.80341600
00001600
  SYS$CTDRIVER                    FFFFFFFF.80342000  FFFFFFFF.8034D200
0000B200
  SYS$RTTDRIVER                   FFFFFFFF.8034E000  FFFFFFFF.80351800
00003800
  SYS$FTDRIVER                    FFFFFFFF.80352000  FFFFFFFF.80354200
00002200

Execlet Data Region
 Pages/Slices
  Base/End VA     FFFFFFFF.80C00000 FFFFFFFF.80CC0000  Current Size
96/  1536
```

```
  Base/End PA     00000000.00800000 00000000.008C0000  Free
 /    11
  Total Size      00000000.000C0000           0.7 MB  In Use
 /  1525
  Bitmap VA/Size  FFFFFFFF.80D17D00 00000000.00000100  Initial Size
128/  2048
  Slice Size      00000000.00000200                    Released
32/   512
  Next free Slice 00000000.000005F5

  Image                                Base               End
Length
  SYS$PUBLIC_VECTORS            FFFFFFFF.80C00000  FFFFFFFF.80C05000
00005000
  SYS$BASE_IMAGE                FFFFFFFF.80C05000  FFFFFFFF.80C25E00
00020E00
  SYS$CNBTDRIVER                FFFFFFFF.80C25E00  FFFFFFFF.80C26200
00000400
  SYS$NISCA_BTDRIVER            FFFFFFFF.80C26200  FFFFFFFF.80C29400
00003200
  SYS$ESBTDRIVER                FFFFFFFF.80C29400  FFFFFFFF.80C29800
00000400
  SYS$OPDRIVER                  FFFFFFFF.80C29800  FFFFFFFF.80C2A200
00000A00
  SYSTEM_DEBUG                  FFFFFFFF.80C2A200  FFFFFFFF.80C4E400
00024200
  SYSTEM_PRIMITIVES             FFFFFFFF.80C4E400  FFFFFFFF.80C58200
00009E00
  SYSTEM_SYNCHRONIZATION        FFFFFFFF.80C58200  FFFFFFFF.80C5A000
00001E00
  ERRORLOG                      FFFFFFFF.80C5A000  FFFFFFFF.80C5A600
00000600
  SYS$CPU_ROUTINES_0402         FFFFFFFF.80C5A600  FFFFFFFF.80C5CA00
00002400
  EXCEPTION_MON                 FFFFFFFF.80C5CA00  FFFFFFFF.80C64C00
00008200
  IO_ROUTINES_MON               FFFFFFFF.80C64C00  FFFFFFFF.80C6AA00
00005E00
  SYSDEVICE                     FFFFFFFF.80C6AA00  FFFFFFFF.80C6B600
00000C00
  PROCESS_MANAGEMENT_MON        FFFFFFFF.80C6B600  FFFFFFFF.80C72600
00007000
  SYS$VM                        FFFFFFFF.80C72600  FFFFFFFF.80C79000
00006A00
  SHELL8K                       FFFFFFFF.80C79000  FFFFFFFF.80C7A000
00001000
  LOCKING                       FFFFFFFF.80C7A000  FFFFFFFF.80C7BA00
00001A00
  MESSAGE_ROUTINES              FFFFFFFF.80C7BA00  FFFFFFFF.80C7D000
00001600
  LOGICAL_NAMES                 FFFFFFFF.80C7D000  FFFFFFFF.80C7E200
00001200
  F11BXQP                       FFFFFFFF.80C7E200  FFFFFFFF.80C7FA00
00001800
  SYSLICENSE                    FFFFFFFF.80C7FA00  FFFFFFFF.80C7FE00
00000400
  IMAGE_MANAGEMENT              FFFFFFFF.80C7FE00  FFFFFFFF.80C80600
00000800
```

```
  SECURITY                         FFFFFFFF.80C80600  FFFFFFFF.80C83000
00002A00
  SYSGETSYI                        FFFFFFFF.80C83000  FFFFFFFF.80C83200
00000200
  SYS$TRANSACTION_SERVICES         FFFFFFFF.80C83200  FFFFFFFF.80C89E00
00006C00
  SYS$UTC_SERVICES                 FFFFFFFF.80C89E00  FFFFFFFF.80C8A200
00000400
  SYS$VCC_MON                      FFFFFFFF.80C8A200  FFFFFFFF.80C8BC00
00001A00
  SYS$IPC_SERVICES                 FFFFFFFF.80C8BC00  FFFFFFFF.80C91000
00005400
  SYSLDR_DYN                       FFFFFFFF.80C91000  FFFFFFFF.80C92200
00001200
  SYS$MME_SERVICES                 FFFFFFFF.80C92200  FFFFFFFF.80C92600
00000400
  SYS$TTDRIVER                     FFFFFFFF.80C92600  FFFFFFFF.80C94C00
00002600
  SYS$PKCDRIVER                    FFFFFFFF.80C94C00  FFFFFFFF.80C96A00
00001E00
  SYS$DKDRIVER                     FFFFFFFF.80C96A00  FFFFFFFF.80C99800
00002E00
  RMS                              FFFFFFFF.80C99800  FFFFFFFF.80CAAC00
00011400
  RECOVERY_UNIT_SERVICES           FFFFFFFF.80CAAC00  FFFFFFFF.80CAB000
00000400
  SYS$GXADRIVER                    FFFFFFFF.80CAB000  FFFFFFFF.80CAF000
00004000
  SYS$ECDRIVER                     FFFFFFFF.80CAF000  FFFFFFFF.80CAFC00
00000C00
  SYS$LAN                          FFFFFFFF.80CAFC00  FFFFFFFF.80CB0800
00000C00
  SYS$LAN_CSMACD                   FFFFFFFF.80CB0800  FFFFFFFF.80CB1800
00001000
  SYS$MKDRIVER                     FFFFFFFF.80CB1800  FFFFFFFF.80CB3000
00001800
  SYS$YRDRIVER                     FFFFFFFF.80CB3000  FFFFFFFF.80CB3C00
00000C00
  SYS$SODRIVER                     FFFFFFFF.80CB3C00  FFFFFFFF.80CB4E00
00001200
  SYS$INDRIVER                     FFFFFFFF.80CB4E00  FFFFFFFF.80CB5E00
00001000
  NETDRIVER                        FFFFFFFF.80CB5E00  FFFFFFFF.80CB8800
00002A00
  SYS$IMDRIVER                     FFFFFFFF.80CB8800  FFFFFFFF.80CB9400
00000C00
  SYS$IKDRIVER                     FFFFFFFF.80CB9400  FFFFFFFF.80CBAA00
00001600
  NDDRIVER                         FFFFFFFF.80CBAA00  FFFFFFFF.80CBB400
00000A00
  SYS$WSDRIVER                     FFFFFFFF.80CBB400  FFFFFFFF.80CBBC00
00000800
  SYS$CTDRIVER                     FFFFFFFF.80CBBC00  FFFFFFFF.80CBD800
00001C00
  SYS$RTTDRIVER                    FFFFFFFF.80CBD800  FFFFFFFF.80CBE200
00000A00
  SYS$FTDRIVER                     FFFFFFFF.80CBE200  FFFFFFFF.80CBEA00
00000800
```

```
  11 free Slices                 FFFFFFFF.80CBEA00  FFFFFFFF.80CC0000
00001600

S0/S1 Executive Data Region
 Pages/Slices
   Base/End VA     FFFFFFFF.80D00000 FFFFFFFF.80ECA000  Current Size
 229/   229
   Base/End PA     00000000.00900000 00000000.00ACA000  Free
  /     0
   Total Size      00000000.001CA000            1.7 MB  In Use
  /   229
   Bitmap VA/Size  FFFFFFFF.80D17E00 00000000.00000020  Initial Size
 229/   229
   Slice Size      00000000.00002000                    Released
 0/     0
   Next free Slice 00000000.00000007

   Item                                 Base               End
 Length
   System Header                 FFFFFFFF.80D00000  FFFFFFFF.80D0A000
 0000A000
   Error Log Allocation Buffers  FFFFFFFF.80D0A000  FFFFFFFF.80D0C000
 00002000
   Nonpaged Pool (initial size)  FFFFFFFF.80D0E000  FFFFFFFF.80ECA000
 001BC000

Resident Image Code Region
 Pages/Slices
   Base/End VA     FFFFFFFF.80400000 FFFFFFFF.80C00000  Current Size
 1024/  1024
   Base/End PA     00000000.00C00000 00000000.01400000  Free
  /   223
   Total Size      00000000.00800000            8.0 MB  In Use
  /   801
   Bitmap VA/Size  FFFFFFFF.80D17E20 00000000.00000080  Initial Size
 1024/  1024
   Slice Size      00000000.00002000                    Released
 0/     0
   Next free Slice 00000000.00000321

   Image                                Base               End
 Length
   LIBRTL                        FFFFFFFF.80400000  FFFFFFFF.8049EA00
 0009EA00
   LIBOTS                        FFFFFFFF.804A0000  FFFFFFFF.804AEC00
 0000EC00
   CMA$TIS_SHR                   FFFFFFFF.804B0000  FFFFFFFF.804B2600
 00002600
   DPML$SHR                      FFFFFFFF.804B4000  FFFFFFFF.8050B600
 00057600
   DECC$SHR                      FFFFFFFF.8050C000  FFFFFFFF.80657000
 0014B000
   SECURESHRP                    FFFFFFFF.80658000  FFFFFFFF.80676000
 0001E000
   SECURESHR                     FFFFFFFF.80676000  FFFFFFFF.8068C000
 00016000
   SECURESHR                     FFFFFFFF.8068C000  FFFFFFFF.8068C200
 00000200
```

```
    LBRSHR                            FFFFFFFF.8068E000  FFFFFFFF.806A3E00
  00015E00
    DECW$TRANSPORT_COMMON             FFFFFFFF.806A4000  FFFFFFFF.806B0C00
  0000CC00
    CDE$UNIX_ROUTINES                 FFFFFFFF.806B2000  FFFFFFFF.806C1E00
  0000FE00
    DECW$XLIBSHR                      FFFFFFFF.806C2000  FFFFFFFF.80781C00
  000BFC00
    DECW$XTLIBSHRR5                   FFFFFFFF.80782000  FFFFFFFF.807C7600
  00045600
    DECW$XMLIBSHR12                   FFFFFFFF.807C8000  FFFFFFFF.8096AE00
  001A2E00
    DECW$MRMLIBSHR12                  FFFFFFFF.8096C000  FFFFFFFF.80994200
  00028200
    DECW$DXMLIBSHR12                  FFFFFFFF.80996000  FFFFFFFF.80A40400
  000AA400
    223 free Slices                   FFFFFFFF.80A42000  FFFFFFFF.80C00000
  001BE000

S2 Executive Data Region
  Pages/Slices
    Base/End VA     FFFFFFFE.00000000 FFFFFFFE.00050000  Current Size
  40/     8
    Base/End PA     00000000.00350000 00000000.003A0000  Free
   /     0
    Total Size      00000000.00050000            0.3 MB  In Use
   /     8
    Bitmap VA/Size  FFFFFFFF.80D17EA0 00000000.00000008  Initial Size
  40/     8
    Slice Size      00000000.0000A000                    Released
  0/     0
    Next free Slice 00000000.00000008

    Item                                     Base                End
  Length
    PFN Database                      FFFFFFFE.00000000  FFFFFFFE.00050000
  00050000
```

The CLUE MEMORY/GH/FULL command displays data structures that describe granularity hint regions and huge pages.

4.

```
SDA>  CLUE MEMORY/LAYOUT
System Virtual Address Space Layout:
------------------------------------
    Item                                    Base                End
  Length
System Virtual Base Address         FFFFFEFE.00000000
PFN Database                        FFFFFEFE.00000000  FFFFFEFE.00280000
  00280000
Permanent Mapping of System L1PT    FFFFFEFE.00280000  FFFFFEFE.00282000
  00002000
Global Page Table (GPT)             FFFFFEFE.00282000  FFFFFEFE.0089CD38
  0061AD38
Resource Hash Table                 FFFFFFFF.6FC1A000  FFFFFFFF.6FC22000
  00008000
Lock ID Table                       FFFFFFFF.6FC22000  FFFFFFFF.70000000
  003DE000
```

```
Execlet Code Region                FFFFFFFF.80000000  FFFFFFFF.80800000
 00800000
Resident Image Code Region         FFFFFFFF.80800000  FFFFFFFF.81000000
 00800000
System Header                      FFFFFFFF.81400000  FFFFFFFF.8140E000
 0000E000
Error Log Allocation Buffers       FFFFFFFF.8140E000  FFFFFFFF.81414000
 00006000
Nonpaged Pool (initial size)       FFFFFFFF.81414000  FFFFFFFF.817C8000
 003B4000
Nonpaged Pool Expansion Area       FFFFFFFF.817C8000  FFFFFFFF.82664000
 00E9C000
Execlet Data Region                FFFFFFFF.81000000  FFFFFFFF.81400000
 00400000
Fork Buffers Secondary to Primary FFFFFFFF.8268C000  FFFFFFFF.8268E000
 00002000
Erase Pattern Buffer Page          FFFFFFFF.8268E000  FFFFFFFF.82690000
 00002000
363 Balance Slots, 33 pages each  FFFFFFFF.826A0000  FFFFFFFF.88436000
 05D96000
Paged Pool                         FFFFFFFF.88436000  FFFFFFFF.887E4000
 003AE000
System Control Block (SCB)         FFFFFFFF.887E4000  FFFFFFFF.887EC000
 00008000
Restart Parameter Block (HWRPB)    FFFFFFFF.88832000  FFFFFFFF.88832B48
 00000B48
Erase Pattern Page Table Page      FFFFFFFF.82690000  FFFFFFFF.82692000
 00002000
Posix Cloning Parent Page Mapping FFFFFFFF.88B1E000  FFFFFFFF.88B20000
 00002000
Posix Cloning Child Page Mapping  FFFFFFFF.88B20000  FFFFFFFF.88B22000
 00002000
Swapper Process Kernel Stack       FFFFFFFF.88B56000  FFFFFFFF.88B5A000
 00004000
Swapper Map                        FFFFFFFF.88B60000  FFFFFFFF.88B82000
 00022000
Idle Loop's Mapping of Zero Pages FFFFFFFF.88C5E000  FFFFFFFF.88C60000
 00002000
PrimCPU Machine Check Logout Area FFFFFFFF.88C60400  FFFFFFFF.88C60800
 00000400
PrimCPU Sys Context Kernel Stack  FFFFFFFF.88C58000  FFFFFFFF.88C5C000
 00004000
Tape Mount Verification Buffer     FFFFFFFF.88C62000  FFFFFFFF.88C66000
 00004000
Mount Verification Buffer          FFFFFFFF.88C66000  FFFFFFFF.88C68000
 00002000
Demand Zero Optimization Page      FFFFFFFF.88E68000  FFFFFFFF.88E6A000
 00002000
Executive Mode Data Page           FFFFFFFF.88E6A000  FFFFFFFF.88E6C000
 00002000
System Space Expansion Region      FFFFFFFF.8C000000  FFFFFFFF.FFDF0000
 73DF0000
System Page Table Window           FFFFFFFF.FFDF0000  FFFFFFFF.FFFF0000
 00200000
N/A Space                          FFFFFFFF.FFFF0000  FFFFFFFF.FFFFFFFF
 00010000
```

The CLUE MEMORY/LAYOUT command decodes and displays the sytem virtual address space layout.

5.
```
SDA>  CLUE MEMORY/LOOKASIDE
Non-Paged Dynamic Storage Pool - Lookaside List Queue Information:
-------------------------------------------------------------------
Listhead Addr: FFFFFFFF.80C50400   Size:   64   Status: Valid, 11
 elements
Listhead Addr: FFFFFFFF.80C50408   Size:  128   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50410   Size:  192   Status: Valid, 29
 elements
Listhead Addr: FFFFFFFF.80C50418   Size:  256   Status: Valid, 3
 elements
Listhead Addr: FFFFFFFF.80C50420   Size:  320   Status: Valid, 7
 elements
Listhead Addr: FFFFFFFF.80C50428   Size:  384   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50430   Size:  448   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50438   Size:  512   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50440   Size:  576   Status: Valid, 6
 elements
Listhead Addr: FFFFFFFF.80C50448   Size:  640   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50450   Size:  704   Status: Valid, 5
 elements
Listhead Addr: FFFFFFFF.80C50458   Size:  768   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50460   Size:  832   Status: Valid, empty
Listhead Addr: FFFFFFFF.80C50468   Size:  896   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50470   Size:  960   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50478   Size: 1024   Status: Valid, 6
 elements
Listhead Addr: FFFFFFFF.80C50480   Size: 1088   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50488   Size: 1152   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50490   Size: 1216   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50498   Size: 1280   Status: Valid, 2
 elements
Listhead Addr: FFFFFFFF.80C504A0   Size: 1344   Status: Valid, 2
 elements
Listhead Addr: FFFFFFFF.80C504A8   Size: 1408   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C504B0   Size: 1472   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C504B8   Size: 1536   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C504C0   Size: 1600   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C504C8   Size: 1664   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C504D0   Size: 1728   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C504D8   Size: 1792   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C504E0   Size: 1856   Status: Valid, empty
Listhead Addr: FFFFFFFF.80C504E8   Size: 1920   Status: Valid, empty
Listhead Addr: FFFFFFFF.80C504F0   Size: 1984   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C504F8   Size: 2048   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50500   Size: 2112   Status: Valid, 1 element
Listhead Addr: FFFFFFFF.80C50508   Size: 2176   Status: Valid, 15
 elements
Listhead Addr: FFFFFFFF.80C50510   Size: 2240   Status: Valid, empty
Listhead Addr: FFFFFFFF.80C50518   Size: 2304   Status: Valid, 1 element
   .
   .
   .

   Total free space:  00016440 (hex)    91200 (dec)  bytes
```

The CLUE MEMORY/LOOKASIDE command summarizes the state of nonpageable lookaside lists. For each list, an indication of whether the queue is well formed is given. If a queue is not well formed or is invalid, messages indicating what is wrong with the queue are displayed. This command is analogous to the SDA command VALIDATE QUEUE.

These messages can also appear frequently when you use the VALIDATE QUEUE command within an SDA session that is analyzing a running system. In a running system, the composition of a queue can change while the command is tracing its links, thus producing an error message.

6.
```
SDA>  CLUE MEMORY/STATISTIC
Memory Management Statistics:
-----------------------------
Pagefaults:                             Non-Paged Pool:
Total Page Faults            1060897     Successful Expansions
 32
Total Page Reads              393414     Unsuccessful Expansions
  0
I/O's to read Pages           163341     Failed Pages Accumulator
  0
Modified Pages Written           121     Total Alloc Requests
 55596
I/O's to write Mod Pages          19     Failed Alloc Requests
  0
Demand Zero Faults            281519
Global Valid Faults           378701     Paged Pool:
Modified Faults               236189     Total Failures
  0
Read Faults                        0     Failed Pages Accumulator
  0
Execute Faults                 28647     Total Alloc Requests
 10229
                                         Failed Alloc Requests

  0

Direct I/O                    591365     Cur Mapped Gbl Sections
 653
Buffered I/O                  589652     Max Mapped Gbl Sections
 654
Split I/O                        213     Cur Mapped Gbl Pages
 12193
Hits                           83523     Max Mapped Gbl Pages
 12196
Logical Name Transl          1805476     Maximum Processes
 46
Dead Page Table Scans              0     Sched Zero Pages Created
  0

Distributed Lock Manager:           Local         Incoming
 Outgoing
$ENQ New Lock Requests            674059                0
  0
$ENQ Conversion Requests          497982                0
  0
$DEQ Dequeue Requests             671626                0
  0
```

```
Blocking ASTs                        26              0
  0
Directory Functions                                  0
  0
Deadlock Messages                                    0
  0

$ENQ Requests that Wait         822     Deadlock Searches Performed
  0
$ENQ Requests not Queued          3     Deadlock Found
  0

MSCP Statistics:                        Total IOs
  0
Count of VC Failures              0     Split IOs
  0
Count of Hosts Served             0     IOs that had to Wait (Buf)
  0
Count of Disks Served            10     Requests in MemWait Queue
  0
MSCP_BUFFER (SYSGEN)            128     Max Req ever in MemWait
  0
MSCP_CREDITS (SYSGEN)             8

File System Cache:     Current SYSGEN Param        Hits      Misses
 Hitrate
File Header Cache     (ACP_HDRCACHE  = 726)      196207        1214
 99.3%
Storage Bitmap Cache  (ACP_MAPCACHE  = 181)          38           9
 80.8%
Directory Data Cache  (ACP_DIRCACHE  = 726)      153415         199
 99.8%
Directory LRU         (ACP_DINDXCACHE= 181)      138543         106
 99.9%
FID Cache             (ACP_FIDCACHE  =  64)         119           6
 95.2%
Extent Cache          (ACP_EXTCACHE  =  64)         229           9
 96.2%
Quota Cache           (ACP_QUOCACHE  = 365)           0           0
 0.0%

Volume Synch Locks              958     Window Turns
 1464
Volume Synch Locks Wait           0     Currently Open Files
 630
Dir/File Synch Locks         432071     Total Count of OPENs
 52903
Dir/file Synch Locks Wait       746     Total Count of ERASE QIOs
 186
Access Locks                 151648
Free Space Cache Wait         12608

Global Pagefile Quota        785957     GBLPAGFIL (SYSGEN) Limit
 786688
```

The CLUE MEMORY/STATISTIC command displays systemwide performance data such as page fault, I/O, pool, lock manager, MSCP, and file system cache statistics.

5.4.10. CLUE PROCESS

Displays process-related information from the current process context.

Format

CLUE PROCESS [/qualifier[,...]]

Parameters

None.

Qualifiers

/ALL

Ignored except when specified with /BUFFER. Displays the buffer objects for all processes (that is, all existing buffer objects).

/BUFFER

Displays the buffer objects for the current process or for all processes if /ALL is specified.

/LAYOUT

Displays the process P1 virtual address space layout.

/LOGICAL

Displays the process logical names and equivalence names, if they can be accessed.

/RECALL

Displays the DCL recall buffer, if it can be accessed.

Description

The CLUE PROCESS command displays process-related information from the current process context. Much of this information is in pageable address space and thus may not be present in a dump file.

Examples

1.
```
SDA>  CLUE PROCESS/LOGICAL
Process Logical Names:
----------------------
   "SYS$OUTPUT" = "_CLAWS$LTA5004:"
   "SYS$OUTPUT" = "_CLAWS$LTA5004:"
   "SYS$DISK" = "WORK1:"
   "BACKUP_FILE" = "_$65$DUA6"
   "SYS$PUTMSG" = "...À...À.."
   "SYS$COMMAND" = "_CLAWS$LTA5004:"
   "TAPE_LOGICAL_NAME" = "_$1$MUA3:"
   "TT" = "LTA5004:"
   "SYS$INPUT" = "_$65$DUA6:"
   "SYS$INPUT" = "_CLAWS$LTA5004:"
   "SYS$ERROR" = "21C00303.LOG"
   "SYS$ERROR" = "_CLAWS$LTA5004:"
```

```
"ERROR_FILE" = "_$65$DUA6"
```

The CLUE PROCESS/LOGICAL command displays logical names for each running process.

2.
```
SDA>  CLUE PROCESS/RECALL
Process DCL Recall Buffer:
--------------------------
Index  Command
  1    ana/sys
  2    @login
  3    mc sysman io auto /log
  4    show device d
  5    sea <.x>*.lis clue$
  6    tpu <.x>*0914.lis
  7    sh log *hsj*
  8    xd <.x>.lis
  9    mc ess$ladcp show serv
 10    tpu clue_cmd.cld
 11    ana/sys
```

The CLUE PROCESS/RECALL command displays a listing of the DCL commands that have been executed most recently.

5.4.11. CLUE REGISTER

Displays the active register set for the crash CPU. The CLUE REGISTER command is valid only when analyzing crash dumps.

Format

CLUE REGISTER [/CPU [cpu-id|ALL]

|/PROCESS [/ADDRESS=*n*|INDEX=*n*

|/IDENTIFICATION=*n*|process-name|ALL]]

Parameters

ALL

When used with /CPU, it requests information about all CPUs in the system. When used with /PROCESS, it requests information about all processes that exist in the system.

cpu-id

When used with /CPU, it gives the number of the CPU for which information is to be displayed. Use of the cpu-id parameter causes the CLUE REGISTER command to perform an implicit SET CPU command, making the indicated CPU the current CPU for subsequent SDA commands.

progress-name

When used with /PROCESS, it gives the name of the process for which information is to be displayed. Use of the **process-name** parameter, the /ADDRESS qualifier, the /INDEX qualifier, or the /IDENTIFICATION qualifier causes the CLUE REGISTER command to perform an implicit SET PROCESS command, making the indicated process the current process for subsequent SDA commands. You can determine the names of the processes in the system by issuing a SHOW SUMMARY command.

The **process-name** can contain up to 15 letters and numerals, including the underscore (_) and dollar sign ($). If it contains any other characters, you must enclose the **process-name** in quotation marks (" ").

Qualifiers

/ADDRESS=*n*

Specifies the PCB address of the desired process when used with CLUE REGISTER/PROCESS.

/CPU [cpu-id|ALL]

Indicates that the registers for a CPU are required. Specify the CPU by its number or use ALL to indicate all CPUs.

/IDENTIFICATION=*n*

Specifies the identification of the desired process when used with CLUE REGISTER/PROCESS.

/INDEX=*n*

Specifies the index of the desired process when used with CLUE REGISTER/PROCESS.

/PROCESS [process-name|ALL]

Indicates that the registers for a process are required. The process should be specified with either one of the qualifiers /ADDRESS, /IDENTIFICATION, or /INDEX, or by its name, or by using ALL to indicate all processes.

Description

The CLUE REGISTER command displays the active register set of the crash CPU. It also identifies any known data structures, symbolizes any system virtual addresses, interprets the processor status (PS), and attempts to interpret R0 as a condition code.

If neither /CPU nor /PROCESS is specified, the parameter (*cpu-id* or *process-name*) is ignored and the registers for the SDA current process are displayed.

Examples

```
SDA> CLUE REGISTER
Current Registers:   Process index: 0042   Process name: BATCH_3   PCB:
 817660C0   (CPU 1)
----------------------------------------------------------------
   R0  =  00000000.00000000
   R1  =  FFFFFFFF.814A2C80   MP_CPU  (CPU Id 1)
   R2  =  00000000.00000000
   R3  =  00000000.23D6BBEE
   R4  =  00000000.00000064
   R5  =  FFFFFFFF.831F8000   PHD
   R6  =  00000000.12F75475
   R7  =  00000000.010C7A70
   R8  =  00000000.00000001
   R9  =  00000000.00000000
   R10 =  00000000.00000000
   R11 =  FFFFFFFF.814A2C80   MP_CPU  (CPU Id 1)
   R12 =  FFFFFFFF.810AA5E0   SYSTEM_SYNCHRONIZATION+293E0
   R13 =  FFFFFFFF.810AC408   SMP$TIMEOUT
```

```
R14 =  FFFFFFFF.810AED00   SMP$GL_SCHED
R15 =  00000000.7FFA1DD8
R16 =  00000000.0000078C
R17 =  00000000.00000000
R18 =  FFFFFFFF.810356C0   SYS$CPU_ROUTINES_2208+1D6C0
R19 =  FFFFFFFF.81006000   EXE$GR_SYSTEM_DATA_CELLS
R20 =  FFFFFFFF.80120F00   SCH$QEND_C+00080
R21 =  00000000.00000000
R22 =  FFFFFFFF.00000000
R23 =  00000000.00000000
R24 =  00000000.00000000
AI  =  FFFFFFFF.81006000   EXE$GR_SYSTEM_DATA_CELLS
RA  =  00000000.00000000
PV  =  00000000.00000000
R28 =  FFFFFFFF.810194A0   EXE$GL_TIME_CONTROL
FP  =  00000000.7FFA1F90
PC  =  FFFFFFFF.800863A8   SMP$TIMEOUT_C+00068
PS  =  18000000.00000804   Kernel Mode, IPL 8, Interrupt
```

5.4.12. CLUE SCSI

Displays information related to SCSI and Fibre Channel.

Format

CLUE SCSI {/CONNECTION=*n* |/PORT=*n*|/REQUEST=*n*|/SUMMARY}

Qualifiers

/CONNECTION=*scdt-address*

Displays information about SCSI connections and decodes the SCSI connection descriptor data structure identified by the SCDT address.

/PORT=*spdt-address*

Displays all or a specific port descriptor identified by its SPDT address.

/REQUEST=*scdrp-address*

Displays information about SCSI requests and decodes the SCSI class driver request packet identified by the SCDRP address.

/SUMMARY

Displays a summary of all SCSI and FC ports and devices and their type and revisions.

Description

The CLUE SCSI command displays information about SCSI and Fibre Channel.

Examples

1.
```
SDA> CLUE SCSI/SUMMARY
SCSI Summary Configuration:
---------------------------
SPDT      Port  STDT   SCSI-Id  SCDT  SCSI-Lun  Device      UCB
 Type   Rev
```

```
--------------  --------------  --------------  --------  --------
 ------  ---
854EB840  PKB0
8549B000  PKA0
                8549D880     0
                                8549DA80     0  DKA0      854C2B00
 36.4G   HPC5
85250040  FGB0
                8549CC80     1
                                8549D500     0  GGA41     8569EDC0
 MSA100
                                85537A40     2  DGA10     85537C00
 MSA100  4.48
                                85538F00     3  DGA20     855390C0
 MSA100  4.48
                                8553A040     4  DGA30     8553A200
 MSA100  4.48
                                8553B340     6  DGA31     8553B500
 MSA100  4.48
                                8553C480     7  DGA21     8553C640
 MSA100  4.48
                                8553D140    11  DGA50     8553D300
 MSA100  4.48
                                8553DE00    12  DGA51     8553DFC0
 MSA100  4.48
                                8553EF40    21  DGA40     8553F100
 MSA100  4.48
851BED80  FGA0
                851BBE00     1
                                851BFA80     0  GGA40     8569E780
 MSA100
                                851C2040     7  DGA21     851A9740
 MSA100  4.48
                                85512840     2  DGA10     85512CC0
 MSA100  4.48
                                85513380     3  DGA20     85513540
 MSA100  4.48
                                85513D80     4  DGA30     85529EC0
 MSA100  4.48
                                8552CA40     6  DGA31     8552CC00
 MSA100  4.48
                                8552F640    11  DGA50     8552F800
 MSA100  4.48
                                85532240    12  DGA51     85532400
 MSA100  4.48
                                85534E40    21  DGA40     85535000
 MSA100  4.48
```

This example shows a full summary report, which includes all SCSI and FC ports and devices and their type and revisions.

2.
```
SDA> CLUE SCSI/PORT=851BED80
SCSI Port Descriptor (SPDT):
----------------------------
FGA0:                                   Driver        SYS$PGQDRIVER
SPDT Address                851BED80    Port Type     QLogic
 ISP23xx FibreChannel
ADP Address                 85189E00    Adapter       PCI
```

```
UCB Address                 8519B4C0        Device
 00000000.00000000 ()
Busarray Address            8518A180        Port Host SCSI Id
       0
Port Flags
 mapping_reg,dir_dma,luns,cmdq,port_autosense,smart_port
Port Device Status          online
Port Dev Status at DIPL     stdt_scdt
Target inited Bus Resets           0        Number of Events
       0
Retry Attempts                     0        Curr I/Os on all Ports
       0
Stray Interrupts                   0        Curr I/Os on all Devices
       0
Unexpected Interrupts              0        Total Outstanding I/Os
       0
Reselections                       0
CRAB Address                8515DD00        Port Wait Queue    empty
Port CRAM Address           00000000        Nonpg Pool FKB Que empty
Port IDB Address            85151340        Bus Reset Waiters  empty
```

This example shows a report for the PORT with SPDT address 851BED80.

3.
```
SDA> CLUE SCSI/CONNECTION=85512840
SCSI Connection Descriptor (SCDT):
----------------------------------
SCDT Connection Descriptor  85512840        Device
 DGA10
STDT Target Descriptor      851BBE00        Type
 MSA1000 VOLUME
SPDT Port Descriptor        851BED80        Revision                4.48
Port UCB Address            8519B4C0        Target SCSI Id
       1
Device UCB Address          85512CC0        Device SCSI Lun
     512
Connection State            open
Capability Mask             scsi_2,cmdq
Connection Flags            ena_discon
Queue Flags                 -
DIPL Queue Flags            -
Total Outstanding I/Os             0        Number of Commands sent
       0
Outstanding Port I/Os              0        Number of Messages sent
       0
Outstanding Device I/Os            0        Number of Bytes sent
       0
Arbitration Failures               0        Parity Errors
       0
Selection Failures                 0        Missing Phase Errors
       0
Count of Controller Errors         0        Bad Phase Errors
       0
Count of Bus Errors                0        Count of Retries
       0
```

This report includes information about SCSI connections and decodes the SCSI connection descriptor data structure identified by the SCDT address 85512840.

5.4.13. CLUE SG

Displays the scatter-gather map.

Format

`CLUE SG [/CRAB=address]`

Parameters

None.

Qualifiers

/CRAB=address

Displays the ringbuffer for the specified Counted Resource Allocation Block (CRAB). The default action is to display the ringbuffer for all CRABs.

Description

CLUE SG decodes and displays the scatter/gather ringbuffer entries.

Examples

1.
```
SDA> CLUE SG/CRAB=81224740
Scatter/Gather Ringbuffer for CRAB 81224740:
--------------------------------------------
XAct   CRCTX     Item_Num  Item_Cnt  DMA_Addr  Status    Callers_PC                                   Count     Buf_Addr
----   --------  --------  --------  --------  --------  -------------------------------------------  --------  --------
ALLO   81272780  00000020  00000004  00000000  00000001  847DDA94  SYS$EWDRIVER+01A94                 00000018  81240AE0
ALLO   81272700  0000001C  00000004  00000000  00000001  847DDA94  SYS$EWDRIVER+01A94                 00000017  81240AC0
ALLO   81272680  00000018  00000004  00000000  00000001  847DDA94  SYS$EWDRIVER+01A94                 00000016  81240AA0
ALLO   81272600  00000014  00000004  00000000  00000001  847DDA94  SYS$EWDRIVER+01A94                 00000015  81240A80
ALLO   81272580  00000010  00000004  00000000  00000001  847DDA94  SYS$EWDRIVER+01A94                 00000014  81240A60
ALLO   81272500  0000000C  00000004  00000000  00000001  847DDA94  SYS$EWDRIVER+01A94                 00000013  81240A40
ALLO   81272480  00000008  00000004  00000000  00000001  847DDA94  SYS$EWDRIVER+01A94                 00000012  81240A20
ALLO   81272400  00000004  00000004  00000000  00000001  847DDA94  SYS$EWDRIVER+01A94                 00000011  81240A00
ALLO   81272380  00000000  00000004  00000000  00000001  847DDA94  SYS$EWDRIVER+01A94                 00000010  812409E0
DEAL   841DBEA0  00000000  0000000C  C0000000  00000001  803B5124  SYS$PKQDRIVER+0B124                0000000F  812409C0
ALLO   841DBEA0  00000000  0000000C  00000000  00000001  803B4FB8  SYS$PKQDRIVER+0AFB8                0000000E  812409A0
DEAL   841DBEA0  00000000  00000012  C0000000  00000001  803B5124  SYS$PKQDRIVER+0B124                0000000D  81240980
ALLO   841DBEA0  00000000  00000012  00000000  00000001  803B4FB8  SYS$PKQDRIVER+0AFB8                0000000C  81240960
DEAL   841DBEA0  00000000  0000000C  C0000000  00000001  803B5124  SYS$PKQDRIVER+0B124                0000000B  81240940
ALLO   841DBEA0  00000000  0000000C  00000000  00000001  803B4FB8  SYS$PKQDRIVER+0AFB8                0000000A  81240920
DEAL   841DBEA0  00000000  00000012  C0000000  00000001  803B5124  SYS$PKQDRIVER+0B124                00000009  81240900
ALLO   841DBEA0  00000000  00000012  00000000  00000001  803B4FB8  SYS$PKQDRIVER+0AFB8                00000008  812408E0
DEAL   841DBEA0  00000000  00000012  C0000000  00000001  803B5124  SYS$PKQDRIVER+0B124                00000007  812408C0
ALLO   841DBEA0  00000000  00000012  00000000  00000001  803B4FB8  SYS$PKQDRIVER+0AFB8                00000006  812408A0
DEAL   841DBEA0  00000000  00000012  C0000000  00000001  803B5124  SYS$PKQDRIVER+0B124                00000005  81240880
ALLO   841DBEA0  00000000  00000012  00000000  00000001  803B4FB8  SYS$PKQDRIVER+0AFB8                00000004  81240860
DEAL   841DBEA0  00000000  00000012  C0000000  00000001  803B5124  SYS$PKQDRIVER+0B124                00000003  81240840
ALLO   841DBEA0  00000000  00000012  00000000  00000001  803B4FB8  SYS$PKQDRIVER+0AFB8                00000002  81240820
DEAL   841DBEA0  00000000  0000000C  C0001E00  00000001  803B5124  SYS$PKQDRIVER+0B124                00000001  81240800
ALLO   841DBEA0  00000000  0000000C  00000000  00000001  803B4FB8  SYS$PKQDRIVER+0AFB8                00000000  812407E0
```

In this example, the scatter-gather ring buffer for the CRAB at address 81224740 is displayed.

2.
```
SDA> CLUE SG/CRAB=8120D600
Scatter/Gather Ringbuffer for CRAB 8120D600:
--------------------------------------------
XAct   CRCTX     Item_Num  Item_Cnt  DMA_Addr  Status    Callers_PC                                   Count     Buf_Addr
----   --------  --------  --------  --------  --------  -------------------------------------------  --------  --------
ALLO   8128A380  0001C000  00004000  00000000  00000001  8480E990  SYS$MCDRIVER+02990                 00000000  8121C760
```

In this example, the scatter-gather ring buffer for the CRAB address 8120D600 is displayed.

5.4.14. CLUE STACK

On Alpha, CLUE STACK identifies and displays the current stack. On Integrity servers, CLUE STACK only identifies the current stack without displaying it. Use the SDA command SHOW STACK on both Alpha and Integrity servers to display and decode the whole stack for the more common bugcheck types.

Format

CLUE STACK

Parameters

None.

Qualifiers

None.

Description

The CLUE STACK command identifies and displays the current stack together with the upper and lower stack limits. In case of a FATALEXCPT, INVEXCEPTN, SSRVEXCEPT, UNXSIGNAL, or PGFIPLHI bugcheck, CLUE STACK tries to decode the whole stack.

Examples

```
SDA>  CLUE STACK
Stack Decoder:
--------------
Normal Process Kernel Stack:
Stack Pointer         00000000.7FFA1C98
Stack Limits (low)    00000000.7FFA0000
             (high)   00000000.7FFA2000

SSRVEXCEPT Stack:
-----------------
Stack Pointer  SP =>  00000000.7FFA1C98

Information saved by Bugcheck:
a(Signal Array)       00000000.7FFA1C98  00000000.00000000

EXE$EXCPTN[E] Temporary Storage:
EXE$EXCPTN[E] Stack Frame:
PV                    00000000.7FFA1CA0  FFFFFFFF.829CF010  EXE$EXCPTN
        Entry Point                      FFFFFFFF.82A21000  EXE$EXCPTN_C
return PC             00000000.7FFA1CA8  FFFFFFFF.82A2059C  SYS
$CALL_HANDL_C+0002C
saved R2              00000000.7FFA1CB0  00000000.00000000
saved FP              00000000.7FFA1CB8  00000000.7FFA1CD0

SYS$CALL_HANDL Temporary Storage:
                      00000000.7FFA1CC0  FFFFFFFF.829CEDA8  SYS$CALL_HANDL
                      00000000.7FFA1CC8  00000000.00000000
SYS$CALL_HANDL Stack Frame:
PV                    00000000.7FFA1CD0  FFFFFFFF.829CEDA8  SYS$CALL_HANDL
        Entry Point                      FFFFFFFF.82A20570  SYS
$CALL_HANDL_C
                      00000000.7FFA1CD8  00000000.00000000
return PC             00000000.7FFA1CE0  FFFFFFFF.82A1E930  CHF_REI+000DC
saved FP              00000000.7FFA1CE8  00000000.7FFA1F40

Fixed Exception Context Area:
```

```
Linkage Pointer       00000000.7FFA1CF0  FFFFFFFF.80C63780
 EXCEPTION_MON_NPRW+06D80
a(Signal Array)       00000000.7FFA1CF8  00000000.7FFA1EB8
a(Mechanism Array)    00000000.7FFA1D00  00000000.7FFA1D40
a(Exception Frame)    00000000.7FFA1D08  00000000.7FFA1F00
Exception FP          00000000.7FFA1D10  00000000.7FFA1F40
Unwind SP             00000000.7FFA1D18  00000000.00000000
Reinvokable FP        00000000.7FFA1D20  00000000.00000000
Unwind Target         00000000.7FFA1D28  00000000.00020000  SYS
$K_VERSION_04
#Sig Args/Byte Cnt    00000000.7FFA1D30  00000005.00000250  BUG$_NETRCVPKT
a(Msg)/Final Status   00000000.7FFA1D38  829CE050.000008F8  BUG
$_SEQ_NUM_OVF

Mechanism Array:
Flags/Arguments       00000000.7FFA1D40  00000000.0000002C
a(Establisher FP)     00000000.7FFA1D48  00000000.7AFFBAD0
reserved/Depth        00000000.7FFA1D50  FFFFFFFF.FFFFFFFD
a(Handler Data)       00000000.7FFA1D58  00000000.00000000
a(Exception Frame)    00000000.7FFA1D60  00000000.7FFA1F00
a(Signal Array)       00000000.7FFA1D68  00000000.7FFA1EB8
saved R0              00000000.7FFA1D70  00000000.00020000  SYS
$K_VERSION_04
saved R1              00000000.7FFA1D78  00000000.00000000
saved R16             00000000.7FFA1D80  00000000.00020004  UCB
$M_NI_PRM_MLT+00004
saved R17             00000000.7FFA1D88  00000000.00010050  SYS
$K_VERSION_16+00010
saved R18             00000000.7FFA1D90  FFFFFFFF.FFFFFFFF
saved R19             00000000.7FFA1D98  00000000.00000000
saved R20             00000000.7FFA1DA0  00000000.7FFA1F50
saved R21             00000000.7FFA1DA8  00000000.00000000
saved R22             00000000.7FFA1DB0  00000000.00010050  SYS
$K_VERSION_16+00010
saved R23             00000000.7FFA1DB8  00000000.00000000
saved R24             00000000.7FFA1DC0  00000000.00010051  SYS
$K_VERSION_16+00011
saved R25             00000000.7FFA1DC8  00000000.00000000
saved R26             00000000.7FFA1DD0  FFFFFFFF.8010ACA4  AMAC
$EMUL_CALL_NATIVE_C+000A4
saved R27             00000000.7FFA1DD8  00000000.00010050  SYS
$K_VERSION_16+00010
saved R28             00000000.7FFA1DE0  00000000.00000000
FP Regs not valid     [................]
a(Signal64 Array)     00000000.7FFA1EA0  00000000.7FFA1ED0
SP Align = 10(hex)    [................]

Signal Array:
Arguments             00000000.7FFA1EB8           00000005
Condition             00000000.7FFA1EBC           0000000C
Argument #2           00000000.7FFA1EC0           00010000  LDRIMG
$M_NPAGED_LOAD
Argument #3           00000000.7FFA1EC4           00000000
Argument #4           00000000.7FFA1EC8           00030078  SYS
$K_VERSION_01+00078
Argument #5           00000000.7FFA1ECC           00000003

64-bit Signal Array:
```

```
Arguments             00000000.7FFA1ED0  00002604.00000005
Condition             00000000.7FFA1ED8  00000000.0000000C
Argument #2           00000000.7FFA1EE0  00000000.00010000  LDRIMG
$M_NPAGED_LOAD
Argument #3           00000000.7FFA1EE8  00000000.00000000
Argument #4           00000000.7FFA1EF0  00000000.00030078  SYS
$K_VERSION_01+00078
Argument #5           00000000.7FFA1EF8  00000000.00000003

Interrupt/Exception Frame:
saved R2              00000000.7FFA1F00  00000000.00000003
saved R3              00000000.7FFA1F08  FFFFFFFF.80C63460
 EXCEPTION_MON_NPRW+06A60
saved R4              00000000.7FFA1F10  FFFFFFFF.80D12740  PCB
saved R5              00000000.7FFA1F18  00000000.000000C8
saved R6              00000000.7FFA1F20  00000000.00030038  SYS
$K_VERSION_01+00038
saved R7              00000000.7FFA1F28  00000000.7FFA1FC0
saved PC              00000000.7FFA1F30  00000000.00030078  SYS
$K_VERSION_01+00078
saved PS              00000000.7FFA1F38  00000000.00000003  IPL INT CURR
 PREV
SP Align = 00(hex)    [...............]                      00  0  Kern
 User

Stack Frame:
PV                    00000000.7FFA1F40  00000000.00010050  SYS
$K_VERSION_16+00010
       Entry Point                       00000000.00030060  SYS
$K_VERSION_01+00060
                      00000000.7FFA1F48  00000000.00010000  LDRIMG
$M_NPAGED_LOAD
return PC             00000000.7FFA1F50  FFFFFFFF.8010ACA4  AMAC
$EMUL_CALL_NATIVE_C+000A4
saved FP              00000000.7FFA1F58  00000000.7FFA1F70

Stack (not decoded):
                      00000000.7FFA1F60  00000000.00000001
                      00000000.7FFA1F68  FFFFFFFF.800EE81C  RM_STD
$DIRCACHE_BLKAST_C+005AC

Stack Frame:
PV                    00000000.7FFA1F70  FFFFFFFF.80C6EBA0  EXE$CMKRNL
       Entry Point                       FFFFFFFF.800EE6C0  EXE$CMKRNL_C
                      00000000.7FFA1F78  00000000.829CEDE8  EXE$SIGTORET
                      00000000.7FFA1F80  00010050.00000002
                      00000000.7FFA1F88  00000000.00020000  SYS
$K_VERSION_04
                      00000000.7FFA1F90  00000000.00030000  SYS
$K_VERSION_01
return PC             00000000.7FFA1F98  FFFFFFFF.800A4D64
 __RELEASE_LDBL_EXEC_SERVICE+00284
saved R2              00000000.7FFA1FA0  00000000.00000003
saved R4              00000000.7FFA1FA8  FFFFFFFF.80D12740  PCB
saved R13             00000000.7FFA1FB0  00000000.00010000  LDRIMG
$M_NPAGED_LOAD
saved FP              00000000.7FFA1FB8  00000000.7AFFBAD0
```

```
Interrupt/Exception Frame:
saved R2              00000000.7FFA1FC0  00000000.7FFCF880  MMG$IMGHDRBUF
+00080
saved R3              00000000.7FFA1FC8  00000000.7B0E9851
saved R4              00000000.7FFA1FD0  00000000.7FFCF818  MMG$IMGHDRBUF
+00018
saved R5              00000000.7FFA1FD8  00000000.7FFCF938  MMG$IMGHDRBUF
+00138
saved R6              00000000.7FFA1FE0  00000000.7FFAC9F0
saved R7              00000000.7FFA1FE8  00000000.7FFAC9F0
saved PC              00000000.7FFA1FF0  FFFFFFFF.80000140  SYS$CLREF_C
saved PS              00000000.7FFA1FF8  00000000.0000001B  IPL INT CURR
 PREV
SP Align = 00(hex)    [...............]                      00  0  User
 User
```

CLUE STACK identifies and displays the current stack and its upper and lower limit. It then decodes the current stack if it is one of the more common bugcheck types. In this case, CLUE STACK tries to decode the entire INVEXCEPTN stack.

5.4.15. CLUE SYSTEM

Displays the contents of the shared logical name tables in the system.

Format

CLUE SYSTEM /LOGICAL

Parameters

None.

Qualifiers

/LOGICAL

Displays all the shared logical names.

Description

The CLUE SYSTEM/LOGICAL command displays the contents of the shared logical name tables in the system.

Examples

```
SDA> CLUE SYSTEM/LOGICAL
Shareable Logical Names:
------------------------
   "XMICONBMSEARCHPATH" = "CDE$HOME_DEFAULTS:[ICONS]%B%M.BM"
   "MTHRTL_TV" = "MTHRTL_D53_TV"
   "SMGSHR_TV" = "SMGSHR"
   "DECW$DEFAULT_KEYBOARD_MAP" = "NORTH_AMERICAN_LK401AA"
   "CONVSHR_TV" = "CONVSHR"
   "XDPS$INCLUDE" = "SYS$SYSROOT:[XDPS$INCLUDE]"
   "DECW$SYSTEM_DEFAULTS" = "SYS$SYSROOT:[DECW$DEFAULTS.USER]"
   "SYS$PS_FONT_METRICS" = "SYS$SYSROOT:[SYSFONT.PS_FONT_METRICS.USER]"
   "SYS$TIMEZONE_NAME" = "???"
```

```
"STARTUP$STARTUP_VMS" = "SYS$STARTUP:VMS$VMS.DAT"
"PASMSG" = "PAS$MSG"
"UCX$HOST" = "SYS$COMMON:[SYSEXE]UCX$HOST.DAT;1"
"SYS$SYLOGIN" = "SYS$MANAGER:SYLOGIN"
"DNS$SYSTEM" = "DNS$SYSTEM_TABLE"
"IPC$ACP_ERRMBX" = "d.Ú."
"CDE$DETACHED_LOGICALS" = "DECW$DISPLAY,LANG"
"DECW$SERVER_SCREENS" = "GXA0"
"DNS$_COTOAD_MBX" = "ä<â."
"DNS$LOGICAL" = "DNS$SYSTEM"
"OSIT$MAILBOX" = "äAë."
"XNL$SHR_TV" = "XNL$SHR_TV_SUPPORT.EXE"
"MOM$SYSTEM" = "SYS$SYSROOT:[MOM$SYSTEM]"
"MOP$LOAD" = "SYS$SYSROOT:<MOM$SYSTEM>"
.
.
.
```

5.4.16. CLUE VCC

Displays virtual I/O cache-related information. If extended file cache (XFC) is enabled, the CLUE VCC command is disabled.

Format

CLUE VCC [/qualifier[,...]]

Parameters

None.

Qualifiers

/CACHE

Decodes and displays the cache lines that are used to correlate the file virtual block numbers (VBNs) with the memory used for caching. Note that the cache itself is not dumped in a selective dump. Use of this qualifier with a selective dump produces the following message:

```
%CLUE-I-VCCNOCAC, Cache space not dumped because DUMPSTYLE is selective
```

/LIMBO

Walks through the limbo queue (LRU order) and displays information for the cached file header control blocks (FCBs).

/STATISTIC

Displays statistical and performance information related to the virtual I/O cache.

/VOLUME

Decodes and displays the cache volume control blocks (CVCB).

Examples

1. `SDA>  CLUE VCC/STATISTIC`

```
Virtual I/O Cache Statistics:
-----------------------------
Cache State       pak,on,img,data,enabled
Cache Flags       on,protocol_only
Cache Data Area   80855200
Total Size (pages)            400     Total Size (MBytes)
  3.1 MB
Free Size (pages)               0     Free Size (MBytes)
  0.0 MB
Read I/O Count              34243     Read I/O Bypassing Cache
 3149
Read Hit Count              15910     Read Hit Rate
 46.4%
Write I/O Count              4040     Write I/O Bypassing Cache
 856
IOpost PID Action Rtns      40829     IOpost Physical I/O Count
 28
IOpost Virtual I/O Count        0     IOpost Logical I/O Count
  7
Read I/O past File HWM        124     Cache Id Mismatches
 44
Count of Cache Block Hits     170     Files Retained
 100
Cache Line LRU    82B11220 82B11620     Oldest Cache Line Time
 00001B6E
Limbo LRU Queue   80A97E3C 80A98B3C     Oldest Limbo Queue Time
 00001B6F
Cache VCB Queue   8094DE80 809AA000     System Uptime (seconds)
 00001BB0
```

2.
```
SDA>  CLUE VCC/VOLUME
Virtual I/O Cache - Cache VCB Queue:
------------------------------------
CacheVCB RealVCB   LockID      IRP Queue     CID  LKSB Ocnt State
-------- -------- -------- ----------------- ---- ---- ----
 ---------------
8094DE80 80A7E440 020007B2 8094DEBC 8094DEBC 0000 0001 0002 on
809F3FC0 809F97C0 0100022D 809F3FFC 809F3FFC 0000 0001 0002 on
809D0240 809F7A40 01000227 809D027C 809D027C 0000 0001 0002 on
80978B80 809F6C00 01000221 80978BBC 80978BBC 0000 0001 0002 on
809AA000 809A9780 01000005 809AA83C 809AA03C 0007 0001 0002 on
```

3.
```
SDA>  CLUE VCC/LIMBO
Virtual I/O Cache - Limbo Queue:
--------------------------------
  CFCB     CVCB     FCB      CFCB   IOerrors   FID (hex)
-------- -------- -------- -Status- -------- --------------
80A97DC0 809AA000 80A45100 00000200 00000000 (076B,0001,00)
80A4E440 809AA000 809CD040 00000200 00000000 (0767,0001,00)
80A63640 809AA000 809FAE80 00000200 00000000 (0138,0001,00)
80AA2540 80978B80 80A48140 00000200 00000000 (0AA5,0014,00)
80A45600 809AA000 80A3AC00 00000200 00000000 (0C50,0001,00)
80A085C0 809AA000 809FA140 00000200 00000000 (0C51,0001,00)
80A69800 809AA000 809FBA00 00000200 00000000 (0C52,0001,00)
80951000 809AA000 80A3F140 00000200 00000000 (0C53,0001,00)
80A3E580 809AA000 80A11A40 00000200 00000000 (0C54,0001,00)
80A67F80 809AA000 80978F00 00000200 00000000 (0C55,0001,00)
809D30C0 809AA000 809F4CC0 00000200 00000000 (0C56,0001,00)
```

```
809D4B80 809AA000 8093E540 00000200 00000000 (0C57,0001,00)
[......]
80A81600 809AA000 8094B2C0 00000200 00000000 (0C5D,0001,00)
80AA3FC0 809AA000 80A2DEC0 00000200 00000000 (07EA,000A,00)
80A98AC0 809AA000 8093C640 00000200 00000000 (0C63,0001,00)
```

4.
```
SDA>  CLUE VCC/CACHE

Virtual I/O Cache - Cache Lines:
--------------------------------
   CL       VA      CVCB     CFCB     FCB      CFCB   IOerrors   FID
 (hex)
-------- -------- -------- -------- -------- -Status- --------
 ------------
82B11200 82880000 809D0240 809D7000 80A01100 00000200 00000000
 (006E,0003,00)
82B15740 82AAA000 809AA000 80A07A00 80A24240 00000000 00000000
 (0765,0001,00)
82B14EC0 82A66000 809AA000 80A45600 80A3AC00 00000200 00000000
 (0C50,0001,00)
82B12640 82922000 809D0240 809D7000 80A01100 00000200 00000000
 (006E,0003,00)
82B123C0 8290E000 809AA000 80A45600 80A3AC00 00000200 00000000
 (0C50,0001,00)
82B13380 8298C000 809D0240 809D7000 80A01100 00000200 00000000
 (006E,0003,00)
82B15A40 82AC2000 809AA000 80A45600 80A3AC00 00000200 00000000
 (0C50,0001,00)
82B15F40 82AEA000 809D0240 809D7000 80A01100 00000200 00000000
 (006E,0003,00)
82B12AC0 82946000 809D0240 809D7000 80A01100 00000200 00000000
 (006E,0003,00)
82B12900 82938000 809D0240 809D7000 80A01100 00000200 00000000
 (006E,0003,00)
82B10280 82804000 809AA000 80A45600 80A3AC00 00000200 00000000
 (0C50,0001,00)
82B122C0 82906000 809AA000 80A1AC00 80A48000 00000000 00000000
 (0164,0001,00)
82B14700 82A28000 809AA000 809FFEC0 809F8DC0 00000004 00000000
 (07B8,0001,00)
82B11400 82890000 809AA000 80A113C0 80A11840 00000000 00000000
 (00AF,0001,00)
[......]
82B11380 8288C000 809AA000 809DA0C0 809C99C0 00002000 00000000
 (00AB,0001,00)
82B130C0 82976000 809AA000 809DA0C0 809C99C0 00002000 00000000
 (00AB,0001,00)
82B11600 828A0000 809AA000 809DA0C0 809C99C0 00002000 00000000
 (00AB,0001,00)
```

5.4.17. CLUE XQP

Displays XQP-related information.

Format

`CLUE XQP [/qualifier[,...]]`

Parameters

None.

Qualifiers

/ACTIVE

Displays all active XQP processes. (See also /FULL.)

/AQB

Displays any current I/O request packets (IRPs) waiting at the interlocked queue.

/BFRD=index

Displays the buffer descriptor (BFRD) referenced by the index specified. The index is identical to the hash value.

/BFRL=index

Displays the buffer lock block descriptor (BFRL) referenced by the index specified. The index is identical to the hash value.

/BUFFER=(n,m)

Displays the BFRDs for a given pool. Specify either 0, 1, 2 or 3, or a combination of these in the parameter list. (See also /FULL.)

/CACHE_HEADER

Displays the block buffer cache header.

/FCB=address

Displays all file header control blocks (FCBs) with a nonzero DIRINDX for a given volume. If no address is specified, the current volume of the current process is used. (See also /FULL.)

The address specified can also be either a valid volume control block (VCB), unit control block (UCB), or window control block (WCB) address.

/FILE=address

Decodes and displays file header (FCB), window (WCB), and cache information for a given file. The file can be identified by either its FCB or WCB address.

/FULL

Ignored except when used with certain other qualifiers. When used with /ACTIVE, CLUE displays additional data on the XQP's caller (for Alpha only). When used with /BUFFER or /VALIDATE, CLUE displays additional data on each buffer descriptor. When used with /FCB, CLUE displays all FCBs, including any that are unused.

/GLOBAL

Displays the global XQP area for a given process.

/LBN_HASH=lbn

Calculates and displays the hash value for a given logical block number (LBN).

/LIMBO

Searches through the limbo queue and displays FCB information from available, but unused file headers.

/LOCK=lockbasis

Displays all file system serialization, arbitration, and cache locks found for the specified lockbasis.

/THREAD=n

Displays the XQP thread area for a given process. The specified thread number is checked for validity. If no thread number is specified, the current thread is displayed. If no current thread, but only one single thread is in use, then that thread is displayed. If more than one thread exists or an invalid thread number is specified, then a list of currently used threads is displayed.

/VALIDATE=(n,m)

Performs certain validation checks on the block buffer cache to detect corruption. Specify 1, 2, 3, 4, or a combination of these in the parameter list. If an inconsistency is found, a minimal error message is displayed. (See also /FULL.)

Description

The CLUE XQP command displays XQP information. XQP is part of the I/O subsystem.

Examples

1.
```
SDA>  CLUE XQP/CACHE_HEADER
Block Buffer Cache Header:
--------------------------
Cache_Header   8437DF90    BFRcnt         000005D2    FreeBFRL
 843916A0
Bufbase        8439B400    BFRDbase       8437E080    BFRLbase
 8438F7E0
Bufsize        000BA400    LBNhashtbl     84398390    BFRLhashtbl
 84399BC8
Realsize       000D78A0    LBNhashcnt     0000060E    BFRLhashcnt
 0000060E

Pool           #0          #1          #2          #3
Pool_LRU       8437E5C0    84385F40    84387E90    8438EEB0
               8437F400    84385D60    8438AC80    8438EE20
Pool_WAITQ     8437DFE0    8437DFE8    8437DFF0    8437DFF8
               8437DFE0    8437DFE8    8437DFF0    8437DFF8
Waitcnt        00000000    00000000    00000000    00000000
Poolavail      00000094    00000252    00000251    00000094
Poolcnt        00000095    00000254    00000254    00000095

AmbigQFL       00000000    Process_Hits   00000000    Cache_Serial
 00000000
AmbigQBL       00000000    Valid_Hits     00000000    Cache_Stalls
 00000000
```

```
Disk_Reads      00000000    Invalid_Hits   00000000    Buffer_Stalls
 00000000
Disk_Writes     00000000    Misses         00000000
```

The SDA command CLUE XQP/CACHE_HEADER displays the block buffer cache header.

2.
```
SDA>  CLUE XQP/VALIDATE=(1,4)
Searching BFRD Array for possible Corruption...
Searching Lock Basis Hashtable for possible Corruption...
```

In this example, executing the CLUE XQP/VALIDATE=(1,4) command indicated that no corruption was detected in either the BFRD Array or the Lock Basis Hashtable.

Chapter 6. SDA FLT Extension

The Alignment Fault Utility (FLT) finds alignment faults and records them in a ring buffer, which can be sized when starting alignment fault tracing. The summary screen displays the results sorted by the program counter (PC) that has incurred the most alignment faults. The detailed trace output also shows the process identification (PID) of the process that caused the alignment fault, with the virtual address that triggered the fault.

Output can be directed to a file using the SDA SET OUTPUT command.

FLT can be started and stopped as required without the need for a system reboot.

6.1. FLT Commands

The table below summarizes the commands for the FLT utility.

Table 6.1. Commands for the Alignment Fault Utility

Commands	Description
FLT LOAD	Loads the FLT$DEBUG execlet.
FLT UNLOAD	Unloads the FLT$DEBUG execlet.
FLT START TRACE	Starts alignment fault tracing.
FLT	Lists the FLT commands.
FLT STOP TRACE	Stops tracing.
FLT SHOW TRACE	Displays detailed information about the trace.

The end of this chapter has an example of how you might use these FLT commands.

6.1.1. FLT

When entered with no keywords, lists the FLT commands.

Format

FLT

Parameters

None.

Qualifiers

None.

6.1.2. FLT LOAD

Loads the FLT$DEBUG execlet. Do this before starting alignment fault tracing.

Format

FLT LOAD

Parameters

None.

Qualifiers

None.

6.1.3. FLT SHOW TRACE

Displays detail about the trace.

Format

FLT SHOW TRACE [/SUMMARY [/RATES (d) | /TOTALS]]

Parameters

None.

Qualifiers

/RATES

When used with /SUMMARY, the alignment fault rate per second for each PC during the collection interval is displayed. This is the default.

/SUMMARY

Displays the results sorted by the program counter (PC) that has incurred the most alignment faults.

/TOTALS

When used with /SUMMARY, the total number of alignment faults for each PC during the collection interval is displayed.

6.1.4. FLT START TRACE

Starts alignment fault tracing. By default, all PCs are traced.

Format

START TRACE [/BUFFER=pages] [/BEGIN=pc_range_low]

[/CALLER] [/END=pc_range_high]

[/INDEX=pid] [MODE=(mode,...)]

Parameters

None.

Qualifiers

/BUFFER=pages

The number of pages to size the trace buffer. The default is 128 pages or 1MB.

/BEGIN=pc_range_low

Start of range of PCs to trace.

/CALLER

For each alignment fault, in addition to recording the PC that incurred the fault, FLT also records the PCs of the caller, the callers caller, and so on, for up to 10 call frames.

/END=pc_range_high

End of range of PCs to trace.

/INDEX=pid

Only trace alignment faults for the specified process. You can specify the process index itself, or the process identification or extended process identification, from which the process index is extracted.

/MODE=(mode,...)

Only trace alignment faults that occur in the specified modes. Allowed modes are KERNEL, EXEC, SUPER and USER. If you specify only one mode, you can omit the parentheses.

6.1.5. FLT STOP TRACE

Stops tracing.

Format

`FLT STOP TRACE`

Parameters

None.

Qualifiers

None.

6.1.6.

Unloads the FLT$DEBUG execlet.

Format

`FLT UNLOAD`

Parameters

None.

Qualifiers

None.

Example

```
SDA> flt load
SDA> flt start trace
 .
 .
 .
SDA> flt show trace /summary

Fault Trace Information: (at 12-OCT-2004 16:09:29.43, trace time 00:00:55.145335)
--------------------------------------------------------------------------------
Exception PC              Count   Exception PC                          Module                            Offset
-----------------   ------------   -------------------------------------  ---------------------------------
FFFFFFFF.86214790           973   RDMSHRP72+0019E790                    RDMSHRP72                       0019E790
FFFFFFFF.86214791           871   RDMSHRP72+0019E791                    RDMSHRP72                       0019E791
FFFFFFFF.8620B261           700   RDMSHRP72+00195261                    RDMSHRP72                       00195261
FFFFFFFF.8620B260           700   RDMSHRP72+00195260                    RDMSHRP72                       00195260
FFFFFFFF.841C3451           208   LIBRTL+00195451                       LIBRTL                          00195451
FFFFFFFF.818E43E0           193   NET$TRANSPORT_NSP+303E0               NET$TRANSPORT_NSP               000303E0
FFFFFFFF.818E4400           193   NET$TRANSPORT_NSP+30400               NET$TRANSPORT_NSP               00030400
FFFFFFFF.818E4430           193   NET$TRANSPORT_NSP+30430               NET$TRANSPORT_NSP               00030430
FFFFFFFF.818E4450           193   NET$TRANSPORT_NSP+30450               NET$TRANSPORT_NSP               00030450
FFFFFFFF.818E44B1           193   NET$TRANSPORT_NSP+304B1               NET$TRANSPORT_NSP               000304B1
FFFFFFFF.818E44D0           193   NET$TRANSPORT_NSP+304D0               NET$TRANSPORT_NSP               000304D0
FFFFFFFF.818E6720           186   NET$TRANSPORT_NSP+32720               NET$TRANSPORT_NSP               00032720
FFFFFFFF.818E64C0           179   NET$TRANSPORT_NSP+324C0               NET$TRANSPORT_NSP               000324C0
FFFFFFFF.818E6520           179   NET$TRANSPORT_NSP+32520               NET$TRANSPORT_NSP               00032520
FFFFFFFF.86DE9480           166   RDMSHRP72+00D73480                    RDMSHRP72                       00D73480
FFFFFFFF.807814A1           162   EXE$SETOPR_C+00841                    MESSAGE_ROUTINES                0001D7A1
FFFFFFFF.86DE8C90           146   RDMSHRP72+00D72C90                    RDMSHRP72                       00D72C90
FFFFFFFF.86DE8EC0           146   RDMSHRP72+00D72EC0                    RDMSHRP72                       00D72EC0
FFFFFFFF.8701C340           146   RDMSHRP72+00FA6340                    RDMSHRP72                       00FA6340
FFFFFFFF.862026E1           100   RDMSHRP72+0018C6E1                    RDMSHRP72                       0018C6E1
FFFFFFFF.86202580           100   RDMSHRP72+0018C580                    RDMSHRP72                       0018C580
FFFFFFFF.862025B0           100   RDMSHRP72+0018C5B0                    RDMSHRP72                       0018C5B0
FFFFFFFF.8701B900            83   RDMSHRP72+00FA5900                    RDMSHRP72                       00FA5900
00000000.000EE990            37
00000000.000EEA51            37
00000000.000EE8D1            37
FFFFFFFF.807359C1            28   LOCKING+253C1                         LOCKING                         000253C1
FFFFFFFF.807359F1            28   LOCKING+253F1                         LOCKING                         000253F1
FFFFFFFF.80732EE0            27   LCK$FILL_RSB_CACHE_C+008F0            LOCKING                         000228E0
FFFFFFFF.86DE8690            18   RDMSHRP72+00D72690                    RDMSHRP72                       00D72690
FFFFFFFF.80B388A0            15   SECURITY+461A0                        SECURITY                        000461A0
FFFFFFFF.80B213F0            13   NSA$SIZE_NSAB_C+00840                 SECURITY                        0002ECF0
FFFFFFFF.86DFE9E0            12   RDMSHRP72+00D889E0                    RDMSHRP72                       00D889E0
[...............]


SDA> flt show trace

Unaligned Data Fault Trace Information:
---------------------------------------
Timestamp               CPU  Unaligned VA       Exception PC                             Access     EPID      Trace Buffer
----------------------- ---  -----------------  ---------------------------------------  --------  --------  -----------------
12-OCT 16:09:56.439499  02  00000000.014A4F8A  86214791 RDMSHRP72+0019E791           Exec      39C004DC  FFFFFFFF.74921610
12-OCT 16:09:56.439493  02  00000000.023DFFD4  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.749215E8
12-OCT 16:09:56.439486  02  00000000.014A4F42  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.749215C0
12-OCT 16:09:56.439480  02  00000000.014A4F8A  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.74921598
12-OCT 16:09:56.439254  02  00000000.0154F1DC  807814A1 EXE$SETOPR_C+00841           Exec      39C004DC  FFFFFFFF.74921570
12-OCT 16:09:56.431606  02  00000000.014A4F5A  86214791 RDMSHRP72+0019E791           Exec      39C004DC  FFFFFFFF.74921548
12-OCT 16:09:56.431601  02  00000000.022DEE44  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.74921520
12-OCT 16:09:56.431594  02  00000000.014A4F42  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.749214F8
12-OCT 16:09:56.431588  02  00000000.014A4F5A  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.749214D0
12-OCT 16:09:56.430255  02  00000000.0155BDDC  807814A1 EXE$SETOPR_C+00841           Exec      39C004DC  FFFFFFFF.749214A8
12-OCT 16:09:56.426878  02  00000000.014A4F72  86214791 RDMSHRP72+0019E791           Exec      39C004DC  FFFFFFFF.74921480
12-OCT 16:09:56.426872  02  00000000.02394ED4  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.74921458
12-OCT 16:09:56.426865  02  00000000.014A4F42  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.74921430
12-OCT 16:09:56.426859  02  00000000.014A4F72  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.74921408
12-OCT 16:09:56.426583  02  00000000.0154A97C  807814A1 EXE$SETOPR_C+00841           Exec      39C004DC  FFFFFFFF.749213E0
12-OCT 16:09:56.421244  02  00000000.014A4F52  86214791 RDMSHRP72+0019E791           Exec      39C004DC  FFFFFFFF.749213B8
12-OCT 16:09:56.421238  02  00000000.02296824  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.74921390
12-OCT 16:09:56.421232  02  00000000.014A4F42  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.74921368
12-OCT 16:09:56.421226  02  00000000.014A4F52  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.74921340
12-OCT 16:09:56.420916  02  00000000.0156405C  807814A1 EXE$SETOPR_C+00841           Exec      39C004DC  FFFFFFFF.74921318
12-OCT 16:09:56.413932  02  00000000.014A4F52  86214791 RDMSHRP72+0019E791           Exec      39C004DC  FFFFFFFF.749212F0
12-OCT 16:09:56.413926  02  00000000.023C10D4  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.749212C8
12-OCT 16:09:56.413918  02  00000000.014A4F42  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.749212A0
12-OCT 16:09:56.413913  02  00000000.014A4F52  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.74921278
12-OCT 16:09:56.413645  02  00000000.01564E9C  807814A1 EXE$SETOPR_C+00841           Exec      39C004DC  FFFFFFFF.74921250
12-OCT 16:09:56.403972  02  00000000.014A4F52  86214791 RDMSHRP72+0019E791           Exec      39C004DC  FFFFFFFF.74921228
12-OCT 16:09:56.403966  02  00000000.023036C4  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.74921200
12-OCT 16:09:56.403960  02  00000000.014A4F42  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.749211D8
12-OCT 16:09:56.403954  02  00000000.014A4F52  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.749211B0
12-OCT 16:09:56.403689  02  00000000.0155E47C  807814A1 EXE$SETOPR_C+00841           Exec      39C004DC  FFFFFFFF.74921188
12-OCT 16:09:56.395575  02  00000000.014A4F8A  86214791 RDMSHRP72+0019E791           Exec      39C004DC  FFFFFFFF.74921160
12-OCT 16:09:56.395569  02  00000000.02448D24  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.74921138
12-OCT 16:09:56.395562  02  00000000.014A4F42  86214790 RDMSHRP72+0019E790           Exec      39C004DC  FFFFFFFF.74921110
```

```
[....................]
```

Chapter 7. SDA OCLA Extension (Alpha Only)

The Alpha EV7 On-Chip Logic Analyzer (OCLA) utility collects Program Counter (PC) traces in a portion of the Alpha EV7 cache. This data enables the user to tell which instructions each Alpha EV7 CPU on the system has executed.

7.1. Overview of OCLA

OCLA enables the user to tell which instructions each Alpha EV7 CPU has executed by setting aside one seventh of the Alpha EV7 cache as acquisition memory which stores the virtual addresses of instructions executed by the Alpha EV7 CPU. The acquisition memory in the cache can later be analyzed with an SDA extension.

The acquisition of instructions can be enabled or disabled while the system is running, thereby allowing the acquisition of instruction streams for a given period of time without the need to restart the system.

If the OCLA is enabled and started, and your system subsequently fails due to a crash, the current acquisition memory is automatically saved to the system dump file. The instructions executed by each CPU prior to the system failure can then be analyzed with SDA. Upon restart of the system, the acquisition memory in the EV7 is still there and can be copied into system memory using the OCLA ENABLE and OCLA DUMP commands.

If the STOP/CPU command is issued on a CPU for which OCLA has been enabled, OCLA is automatically disabled if the CPU is allowed to leave the active set. When a CPU is started with the START/CPU command, OCLA is not automatically enabled; rather, it must be enabled using SDA.

Table 7.1 summarizes the SDA commands and qualifiers for the OCLA utility.

7.2. SDA OCLA Commands

Table 7.1. SDA Commands for the OCLA Utility

Commands	Description
OCLA ENABLE	Enables the OCLA. The command reserves one seventh of the EV7 cache as acquisition memory for instructions.
OCLA DISABLE	Disables the OCLA and returns the cache set to the Alpha EV7 CPU.
OCLA DUMP	Copies the acquisition memory in the Alpha EV7 cache to a region in system space for later analysis by SDA.
OCLA HELP	Provides online help about OCLA commands.
OCLA LOAD	Loads the OCLA$PCTRACE execlet. This must be done prior to enabling any OCLA.
OCLA SET REGISTER/RESET	Resets OCLA registers to the default values.
OCLA SHOW REGISTER	Displays detailed information about the OCLA registers.

Commands	Description
OCLA SHOW STATUS	Displays the status of an OCLA.
OCLA SHOW TRACE	Decodes the acquired compressed instruction stream and displays it.
OCLA START	Starts the acquisition of instructions into the acquisition memory.
OCLA STOP	Stops the acquisition of instructions.
OCLA UNLOAD	Unloads the OCLA$PCTRACE execlet and returns the acquisition buffers to the system.

7.2.1. OCLA DISABLE

Disables the OCLA and returns the cache set to the Alpha EV7 CPU.

Format

`OCLA DISABLE [/CPU=n]`

Parameters

None.

Qualifier

/CPU=n

Specifies the CPU on which OCLA should be disabled. If this qualifier is omitted, OCLA is disabled on every CPU in the system.

7.2.2. OCLA DUMP

Copies the acquisition memory in the Alpha EV7 cache to a region in system space for later analysis by SDA. When a system fails, data collected in the EV7 cache is automatically saved in the system dump file for each enabled CPU. (See the OCLA SHOW TRACE command for more information.)

Format

`OCLA DUMP [/CPU=n]`

Parameters

None.

Qualifier

/CPU=n

Specifies the CPU for which to dump the acquisition memory. If this qualifier is omitted, the acquisition memory is dumped for all CPUs.

7.2.3. OCLA ENABLE

Enables the OCLA. Reserves one-seventh of the EV7 cache as acquisition memory for instructions.

Format

`OCLA ENABLE [/CPU=n] [/RESET]`

Parameters

None.

Qualifiers

/CPU=n

Specifies the CPU on which to enable OCLA. If this qualifier is omitted, OCLA is enabled on every CPU in the system.

/RESET

Initializes the OCLA to default values.

Under certain circumstances, the OCLA might not be initialized properly when the system is powered on. For more information, see the OCLA SHOW REGISTER command.

If you wish to reset only certain registers to default values, use the OCLA SET REGISTER/RESET command.

7.2.4. OCLA HELP

Provides online help on OCLA commands.

Format

`OCLA HELP`

Parameters

None.

Qualifiers

None.

7.2.5. OCLA LOAD

Loads the OCLA$PCTRACE execlet. This must be done before enabling any OCLA.

Format

`OCLA LOAD`

Parameters

None.

Qualifiers

None.

7.2.6. OCLA SET REGISTER

Resets a specified OCLA register to its default value. The /RESET qualifier is required for this operation.

Format

`OCLA SET REGISTER /RESET keyword`

Parameter

keyword

Specifies which OCLA register to reset to its default value. The valid keywords are as follows:

MISC	OCLA 1 miscellaneous register
OCLA1_CTL	OCLA 1 control register
PC_CTL	OCLA 1 PC control register
SMASK	OCLA 1 select mask register
SMATCH	OCLA 1 select match register
TMASK	OCLA 1 trigger mask register
TMATCH	OCLA 1 trigger match register

Note

You cannot reset all registers using a single command if OCLA has already been enabled. You must first disable OCLA using the OCLA DISABLE command. You can then reset all the registers by performing an OCLA ENABLE/RESET command.

Qualifier

/RESET

This qualifier is required to reset the specified register to its default value.

7.2.7. OCLA SHOW REGISTER

Displays detailed information about OCLA registers.

Format

`OCLA SHOW REGISTER [/CPU=n]`

Parameter

None.

Qualifier

/CPU=n

Specifies the CPU for which to display registers. If this qualifier is omitted, registers are displayed for all CPUs.

Example

```
SDA>  SHOW REGISTER/CPU=7
OCLA EV7 CPU Registers for CPU: 07
----------------------------------
ZBOX control register for CPU 07: 00000000ffffffff

CBOX control register for CPU 07: 078000001024a807

OCLA 1 MISC register for CPU 07:  0000000000000000

OCLA 1 TMATCH:    40000002ffffffff
OCLA 1 SMATCH:    0000000000000000
OCLA 1 PC_TMATCH: 0000000000000000
OCLA 1 PC_SMATCH: 0000000000000000

OCLA 1 TMASK:     4000000000000000
OCLA 1 SMASK:     0000000000000000
OCLA 1 PC_TMASK:  0000000000000000
OCLA 1 PC_SMASK:  0000000000000000

OCLA 1 control register for CPU 07: 8000210000000000
Enab Run  RDRST ITRIG IFULL TAG_EN TS_EN PDAT_EN SFILT TMODE IRQF IRQT
 TIHANG
   1   0      0     0     0      0    0        0    00    00    0    0
 0
TAG_SRC EXT_SRC TS_FORCE EIO WRAP SREL  AMATCH  AADDR
    000     004        0   0    1    0   00000  00000

OCLA 1 PC Control register for CPU 07: 000000000000003f
STGSEL TRGSEL OUTSEL CDEPTH        CMASK CAMEN
    03     03     03     00        00000     0
```

This command displays all OCLA-related registers on the EV7 CPU. This particular CPU was enabled with the /RESET qualifier, so the values have default settings.

7.2.8. OCLA SHOW STATUS

Displays the status of an OCLA.

Format

OCLA SHOW STATUS [/CPU=n]

Parameters

None.

Qualifiers

/CPU=n

Specifies the CPU for which to show OCLA status. If this qualifier is omitted, status is displayed for all CPUs.

Example

```
SDA> OCLA SHOW STATUS
EV7 OCLA status
---------------
CPU 00 is enabled, no entries, no dump done
CPU 01 is enabled, no entries, no dump done
CPU 02 is enabled, no entries, no dump done
CPU 03 is enabled, no entries, no dump done
CPU 04 is enabled, no entries, no dump done
CPU 05 is enabled, no entries, no dump done
CPU 06 is enabled, no entries, no dump done
CPU 07 is enabled, running, no entries, no dump done
```

7.2.9. OCLA SHOW TRACE

Decodes the acquired compressed instruction stream and displays it.

Format

`OCLA SHOW TRACE [/CPU=n] [/LAST=n][/NOPAL][/REVERSE][/SUMMARY][/SYMBOLIZE]`

Parameters

None.

Qualifiers

/CPU=n

Specifies the CPU for which to show data. If this qualifier is omitted, trace data is displayed for all CPUs.

/LAST=n

Displays the last n instructions. If this qualifier is omitted, trace data is displayed for all instructions.

/NOPAL

Do not include PAL code when displaying instructions.

/REVERSE

Displays the instructions in reverse order.

/SUMMARY

Displays the last 42 instructions.

/SYMBOLIZE

Attempts to symbolize each instruction.

Example

```
SDA> OCLA SHOW TRACE/CPU=7/SUMMARY/SYMBOLIZE
OCLA PC trace information for CPU 07
------------------------------------
CPU 07 has 16384 valid entries
42 PC values displayed
0000002c00030358 ,PAL Code
0000002c0003035c ,PAL Code
ffffffff81244c94  OCLA$DEBUG+00C94
ffffffff81244c98  OCLA$DEBUG+00C98
ffffffff81244c9c  OCLA$DEBUG+00C9C
ffffffff81244ca0  OCLA$DEBUG+00CA0
ffffffff81244ca4  OCLA$DEBUG+00CA4
ffffffff81244ca8  OCLA$DEBUG+00CA8
ffffffff81244cac  OCLA$DEBUG+00CAC
ffffffff81244cb0  OCLA$DEBUG+00CB0
ffffffff81244cd0  OCLA$DEBUG+00CD0
ffffffff81244cd4  OCLA$DEBUG+00CD4
ffffffff81244cd8  OCLA$DEBUG+00CD8
ffffffff81244cdc  OCLA$DEBUG+00CDC
ffffffff81244ce0  OCLA$DEBUG+00CE0
 ...
```

This example shows a summary of the last PC instructions executed by CPU 7 and symbolizes the PC values.

In this example, lines of PAL code are identified by ",PAL Code".

7.2.10. OCLA START

Starts the acquisition of instructions into acquisition memory.

Format

`OCLA START [/CPU=n]`

Parameters

None.

Qualifiers

/CPU=n

The CPU on which to start instruction acquisition. If this qualifier is omitted, instruction acquisition is started on all CPUs.

7.2.11. OCLA STOP

Stops the acquisition of instructions.

Format

`OCLA STOP [/CPU=n]`

Parameters

None.

Qualifiers

/CPU=n

Specifies the CPU on which to stop acquisition. If this qualifier is omitted, acquisition is stopped on all CPUs.

7.2.12. OCLA UNLOAD

Unloads the OCLA$PCTRACE execlet and returns the acquisition buffers to the system.

Format

`OCLA UNLOAD`

Parameters

None.

Qualifiers

None.

Examples

1.
```
SDA> OCLA DUMP
OCLA PC trace performed for 8 CPUs
SDA> OCLA SHOW TRACE/SUMMARY/SYMBOLIZE/CPU=0
OCLA PC trace information for CPU 00
------------------------------------
CPU 00 has 16384 valid entries
The overhead per allocation is 1208
42 PC values displayed
ffffffff8012d3ac  SCH$CALC_CPU_LOAD_C+0030C
ffffffff8012d3b0  SCH$CALC_CPU_LOAD_C+00310
ffffffff8012d3b4  SCH$CALC_CPU_LOAD_C+00314
ffffffff8012d3b8  SCH$CALC_CPU_LOAD_C+00318
ffffffff8012d3bc  SCH$CALC_CPU_LOAD_C+0031C
ffffffff8012d3c0  SCH$CALC_CPU_LOAD_C+00320
ffffffff8012d4d8  SCH$CALC_CPU_LOAD_C+00438
...
```

This series of commands demonstrates how you can use the OCLA SDA extension to interactively inspect a running system by reading the EV7 acquisition memory. The second command copies the EV7 acquisition cache memory into system memory and displays the collected values for CPU 0.

2.
```
SDA> OCLA LOAD
OCLA$PCTRACE load status = 00000001

SDA> OCLA ENABLE/RESET
OCLA PC tracing enabled for 8 CPUs

SDA> OCLA START
OCLA PC tracing started for 8 CPUs
```

The series of commands in this example demonstrates how to load the OCLA execlet, enable the OCLA SDA extensions on each CPU in the system, and start each OCLA. Once started, the EV7 OCLA extensions collect data for each PC instruction executed by the active CPUs in the system.

In the unlikely event of a system failure, PC values recorded by the OCLA extensions are stored in the system dump file and can later be retrieved by using the System Dump Analyzer (SDA).

3.
```
SDA> OCLA STOP
OCLA PC tracing stopped for 8 CPUs

SDA> OCLA DISABLE
OCLA PC tracing disabled for 8 CPUs

SDA> OCLA UNLOAD
OCLA$PCTRACE unload status = 00000001
```

This series of commands stops all running OCLA extensions, disables and frees up system memory associated with each OCLA, and unloads the OCLA execlet from system memory.

Chapter 8. SDA SPL Extension

This chapter presents an overview of the SDA Spinlock Tracing (SPL) Utility and describes the SDA Spinlock Tracing commands.

8.1. Overview of the SDA Spinlock Tracing Utility

To synchronize access to data structures, the OpenVMS operating system uses a set of static and dynamic spinlocks, such as IOLOCK8 and SCHED. The operating system acquires a spinlock to synchronize data, and at the end of the critical code path the spinlock is then released. If a CPU attempts to acquire a spinlock while another CPU is holding it, the CPU attempting to acquire the spinlock has to spin, waiting until the spinlock is released. Any lost CPU cycles within such a spinwait loop are charged as MPsynch time.

By using the MONITOR utility, you can monitor the time in process modes, for example, with the command $ MONITOR MODES. A high rate of MP synchronization indicates contention for spinlocks. However, until the implementation of the Spinlock Tracing utility, there was no way to tell which spinlock was heavily used, and who was acquiring and releasing the contended spinlocks. The Spinlock Tracing utility allows a characterization of spinlock usage. It can also collect performance data for a given spinlock on a per-CPU basis.

This tracing ability is built into the system synchronization execlet, which contains the spinlock code, and can be enabled or disabled while the system is running. There is no need to reboot the system to load a separate debug image. The images that provide spinlock tracing functionality are as follows:

SYS$LOADABLE_IMAGES:SPL$DEBUG.EXE

SYS$SHARE:SPL$SDA.EXE

The SDA> prompt provides the command interface. From this command interface, you can load and unload the spinlock debug execlet using SPL LOAD and SPL UNLOAD, and start, stop and display spinlock trace data. This allows you to collect spinlock data for a given period of time without system interruption. Once information is collected, the trace buffer can be deallocated and the execlet can be unloaded to free up system resources. The spinlock trace buffer is allocated from S2 space and pages are taken from the free page list.

Should the system crash while spinlock tracing is enabled, the trace buffer is dumped into the system dump file, and it can later be analyzed using the spinlock trace utility. This is very useful in tracking down CPUSPINWAIT bugcheck problems.

Note that by enabling spinlock tracing, there is a performance impact. The amount of the impact depends on the amount of spinlock usage.

8.2. How to Use the SDA Spinlock Tracing Utility

The following steps will enable you to collect spinlock statistics using the Spinlock Tracing Utility.

1. Load the Spinlock Tracing Utility execlet.

```
SDA> SPL LOAD
```

2. Allocate a trace buffer and start tracing.

   ```
   SDA> SPL START TRACE
   ```

3. Wait a few seconds to allow some tracing to be done, then find out which spinlocks are incurring the most acquisitions and the most spinwaits.

   ```
   SDA> SPL SHOW TRACE/SUMMARY
   ```

   For example, you might see contention for the SCHED and IOLOCK8 spinlocks (a high acquisition count, with a significant proportion of the acquisitions being forced to wait).

4. Look to see if the spinlocks with a high proportion of spinwaits caused a significant delay in the acquisition of the spinlock. You must now collect more detailed statistics on a specific spinlock.

   ```
   SDA> SPL START COLLECT/SPINLOCK=SCHED
   ```

   This command accumulates additional data for the specified spinlock. As long as tracing is not stopped, collection will continue to accumulate spinlock-specific data from the trace buffer.

5. Display the additional data collected for the specified spinlock.

   ```
   SDA> SPL SHOW COLLECT
   ```

   This display includes the average hold time of the spinlock and the average spinwait time while acquiring the spinlock.

6. Repeat steps 4 and 5 for each spinlock that has contention. A START COLLECT cancels the previous collection.

7. Disable spinlock tracing when you have collected all the needed spinlock statistics and release all the memory used by the Spinlock Tracing utility with the following commands.

   ```
   SDA> SPL STOP COLLECT
   SDA> SPL STOP TRACE
   SDA> SPL UNLOAD
   ```

8.3. Example Command Procedure for Collection of Spinlock Statistics

The following example shows a command procedure that can be used for gathering spinlock statistics:

```
$ analyze/system
  spl load
  spl start trace/buffer=1000
  wait 00:00:15
  spl stop trace
  read/executive/nolog
  set output spl_trace.lis
  spl analyze
  spl show trace/summary
  spl start collect/spin=sched
  wait 00:00:05
```

```
  spl show collect
  spl start collect/spin=iolock8
  wait 00:00:05
  spl show collect
  spl start collect/spin=lckmgr
  wait 00:00:05
  spl show collect
  spl start collect/spin=mmg
  wait 00:00:05
  spl show collect
  spl start collect/spin=timer
  wait 00:00:05
  spl show collect
  spl start collect/spin=mailbox
  wait 00:00:05
  spl show collect
  spl start collect/spin=perfmon
  wait 00:00:05
  spl show collect
  spl stop collect
  spl unload
  exit
$ exit
```

A more comprehensive procedure is provided as SYS$EXAMPLES:SPL.COM.

8.4. SDA Spinlock Tracing Commands

The SPL commands are described below.

8.4.1. SPL

Invokes the Spinlock Tracing Utility.

When entered by itself with no command keyword, the SPL command lists the SPL command options.

```
SDA> SPL
```

8.4.2. SPL ANALYZE

Analyzes collected spinlock data and presents the most relevant data.

Format

`SPL ANALYZE [/[NO]CPU_STATISTICS |/[NO]PLATFORM | /[NO]HOLD_TIMES=n/[NO]WAIT_`

Parameters

None.

Qualifiers

/CPU_STATISTICS (default)

/NOCPU_STATISTICS

Displays per-CPU statistics.

/HOLD_TIMES=n

/NOHOLD_TIMES=n

Displays occurrences of spinlocks held longer than n microseconds. The default is 1000 microseconds.

/PLATFORM (default)

/NOPLATFORM

Displays system platform information.

/USAGE=(HOLD=n,SPIN=n, TOP_PCS=n)

Specifies thresholds for displaying information on a spinlock. If the percentage of time a spinlock is held exceeds the value of HOLD=n, where n is a value from 0 to 100, displays the information on the spinlock. The default is 10%. If the percentage of time a spinlock is spinning exceeds the value of SPIN=n, displays the information on the spinlock. The default is 10%. If either the HOLD or SPIN thresholds are exceeded, displays information on a spinlock. The TOP_PCS=n keyword displays the top n unique callers to lock a spinlock. The default is to display the top five unique callers.

By specifying either /USAGE=(HOLD=0) or /USAGE=(SPIN=0), SPL displays information on all spinlock usage from the trace buffer.

/WAIT_TIMES=n

/NOWAIT_TIMES=n

Displays occurrences of spinlocks held longer than n microseconds. The default is 1000 microseconds.

Description

The SPL ANALYZE command analyzes collected spinlock data and displays the most relevant data.

The SPL ANALYZE command provides an overview of SPINLOCK usage on a system. Data are provided by CPU and by spinlock. When looking at a system with high MP_Synch time, this is a good command to start with. Stop spinlock tracing before using this command.

Example

```
SDA> SPL ANALYZE/HOLD=50/WAIT=50/USAGE=HOLD=5

Spinlock Analysis (1)

 Platform
 ------------------------------------------------
 Node:  CLU21
 Hardware: AlphaServer ES45 Model 2
 Active CPUs: 4
 Memory:  16.00 GB
 CPU Frequency: 1.000 GHz
```

```
 Trace Buffer: 1280 pages (10.00 MB)
 Trace Time: 0.48 seconds
 Trace Start: 15-OCT 10:51:53.427386

CPU statistics (2)
              % Time in          % Time          % Time      All Spinlocks  All Spinlocks
CPU ID    Fork Dispatcher   Spinlocks Held       MP_Synch      Acquires/sec     Waits/sec
------    ---------------   --------------      ----------      -------------  -------------
    00               0.1             16.2             1.1            82210.4         1434.7
    01               0.1             15.8             1.2            79551.5         1548.3
    02               0.0             16.4             1.2            85690.9         1511.1
    03               1.7             17.7             1.1            86601.3         1451.2
------    ---------------   --------------      ----------      -------------  -------------
 Total               1.9             66.1             4.6           334054.1         5945.3

Spinlock Usage (3)
                                                                                                Spin to
Spinlock      % Time Held Acquires/sec Average Hold % Time Spinning    Waits/sec  Average Spin   Hold Ratio
------------  ----------- ------------ ------------ --------------- ------------  ------------  -----------
FILSYS               15.6      33776.8         4609             2.6       2314.1         11379          0.2
LCKMGR                9.3      26198.6         3560             1.2       2208.8          5494          0.1
PCB$00000426          7.2      49420.4         1451             0.0         35.1          6342          0.0
PCB$00000428          7.1      49125.2         1437             0.0         14.5          7532          0.0


Spinlock    (4)                                            % Time   Acquires            Spinwaits    Average
        Caller's PC                                          Held       /sec    Average       /sec   Spinwait
        ---------------------------------------------  ------  ---------  ---------  ---------  ---------
FILSYS
        8022CA44  SEARCH_FCB_C+00604                     12.0     4021.3      29793      303.5      11985
        80222E10  SET_DIRINDX_C+00030                     0.5     4194.7       1163      247.7      11477
        8021B06C  START_REQUEST_C+0006C                   0.4     2438.0       1607      384.0      15838
        8021B208  FINISH_REQUEST_C+00058                  0.4     2440.1       1510      206.4      15862
        800FC508  IOC_STD$MAPVBLK_C+000C8                 0.3     2014.8       1713      402.5       9518
LCKMGR
        801DEB14  EXE$ENQ_C+00A44                         3.5    12984.7       2657      988.8       5727
        801E3B94  EXE$DEQ_C+00114                         3.0     5943.2       5109      538.8       4849
        801E03BC  LOCKING+023BC                           2.6     5941.2       4315      392.2       5682
        801E5C84  LCK$DEQLOCK_C+00F54                     0.3     1323.2       2091      289.0       5642
PCB$00000426
        801782F8  SCH$ASTDEL_C+00078                      1.9    15525.9       1256        0.0          0
        80179AC4  SCH$QAST_C+00094                        1.7     8907.6       1935        0.0          0
        8017A780  SCH$QUEUE_AST_CURRENT_C+00070           1.2     7859.0       1532        0.0          0
        80178FE0  SCH$ASTDEL_K_C+00090                    1.2     8895.3       1320        8.3       2346
        80179124  SCH$ASTDEL_K_C+001D4                    1.1     7780.5       1355        0.0          0
PCB$00000428
        801782F8  SCH$ASTDEL_C+00078                      2.0    15606.4       1308        0.0          0
        80179AC4  SCH$QAST_C+00094                        1.6     8810.6       1794        0.0          0
        80178FE0  SCH$ASTDEL_K_C+00090                    1.2     8810.6       1344        6.2       2589
        8017A780  SCH$QUEUE_AST_CURRENT_C+00070           1.2     7904.4       1492        0.0          0
        80179124  SCH$ASTDEL_K_C+001D4                    1.0     7728.9       1340        0.0          0
        8017A780  SCH$QUEUE_AST_CURRENT_C+00070           1.1     8655.8       1298        0.0          0
        80179124  SCH$ASTDEL_K_C+001D4                    1.1     8598.0       1225        0.0          0
        80178FE0  SCH$ASTDEL_K_C+00090                    1.1     9192.5       1144        2.1       2326

Long Spinlock Hold Times (> 50 microseconds) (5)

Timestamp              CPU Spinlock | Forklock   Calling PC | Forking PC               EPID      Hold (us)
---------------------- --- --------------------- -------------------------------------- --------  ---------
15-OCT 10:51:53.801244  00 81D6A200 81D6A200      8051B380 LAN$COMPLETE_VCRP_CSMACD_C+00 00000000         64
15-OCT 10:51:53.538665  00 818BBE00 POOL          8004B334 EXE$ALONPAGVAR_C+002F4        00000000         59
15-OCT 10:51:53.538331  03 81F75980 PCB$00000429 8017A808 SCH$QUEUE_AST_CURRENT_C+000F8 00000000         56
15-OCT 10:51:53.597448  03 818BBE00 POOL          8004B334 EXE$ALONPAGVAR_C+002F4        00000000         52
15-OCT 10:51:53.670228  03 818BBE00 POOL          8004B334 EXE$ALONPAGVAR_C+002F4        00000000         51

Long Spinlock Wait Times (> 50 microseconds) (6)

Timestamp              CPU Spinlock | Forklock   Calling PC | Forking PC               EPID      Wait (us)
---------------------- --- --------------------- -------------------------------------- --------  ---------
15-OCT 10:51:53.454082  03 818BCB00 FILSYS        800FC508 IOC_STD$MAPVBLK_C+000C8       00000000         79
15-OCT 10:51:53.661343  02 818BCB00 FILSYS        8021B208 FINISH_REQUEST_C+00058        00000000         76
15-OCT 10:51:53.661256  00 818BCB00 FILSYS        8021EDD0 F11BXQP+08DD0                 00000000         66
15-OCT 10:51:53.898618  00 818BCB00 FILSYS        8021B06C START_REQUEST_C+0006C         00000000         53
```

This example shows the output of the SPL ANALYZE command, which is divided into several sections:

1. Spinlock Analysis:

   Shows information on the platform such as the hardware type, the number of CPUs and the speed of the CPUs.

2. CPU Statistics:

Shows spinlock information on a per CPU basis. The percentage of time the CPU owns spinlock is displayed along with a percentage of time the CPU was executing from the fork dispatcher. This information can be very useful in determining the amount of time a CPU is in use for processing I/O.

3. Spinlock Usage:

   Shows information on the spinlock usage by the system. This data is sorted by the percentage of time the spinlocks are held. The average hold time displayed is in system cycles. The display also includes the percent of time that CPUs are waiting on this spinlock along with the average number of cycles a CPU needed to wait before it was able to acquire the spinlock.

4. Spinlock:

   For each spinlock displayed in section 3, the top callers are displayed sorted by the number of acquires per second that occurred. In addition, the average hold and wait time for each caller is displayed in system cycles.

5. Long Spinlock Hold Times:

   The section on Long Spinlock Hold Times shows occurrences of spinlocks whose hold time exceeded a threshold. In the above report, the threshold was specified as 50 microseconds. The EPID at the time of the acquire is also displayed. An EPID of 0 indicates that the spinlock acquire did not occur in process context.

6. Long Spinlock Wait Times:

   The section on Long Spinlock Wait Times shows occurrences of spinlocks whose wait time exceeded a threshold. In the above report, the threshold was specified as 50 microseconds. The EPID at the time of the acquire is also displayed. An EPID of 0 indicates that the spinlock acquire did not occur in process context.

8.4.3. SPL LOAD

Loads the SPL$DEBUG execlet. This must be done prior to starting spinlock tracing.

Format

SPL LOAD

Parameters

None.

Qualifiers

None.

Description

The SPL LOAD command loads the SPL$DEBUG execlet, which contains the tracing routines.

Example

```
SDA> SPL LOAD
```

```
SPL$DEBUG load status = 00000001
```

8.4.4. SPL SHOW COLLECT

Displays the collected spinlock data.

Format

SPL SHOW COLLECT [/RATES|/TOTALS]

Parameters

None.

Qualifiers

/RATES

Reports activity as a rate per second and hold/spin time as a percentage of time. This is the default.

/TOTALS

Reports activity as a count and hold/spin time as cycles.

Description

The SPL SHOW COLLECT command displays the collected spinlock data. It displays first a summary on a per-CPU basis, followed by the callers of the specific spinlock. This second list is sorted by the top consumers of the spinlock (in percent of time held). These displays show average spinlock hold and spinlock wait time in system cycles.

Example

```
SDA> SPL SHOW COLLECT

Spinlock Trace Information for SCHED:
-------------------------------------

                                                                                                       Spin to
CPU ID      % Time Held   Acquires/sec   Average Hold   % Time Spinning     Waits/sec   Average Spin   Hold Ratio
------  ---------------   ------------   ------------   ---------------  ------------   ------------  -----------
    08              4.6         1651.4           8296               0.3         298.2           2601         0.06
    09              4.9         1941.8           7578               0.2         276.3           1841         0.03
    10              4.0         1593.5           7454               0.1         225.4           1794         0.03
    11              5.2         2185.6           7185               0.2         272.8           1924         0.03
    12              5.4         2105.1           7702               0.2         271.3           2012         0.03
    13              5.7         6131.5           2785               2.5        2288.8           3330         0.45
        ---------------   ------------   ------------   ---------------  ------------   ------------  -----------
                   29.7        15608.8           6833               3.5        3632.8           2250         0.12

Spinlock Trace Information for SCHED: ( 6-DEC-2001 09:01:52.26,  3.3 nsec, 300 MHz)
----------------------------------------------------------------------------------

                                                     % Time   Acquires                                  Spinwaits    Average  % Time
Caller's PC                                            Held       /sec    Maximum   Minimum    Average       /sec   Spinwait    Spin
-------------------------------------------------   ------  ---------  ---------  --------  ---------  ---------  ---------  ------
80342384  LCK$SND_CVTREQ_C+00344                      17.1     5758.4      26384      3531       8912       65.7       3181     0.1
8012D53C  SCH$IDLE_C+0024C                             5.3     2614.5      20897      1384       6134     1083.3       1524     0.5
80347BB0  LCK$DEALLOC_LKB_C+00220                      5.2     5880.6       7767       472       2641     2248.5       3332     2.5
80151F84  SCH$INTERRUPT+00064                          0.5      214.1      15564      1619       6895       35.3       6092     0.1
80343FB8  LCK$SND_LOCKREQ_C+00148                      0.4      137.8      24063      4716       9509        0.0          0     0.0
801375C0  SCH$QEND_C+00080                             0.3      228.9      12107      2474       4251       29.0       3315     0.0
```

8.4.5. SPL SHOW TRACE

Displays spinlock tracing information.

Format

SPL SHOW TRACE [/[NO]ACQUIRE | /CPU=n

| /[NO]FORKLOCK=forklock | /[NO]FRKDSPTH

| /[NO]FRKEND | /RATES | /[NO]RELEASE

| /[NO]SPINLOCK=spinlock | /SUMMARY

| /TOP=n | /TOTALS | /[NO]WAIT]

Parameters

None.

Qualifiers

/ACQUIRE

/NOACQUIRE

The /ACQUIRE qualifier displays any spinlock acquisitions.

The /NOACQUIRE qualifier ignores any spinlock acquisitions.

/CPU=n

Specifies the display of information for a specific CPU only, for example, /CPU=5 or /
CPU=PRIMARY. By default, all trace entries for all CPUs are displayed.

/FORKLOCK=*forklock*

/NOFORKLOCK

The /FORKLOCK=*forklock* qualifier specifies the display of a specific forklock, for example, /
FORKLOCK=IOLOCK8 or /FORKLOCK=IPL8.

The /NOFORKLOCK qualifier specifies that no forklock trace information be displayed. By default, all fork trace entries are decoded and displayed.

/FRKDSPTH

/NOFRKDSPTH

The /FRKDSPTH qualifier displays all invocations of fork routines within the fork dispatcher. This is the default.

The /NOFRKDSPTH qualifier ignores all of the operations of the /FRKDSPTH qualifier.

/FRKEND

/NOFRKEND

The /FRKEND qualifier displays all returns from fork routines within the fork dispatcher. This is the default.

The /NOFRKEND qualifier ignores all operations of the /FRKEND qualifier.

/RATES

Reports activity as a rate per second and hold/spin time as a percentage of time. This is the default.

/RELEASE

/NORELEASE

The /RELEASE qualifier displays any spinlock releases.

The /NORELEASE qualifier ignores any spinlock releases.

/SPINLOCK=*spinlock*

/NOSPINLOCK

The /SPINLOCK=*n* qualifier specifies the display of a specific spinlock, for example, /SPINLOCK=LCKMGR or /SPINLOCK=SCHED.

/NOSPINLOCK specifies that no spinlock trace information be displayed. By default, all spinlock trace entries are decoded and displayed.

/SUMMARY

Steps through the entire trace buffer and displays a summary of all spinlock and forklock activity. It also displays the top ten callers.

/TOP=*n*

Displays a different number other than the top ten callers or fork PCs. By default, the top ten are displayed. This qualifier is useful only when you also specify /SUMMARY.

/TOTALS

Reports activity as a count and hold/spin time as cycles.

/WAIT

/NOWAIT

The /WAIT qualifier displays any spinwait operations.

The /NOWAIT qualifier ignores any spinwait operations.

Description

The SPL SHOW TRACE command displays spinlock tracing information. The latest acquired or released spinlock is displayed first, and then the trace buffer is stepped backwards in time.

By default, all trace entries will be displayed, but you can use qualifiers to select only certain entries.

Since this is not a time critical activity and a table lookup has to be done anyway to translate the SPL address to a spinlock name, commands like /SPINLOCK=(SCHED,IOLOCK8) do work. /SUMMARY will step the entire trace buffer and display a summary of all spinlock activity, along with the top-ten callers' PCs. You can use /TOP=n to display a different number of the top ranked callers.

Examples

```
Spinlock Trace Information:
---------------------------
Timestamp                 CPU Spin/Forklock/IPL Caller's/Fork PC                             EPID     Operation                  Trace Buffer
1                         2   3                 4                                            5        6                          7
------------------------- --- ----------------- -------------------------------------------- -------- -------------------------- -----------------
23-JAN 15:32:03.223052  05 810B2200 MMG      80175594 MMG_STD$IOLOCK_BUF_C+00214    00000568 Release             FFFFFFFE.05F635E0
23-JAN 15:32:04.794732  0B 810B2900 FILSYS   800F4340 IOC_STD$MAPVBLK_C+002A0       0000056E Restore             FFFFFFFE.05F635C0
23-JAN 15:32:05.307011  0D 810B2200 MMG      8017B154 SYS$VM+17154                  00000570 Release             FFFFFFFE.05F635A0
23-JAN 15:32:05.307497  09 810B2100 SCHED    80144770 PROCESS_MANAGEMENT+2A770      00000000 Release             FFFFFFFE.05F63580
23-JAN 15:32:05.306490  0E 810B2200 MMG      8017550C MMG_STD$IOLOCK_BUF_C+0018C    00000571 Acquire  (spin)     FFFFFFFE.05F63560
23-JAN 15:32:05.307951  00 810B2200 MMG      80175D9C MMG_STD$IOUNLOCK_BUF_C+000    00000000 Acquire  (spin)     FFFFFFFE.05F63540
23-JAN 15:32:05.818853  0E 810B2200 MMG      80175594 MMG_STD$IOLOCK_BUF_C+00214    00000571 Release             FFFFFFFE.05F63520
23-JAN 15:32:05.819422  0C 810B2100 SCHED    8011F53C SCH$CALC_CPU_LOAD_C+0049C     00000000 Acquire  (spin)     FFFFFFFE.05F63500
23-JAN 15:32:05.819374  0D 810B2100 SCHED    8014C0E8 EXE$SYNCH_LOOP_C+00458        00000570 Acquire  (spin)     FFFFFFFE.05F634E0
23-JAN 15:32:05.818851  0E 810B2200 MMG      8017550C MMG_STD$IOLOCK_BUF_C+0018C    00000571 Acquire             FFFFFFFE.05F634C0
23-JAN 15:32:05.820320  00 810B2100 SCHED    801473A0 SCH$QAST_C+004F0              00000000 Acqnoipl            FFFFFFFE.05F634A0
23-JAN 15:32:05.819370  0D 810B2700 IOLOCK8  800FFB30 EXE_STD$INSIOQ_C+002B0        00000570 Release             FFFFFFFE.05F63480
23-JAN 15:32:05.819415  0C 810B2100 SCHED    8011F370 SCH$CALC_CPU_LOAD_C+002D0     00000000 Release             FFFFFFFE.05F63460
23-JAN 15:32:05.820316  00 8994FE00 ???      80146F44 SCH$QAST_C+00094              00000000 Acquire  (nospin)   FFFFFFFE.05F63440
23-JAN 15:32:05.820314  00 810B2200 MMG      80175DC0 MMG_STD$IOUNLOCK_BUF_C+000    00000000 Restore             FFFFFFFE.05F63420
23-JAN 15:32:05.820312  00 810B2200 MMG      80175D9C MMG_STD$IOUNLOCK_BUF_C+000    00000000 Acquire             FFFFFFFE.05F63400
23-JAN 15:32:05.819409  0C 810B2100 SCHED    8014C0E8 EXE$SYNCH_LOOP_C+00458        0000056F Acquire             FFFFFFFE.05F633E0
```

Callout	Meaning
1	Shows timestamps that are collected as system cycle counters (SCC) and then displayed with an accuracy down to microseconds. Each CPU is incrementing its own SCC as soon as it is started, so there is some difference between different CPUs' system cycle counters. The standard system time is incremented only every 10 Msec and as such is not exact enough. Adjusting the SCC to the specific CPU's system time and translating it into an accurate timestamp will thus sometimes display times out of order for different CPUs. However, for the same CPU ID, the timestamps are accurate.
2	Shows the physical CPU ID of the CPU logging the trace entry.
3	Shows the address of the spinlock fork. If it is a static one, its name is displayed; otherwise, it is marked as ???.
4	Shows the caller's PC address that acquired or released the spinlock, or the fork PC if the trace entry is a forklock. Symbolization is attempted, so a READ/EXECUTIVE might help to display a routine name, instead of simply a module and offset.
5	Shows the EPID, which is the external PID of the process generating the trace entry. If an interrupt or fork was responsible for the entry, then a zero EPID is displayed.
6	Shows the trace operation. For a spinlock, which was acquired without going through a spinwait,

Callout	Meaning
	there is a matching acquire/release pair of trace entries for the same CPU ID for a given spinlock. If a spinlock is held, it cannot be acquired immediately, so there is also a spinwait trace entry for this pair. The different variations of the acquire and release operations are distinguished, as are the same spinlocks if they are acquired recursively multiple times.
7	Shows the address of the trace buffer entry, in case there is a need to access the raw and undecoded trace data.

```
SDA> SPL SHOW TRACE/SUMMARY 8

Spinlock Trace Information: (at  6-DEC-2001 09:01:47.02, trace time 00:00:01.415159)
--------------------------------------------------------------------------------------

               Events   Acquires   Releases    Acq Own Acq NoSpin  Spinwaits          %
Spinlock         /sec       /sec       /sec       /sec       /sec       /sec   Spinwait
---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
EMB               1.4        0.7        0.7        0.0        0.0        0.0        0.0
MEGA              1.4        0.7        0.7        0.0        0.0        0.0        0.0
HWCLK          2049.2     1024.6     1024.6        0.0        0.0        0.0        0.0
INVALIDATE      221.9      110.9      110.9        0.0        0.0        0.0        0.0
MAILBOX           4.2        2.1        2.1        0.0        0.0        0.0        0.0
SCHED         34851.2    15609.6    15608.8        0.0        0.0     3632.8       23.3
MMG            1776.5      781.5      888.2       12.7       94.0        0.0        0.0
TIMER           308.1      154.0      154.0        0.0        0.0        0.0        0.0
TX_SYNCH         57.9       29.0       29.0        0.0        0.0        0.0        0.0
IOLOCK8       33944.6    15285.9    15292.3        6.4        0.0     3360.0       22.0
LCKMGR        53421.6    17816.4    17843.2        0.0       28.3    17733.7       99.4
FILSYS          278.4      139.2      139.2        0.0        0.0        0.0        0.0
QUEUEAST          5.7        2.8        2.8        0.0        0.0        0.0        0.0
???           41312.0    20538.3    20655.6        0.0      117.3        0.7        0.0
---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
             168234.1    71495.8    71752.4       19.1      239.5    24727.3       34.5

Spinlock Trace Information: 9
---------------------------

              Events  Acquires  or   Spins     %   Own
Spinlock        /sec  Releases/sec    /sec  Spin  /sec Caller's PC                         Module                                 Offset
---------- ---------- -------------- ------- ----- ------ ----------------------------------- ----------------------------------
.
.
.
SCHED         8129.1   5880.6 Acq/s  2248.5  38.2    0.0 80347BB0  LCK$DEALLOC_LKB_C+00220     SYS$CLUSTER                        00027BB0
SCHED         6186.6   6186.6 Rel/s     0.0   0.0    0.0 80152668  SCH$INTERRUPT+00748         PROCESS_MANAGEMENT                 0002A668
SCHED         5880.6   5880.6 Rel/s     0.0   0.0    0.0 80347C24  LCK$DEALLOC_LKB_C+00294     SYS$CLUSTER                        00027C24
SCHED         5824.1   5758.4 Acq/s    65.7   1.1    0.0 80342384  LCK$SND_CVTREQ_C+00344      SYS$CLUSTER                        00022384
SCHED         3697.8   2614.5 Acq/s  1083.3  41.4    0.0 8012D53C  SCH$IDLE_C+0024C            PROCESS_MANAGEMENT                 0000553C
SCHED         2614.5   2614.5 Rel/s     0.0   0.0    0.0 8012D370  SCH$IDLE_C+00080            PROCESS_MANAGEMENT                 00005370
SCHED          444.5    368.9 Acq/s    75.6  20.5    0.0 80157E10  SCH$POSTEF_C+00050          PROCESS_MANAGEMENT                 0002FE10
SCHED          368.9    368.9 Rel/s     0.0   0.0    0.0 80157A70  SCH$POSTEF_SCHED_C+00140    PROCESS_MANAGEMENT                 0002FA70
SCHED          258.6    229.7 Acq/s    29.0  12.6    0.0 801375C0  SCH$QEND_C+00080            PROCESS_MANAGEMENT                 0000F5C0
SCHED          249.4    214.1 Acq/s    35.3  16.5    0.0 80151F84  SCH$INTERRUPT+00064         PROCESS_MANAGEMENT                 00029F84

MMG            154.8    154.8 Acq/s     0.0   0.0    0.0 80186AA4  MMG$PAGEFAULT_C+000A4       SYS$VM                             00014AA4
MMG            106.7    106.7 Acq/s     0.0   0.0    0.0 8017E658  MMG_STD$SET_GH_AND_FASTMAP_6 SYS$VM                            0000C658
MMG            106.7    106.7 Rel/s     0.0   0.0    0.0 8017E68C  MMG_STD$SET_GH_AND_FASTMAP_6 SYS$VM                            0000C68C
MMG             88.3     88.3 Rel/s     0.0   0.0    0.0 80187024  MMG$PAGEFAULT_C+00624       SYS$VM                             00015024
MMG             77.7     77.7 Rel/s     0.0   0.0    0.0 8019E904  MMG_STD$SETPRTPAG_64_C+002C4 SYS$VM                            0002C904
.
.
.
```

Callout	Meaning
8	Shows the summary information by stepping through the whole trace buffer, and displaying a single line of information for each spinlock. If the percent of spin wait is very high, then a spinlock is a candidate for high contention.
9	For each spinlock in the summary display, the top ten callers' PCs are displayed along with the number of spinlock acquisitions and releases, as

Callout	Meaning
	well as spinwait counts and the number of multiple acquisitions of the same spinlock.

```
Forklock Trace Information: (at  6-DEC-2001 09:01:47.02, trace time 00:00:01.415159) 10
-----------------------------------------------------------------------------------

                Total          CPU ID
Forklock     Events/sec          8      9     10     11     12     13
----------   ----------      -------------------------------------------
IPL 08           2523.4          0.0    0.0    0.0    0.0    0.0 2523.4
TIMER              49.5         49.5    0.0    0.0    0.0    0.0    0.0
IOLOCK8           686.1        684.0    0.7    0.7    0.0    0.7    0.0
LCKMGR           3069.6        168.2    0.0    0.0    0.0    0.0 2901.4
QUEUEAST            2.8          0.0    0.7    0.0    1.4    0.7    0.0
             ----------      -------------------------------------------
Totals           6331.4        901.7    1.4    0.7    1.4    1.4 5424.8

Forklock Trace Information:
---------------------------

Forklock     Event/sec      % Time Held    Average    Minimum    Maximum   Fork PC
----------   ---------   ---------------  ---------  ---------  ---------  ----------------------------------------

IPL 08          2523.4             16.7      19911       5761      66873   803F1490   SYS$PCADRIVER+05490
----------   ---------   ---------------
Totals          2523.4             16.7

TIMER             49.5              0.6      35812        504     813332   80050050   EXE$SWTIMER_FORK_C
----------   ---------   ---------------
Totals            49.5              0.6

IOLOCK8          496.1              1.1       6732        491      24046   805C4840   SYS$EWDRIVER+04840
IOLOCK8          190.1              0.5       7619       1224      28993   805EEEC8   EXEC.FORK_C+00080
----------   ---------   ---------------
Totals           686.1              1.6

LCKMGR          3069.6             18.7      18268       3933      64563   8032E5E0   CNX$RCV_MSG_LCKMGR_FRK_C
----------   ---------   ---------------
Totals          3069.6             18.7

QUEUEAST           2.8              0.0      24885      20589      32203   802E4370   XFCCOMMONFORKDISPATCH_C
----------   ---------   ---------------
Totals             2.8              0.0

==========   =========   ===============
Totals          6331.4             37.6
```

Callout	Meaning
10	The forklock summary displays the number of fork operations on a specific CPU for each forklock. For each forklock, the top ten fork PC addresses are displayed, along with the minimum, maximum and average duration of the fork operation in system cycles. The percent of time spent in a given fork routine is displayed along with the percent of time for the forklock.

8.4.6. SPL START COLLECT

Starts to collect spinlock information a longer period of time than will fit into the trace buffer.

Format

SPL START COLLECT [/SPINLOCK=*spinlock*|/ADDRESS=*n*]

Parameters

None.

Qualifiers

/ADDRESS=*n*

Specifies the tracing of a specific spinlock by address.

/SPINLOCK=*spinlock*

Specifies the tracing of a specific spinlock, for example, /SPINLOCK=LCKMGR or /SPINLOCK=SCHED.

Description

The SPL START COLLECT command starts a collection of spinlock information for a longer period of time than will fit into the trace buffer. You need to enable spinlock tracing before a spinlock collection can be started. On a system with heavy activity, the trace buffer typically can only hold a relatively small time window of spinlock information. In order to collect spinlock information over a longer time period, a collection can be started. The collection tries to catch up with the running trace index and save the spinlock information into a balanced tree within the virtual address space of the process performing the spinlock collection. Either use the name of a static spinlock, or supply the address of a dynamic spinlock, for which information should be gathered.

The trace entries are kept in the trace buffer, which is allocated from S2 space, hence there is no disruption, if tracing is started from within SDA and then the user exits from SDA. However, for the longer period data collection, the information is kept in process-specific memory, thus a user needs to stay within SDA; otherwise the data collection is automatically terminated by SDA's image rundown. You can collect data for two or more spinlocks simultaneously, by using a separate process for each collection.

Example

1. ```
   SDA> SPL START COLLECT
   Use /SPINLOCK=name or /ADDRESS=n to specify which spinlock info needs to
    be collected...
   ```

   This example shows that you need to supply either a spinlock name of a static spinlock, or the address of a dynamic spinlock, if you want to collect information over a long period of time.

2. ```
   SDA> SPL START COLLECT/SPINLOCK=LCKMGR
   ```

   This example shows the command line to start to collect information on the usage of the LCKMGR spinlock.

8.4.7. SPL START TRACE

Enables spinlock tracing.

Format

SPL START TRACE [/[NO]ACQUIRE | /BUFFER=pages | /CPU=n

| /[NO]FORKLOCK=forklock | /[NO]FRKDSPTH

| /[NO]FRKEND | /[NO]RELEASE

| /[NO]SPINLOCK=spinlock | /[NO]WAIT]

Parameters

None.

Qualifiers

/ACQUIRE

/NOACQUIRE

The /ACQUIRE qualifier traces any spinlock acquisitions. This is the default.

The /NOACQUIRE qualifier ignores any spinlock acquisitions.

/BUFFER=*pages*

Specifies the size of the trace buffer (in page units). It defaults to 128 pages, which is equivalent to 1MB, if omitted.

/CPU=*n*

Specifies the tracing of a specific CPU only, for example, /CPU=5 or /CPU=PRIMARY. By default, all CPUs are traced.

/FORKLOCK=*forklock*

/NOFORKLOCK

The /FORKLOCK=*forklock* qualifier specifies the tracing of a specific forklock, for example, /FORKLOCK=IOLOCK8 or /FORKLOCK=IPL8.

The /NOFORKLOCK qualifier disables forklock tracing and does not collect any forklock data. By default, all forks are traced.

/FRKDSPTH

/NOFRKDSPTH

The /FRKDSPTH qualifier traces all invocations of fork routines within the fork dispatcher. This is the default.

The /NOFRKDSPTH qualifier ignores all of the /FRKDSPTH operations.

/FRKEND

/NOFRKEND

The /FRKEND qualifier traces all returns from fork routines within the fork dispatcher. This is the default.

The /NOFRKEND qualifier ignores all of the operations of the /FRKEND qualifier.

/RELEASE

/NORELEASE

The /RELEASE qualifier traces any spinlock releases. This is the default.

The /NORELEASE qualifier ignores any spinlock releases.

/SPINLOCK=*spinlock*

/NOSPINLOCK

The /SPINLOCK=*spinlock* qualifier specifies the tracing of a specific spinlock, for example, /SPINLOCK=LCKMGR or /SPINLOCK=SCHED.

The /NOSPINLOCK qualifier disables spinlock tracing and does not collect any spinlock data. By default, all spinlocks are traced.

/WAIT

/NOWAIT

The /WAIT qualifier traces any spinwait operations. This is the default.

The /NOWAIT qualifier ignores any spinwait operations.

Description

The SPL START TRACE command enables spinlock and fork tracing. By default all spinlocks and forklocks are traced and a 128 page (1MByte) trace buffer is allocated and used as a ring buffer.

Example

1. ```
   SDA> SPL START TRACE/BUFFER=1000
   Tracing started... (Spinlock = 00000000, Forklock = 00000000)
   ```

   This example shows how to enable a tracing for all spinlock and forklock operations into a 8 MByte trace buffer.

2. ```
   SDA> SPL START TRACE/CPU=PRIMARY/SPINLOCK=SCHED /NOFORKLOCK
   Tracing started... (Spinlock = 810AF600, Forklock = 00000000)
   ```

   This example shows how to trace only SCHED spinlock operations on the primary CPU.

3. ```
   SDA> SPL START TRACE /NOSPINLOCK /FORKLOCK=IPL8
   Tracing started... (Spinlock = 00000000, Forklock = 863A4C00)
   ```

   This example shows how to trace only fork operations to IPL8.

8.4.8. SPL STOP COLLECT

Stops the spinlock collection, but does not stop spinlock tracing.
   ```

Format

SPL STOP COLLECT

Parameters

None.

Qualifiers

None.

Description

The SPL STOP COLLECT command stops the data collection, but does not affect tracing. This allows the user to start another collection for a different spinlock during the same trace run.

Example

```
SDA> SPL STOP COLLECT
```

8.4.9. SPL STOP TRACE

Disables spinlock tracing, but it does not deallocate the trace buffer.

Format

SPL STOP TRACE

Parameters

None.

Qualifiers

None.

Description

The SPL STOP TRACE command stops tracing, but leaves the trace buffer allocated for further analysis.

Example

```
SDA> SPL STOP TRACE
Tracing stopped...
```

8.4.10. SPL UNLOAD

Unloads the SPL$DEBUG execlet and performs cleanup. Tracing is automatically disabled and the trace buffer deallocated.

Format

SPL UNLOAD

Parameters

None.

Qualifiers

None.

Description

The SPL UNLOAD command disables the tracing or collection functionality with a delay to a state of quiescence. This ensures that all pending trace operations in progress have finished before the trace buffer is deallocated. Finally the SPL UNLOAD command unloads the SPL$DEBUG execlet.

Example

```
SDA> SPL UNLOAD
SPL$DEBUG unload status = 00000001
```

Chapter 9. SDA XFC Extension

The SDA extension commands for Extended File Cache (XFC) enable you to display the following information in a convenient and readable format:

- Various XFC data structures
- Statistics that aid in tuning the extended file cache

You can also control the types of events that are recorded by XFC's tracing feature.

9.1. SDA XFC Commands

The following pages describe the SDA XFC extension commands.

You can enter XFC commands at the SDA prompt or you can access online help, as follows:

```
SDA> XFC HELP
```

9.1.1. XFC SET TRACE

Controls the types of events to be recorded by XFC's trace facility and initializes the trace structures (to eliminate events that have already been recorded).

Format

`XFC SET TRACE [/SELECT=LEVEL:level] [/RESET]`

Parameters

Qualifiers

/SELECT=LEVEL:level

Specifies the level of tracing in XFC on a live system. The possible values for *level* are as follows:

1	(Default) Traces only major, unusual events.
2	Traces file access, deacess, truncate, read start and complete, and write start and complete operations. Results are displayed using the SHOW TRACE command. Setting this trace level has only a minor performance impact.
3	Performs more detailed tracing, which can be viewed using the SHOW TRACE/RAW command. Has some performance impact.
4	Performs very detailed tracing with a noticeable performance impact.

/RESET

Initializes the trace buffer to eliminate all events that have already been traced.

Description

Traceable events within the XFC facility are organized by level of importance, from level 1 for rare, unusual events only, through level 4, which is a very detailed trace of events within the I/O flow through XFC. The trace buffer can be reset to clear older trace points.

9.2. XFC SHOW CONTEXT

Displays the contents of an XFC context block (CTX).

Format

XFC SHOW CONTEXT [address][/STALLING|/FULL|/BRIEF]

Parameters

address

The address of the CTX. If no address is supplied, then all the context structures are displayed.

Qualifiers

/BRIEF

Displays a brief summary for each context; for example, the I/O type, start virtual block number (VBN), and length of I/O.

/FULL

Displays the complete context structure. This is the default.

/STALLING

Displays only contexts that are stalling; for example, those that have a stall reason code other than **estrNotStalling**.

Description

The SHOW CONTEXT command displays the contents of an active context block. The state of each active operation within XFC is maintained in a data structure called a context block.

Examples

1.
```
SDA> XFC SHOW CONTEXT/BRIEF

List of All XFC Active Contexts (CTX)
-------------------------------------
Address           I/O Type          I/O phase        I/O Stall reason        Volume ID  File ID   Start VBN    Length      IRP
FFFFFFFF818C6250  eiotReadThrough   eiopFillContext  estrWindowTurn   FFFFFFFD8311BD00     3156      382593        32  818F7780
FFFFFFFF81854D10  eiotReadThrough   eiopFillContext  estrWindowTurn   FFFFFFFD8311BD00     3156      283873        32  81B26940
FFFFFFFF818787D0  eiotReadThrough   eiopFillContext  estrWindowTurn   FFFFFFFD8311BD00     3156      351777        32  81265FC0
FFFFFFFF81849E50  eiotReadAround    eiopSegmentDone  estrDiskIO       FFFFFFFD8311BD00     3156      289089        32  818F7540
FFFFFFFF818DC0D0  eiotReadAround    eiopSegmentDone  estrDiskIO       FFFFFFFD8311BD00     3156      271809        32  817C1800
FFFFFFFF81854190  eiotClusterTrans  eiopClusterIdle  estrNotStalled   0000000000000000        0           0         0  00000000
```

This example shows the address of the context block, I/O type (the type of operation), I/O phase (what phase the operation is in), I/O stall (reason for its stalling), volume ID (address of the control volume block), start VBN (starting VBN of the I/O), length of the I/O, and I/O request packet (the address of the IRP).

2.
```
SDA> XFC SHOW CONTEXT FFFFFFFF8190D690
List of All XFC Active Contexts (CTX)
-------------------------------------
Context (CTX) Address: FFFFFFFF8190D690
I/O Phase:             eiopFillContext
I/O Type:              eiotReadThrough
Operation started:   17-APR-2002 11:23:29.00
Stall Reason:          estrWindowTurn
Stall Extent:          0000000000000000
Stall Op (IRP):        FFFFFFFF81267A40
Saved AST Parameter:   0000000000000000
Restart Routine:       0000000000000000
Context state flags    00000000
  Cache Hit:               False
  HWM Checked:             False
  Fork Restarted           False
  AST Required (flush)     False
  Buffer locked            False
  Stalled converting       False
  Fork Block in use        False
  Override resource checks False
  Restart cluster trans    False
  Restart cluster flush    False
  MV volumes skipped       False
  Depose pending           False
  Ignore CFB Quiesce       False
  Delete CFB               False
  Read-ahead hit           False
ECB Count:                      0
Index:                 00000000 (         0)
Start VBN:             000107C1 (     67521)
Length in Blocks:      00000020 (        32)
Next VBN:              000107C1 (     67521)
I/O Extent Count:               0
Disk I/O Length:       00000020 (        32)
Bytes Copied:                   0
Bytes Zeroed:                   0
Bytes Requested:            16384
Volume (CVB):          0000000000000000
Volume Id:             FFFFFFFD8311BD00
File Id:               0000000000000C54
Cache File Block:      FFFFFFFD82CEA2A0
Process (PCB):         FFFFFFFF818FA500
```

This example shows output of a full display of a context block for a read I/O.

9.3. XFC SHOW EXTENT

Displays the contents of an extent control block (ECB).

Format

`XFC SHOW EXTENT address`

Parameters

address

The address of the ECB.

Qualifiers

None.

Description

The SHOW EXTENT command diplays the contents of an extent control block (ECB). The data in the cache is divided into groups of VBNs called extents. Each extent is maintained in a data structure called an extent control block.

Example

```
SDA> XFC SHOW EXTENT FFFFFFFD82A58A20
Cache Extent Address:  FFFFFFFD82A58A20
Type:                  Primary
Flink:                 FFFFFFFF7F880350
Blink:                 FFFFFFFF7F880350
Start VBN:             00000001 (         1)
Start LBN:             00BA711C (  12218652)
Length in Blocks:      00000006 (         6)
Data State:            Clean
Pin:                   None
Buffer Address:        FFFFFFFDB0996000
Secondary ECB Queue:   FFFFFFFD82A58A60
    Flink:               FFFFFFFD83199A20
    Blink:               FFFFFFFD83199A20
Primary ECB:           0000000000000000
LRU Queue:             FFFFFFFD82A58AAC
    Flink:               FFFFFFFD82A5A26C
    Blink:               FFFFFFFD82A5344C
Waiters Queue:         FFFFFFFD82A58A50
    Flink:               FFFFFFFD82A58A50
    Blink:               FFFFFFFD82A58A50
Lock Id:               00000000
Parent CFB:            FFFFFFFD82A61180
ECB delete pending     False
ECB on LRU queue       True
ECB depose pending     False
ECB read ahead         False
LRU priority:             1
```

This example shows the contents of an extent control block.

9.4. XFC SHOW FILE

Displays the contents of the cache file block (CFB).

Format

`XFC SHOW FILE [address] [/EXTENTS|/ID=file-id`

|/CVB=address |/OPEN|/CLOSED|/STATISTICS |/FULL

|/BRIEF]

Parameters

address

The address of the CFB. The /OPEN and /CLOSED qualifiers, if present, are ignored. If no address is supplied, then all the CFBs are displayed.

Qualifiers

/BRIEF

Displays the following summary information for each cache file block (CFB): CFB address, cache volume block (CVB) address, access count, active I/O count, and file ID.

/BRIEF is incompatible with /EXTENTS, /FULL, and /STATISTICS.

If the file specification is available in LIB$FID_TO_NAME(), it is displayed; otherwise, the file ID is displayed.

Note

Because the volume is accessed through its logical name, if two volumes are mounted that have the same logical name (for example, one mounted /SYSTEM and one mounted privately, which results in the same logical name in two different access-mode logical name tables), the incorrect file specification might be displayed.

/CLOSED

Displays only CFBs whose access count is zero.

/CVB=*address*

Displays information only for files matching the given cache volume block address.

/DISPLAY_NAME (default)

/NODISPLAY_NAME

Controls whether the file specification is displayed.

/EXTENTS

Displays the cache extents held in cache for any displayed files. This shows the primary and secondary cache extents along with their data state, virtual block numbers (VBNs), and logical block numbers (LBNs). It also shows a summary of memory usage (pagelets used and pagelets valid) for any displayed files. The /EXTENTS qualifier is incompatible with the /BRIEF qualifier.

/FULL

Displays all fields for each cache file block. This is the default.

If the file specification is available in LIB$FID_TO_NAME(), it is displayed; otherwise, the file ID is displayed.

Note

Because the volume is accessed through its logical name, if two volumes are mounted that have the same logical name (for example, one mounted /SYSTEM and one mounted privately, which results in the same logical name in two different access-mode logical name tables), the incorrect file specification might be displayed.

/ID=*file-id*

Displays only information about any files matching the given file-identification (FID). The file identification (FID) is the hexadecimal file number component in a format file ID (file number, sequence number, relative volume number).

/OPEN

Displays only CFBs whose access count is greater than zero.

/STATISTICS

Displays more statistics about the specified file. The /STATISTICS qualifier is incompatible with the /BRIEF qualifier.

Description

The SHOW FILE command displays the contents of the XFC cache file block. The state of any file in the cache is maintained in a data structure called a cache file block (CFB). There is a CFB for every open file on a system and a CFB for each closed file that is still being cached.

Examples

1.
```
SDA> XFC SHOW FILE/BRIEF

XFC Cache File Block brief listing
----------------------------------
CFB Address      CVB Address      Volume Name            File ID  Access   Write   Total    Read     Hit  Extent  Allocated
                                                                   Count  Access    I/Os    Hits    Rate   Count      Pages
FFFFFFFD831A24C0 FFFFFFFD831FE080 DISK$FRROOG_RUBY      (899,4,0)      1       0      14       6  42.86%      13         13
FFFFFFFD8319EF60 FFFFFFFD831FE080 DISK$FRROOG_RUBY     (2098,4,0)      1       0       1       0   0.00%       1          1
FFFFFFFD831E97E0 FFFFFFFD831FE080 DISK$FRROOG_RUBY     (2336,4,0)      1       0      10       3  30.00%       4          4
FFFFFFFD831F3C20 FFFFFFFD831FE080 DISK$FRROOG_RUBY      (423,4,0)      1       0       2       0   0.00%       3          3
FFFFFFFD831104C0 FFFFFFFD831FE080 DISK$FRROOG_RUBY      (904,4,0)      1       0       6       0   0.00%       3          3
FFFFFFFD831F04C0 FFFFFFFD831FE080 DISK$FRROOG_RUBY      (426,4,0)      1       0       2       0   0.00%       4          4
FFFFFFFD8318FA00 FFFFFFFD831FE080 DISK$FRROOG_RUBY     (2338,4,0)      1       0     141     101  71.63%     131        131
FFFFFFFD831F0080 FFFFFFFD831FE080 DISK$FRROOG_RUBY      (427,4,0)      1       0       2       0   0.00%       4          4
.
.
.
```

This example shows the brief output from this command.

2.
```
SDA> XFC SHOW FILE/STATISTICS FFFFFFFD831A24C0
Full Cache File Block (CFB) Details
-----------------------------------
CFB Address:           FFFFFFFD831A24C0
CFB Address:           FFFFFFFD831A24C0
Flink:                 FFFFFFFD831A22C0
Blink:                 FFFFFFFD831A2700
Access Count:                  1
Write Access Count:            0
Volume (CVB):          FFFFFFFD831FE080
Quiescing:             False
File (FCB):            FFFFFFFF81943D80
Volume Id:             FFFFFFFD831FE080
```

```
File Id:               0000000000000383
External FID:          (899,4,0)
Predicted Next VBN:    000000FB (       251)
Active Caching Mode:   Write Through
Active I/O count:               0
Flush Fail Status:     00000000 (         0)
No Readahead Reasons:           0
Active Readaheads:              0
File Bad:              False
Caching disabled:      False
File deleted on close: False
File Quiescing:        False
File Deposing:         False
File Deleting:         False
File BlkASTInProg:     False
File IgnoreBlkAST      False
File Readahead EOF     False
PECBs Allocated:               13 (        13 pages)
PECBs Deallocated:              0
PECBs Deallocated:              0
SECBs Allocated:                3
SECBs Deallocated:             19
Lock Id:               0C00037F
   Granted Lock mode:  PRMode
   Conversion phase:   Illegal
Conversion phase count:         1
Hash Bucket Queue:     FFFFFFFD831A2520
    Flink:               FFFFFFFF7FF819B0
    Blink:               FFFFFFFF7FF819B0
PECB Queue:            FFFFFFFD831A2530
    Flink:               FFFFFFFD8311888C
    Blink:               FFFFFFFD831A072C
Stalled IOs Queue:     FFFFFFFD831A24F0
    Flink:               FFFFFFFD831A24F0
    Blink:               FFFFFFFD831A24F0
FAL transition Queue:  FFFFFFFD831A2500
    Flink:               FFFFFFFD831A2500
    Blink:               FFFFFFFD831A2500
Contexts Waiting:      FFFFFFFD831A2510
    Flink:               FFFFFFFD831A2510
    Blink:               FFFFFFFD831A2510
BlkASTs Waiting:       FFFFFFFD831A2540
    Flink:               FFFFFFFD831A2540
    Blink:               FFFFFFFD831A2540
Deaccess Wait List:    FFFFFFFD831A2600
    Flink:               0000000000000000
Quiesce context:       0000000000000000
Up convert context:    0000000000000000
File IO Statistics - all in decimal
-----------------------------------
Statistics Valid From:   19-APR-2002 07:10:32.77

Total QIOs to this file:                14
Read IOs to this file:                  14
Write IOs to this file:                  0
Write IOs to this file:                  0
Read Hits:                               6
Hit Rate:                            42.86 %
```

```
Average Overall I/O response time to this file
 in milliseconds:                     0.9525
Average Cache Hit I/O response time to this file
 in milliseconds:                     0.0702
Average Disk I/O response time to this file
 in milliseconds:                     1.6141
Accuracy of I/O resp time:                   65 %
Read Ahead Count:                        0
Read Through Count:                     14
Write Through Count:                     0
Read Around Count:                       0
Write Around Count:                      0
CFB FAL stalls:                          1
CFB Operation stalls:                    0
FAL Blocking ASTs:                       0
Quiesce Depose:                          0
Quiesce depose Stalls:                   0

(I/O size statistics not collected for this file)

Files found: 1
```

This example shows a collection of performance statistics for a file.

9.5. XFC SHOW HISTORY

Displays approximately three days of XFC activity in 10-minute intervals.

Format

XFC SHOW HISTORY

Parameters

None.

Qualifiers

None.

9.6. XFC SHOW IRP

Displays a subset of the fields of an I/O Request Packet that has relevance for XFC debugging.

Format

XFC SHOW IRP address

Parameters

address

The address of the IRP structure whose relevant fields are to be decoded and displayed.

Qualifiers

None.

9.7. XFC SHOW MEMORY

Displays information about memory used by the cache.

Format

XFC SHOW MEMORY [/BRIEF|/FULL]

Parameters

None.

Qualifiers

/BRIEF

Displays summary statistics on XFC memory use.

/FULL

Displays full statistics on XFC memory use. This is the default.

Examples

1.
```
SDA> XFC SHOW MEMORY
XFC Memory Statistics
---------------------
Pool allocation calls           : 430
Pool allocation failures        : 0
Pool deallocation calls         : 0

Page allocation calls           : 2745
Page deallocation calls         : 6

Cache VA Regions and Limits
---------------------------
Cache VA region from FFFFFFFD80000000 to FFFFFFFF80000000 ( 1048576
 pages)

  permanent area   : FFFFFFFD80000000 to FFFFFFFDBE800000 (  128000
 pages)
            pool   : FFFFFFFD80000000 to FFFFFFFD83200000 (    6400
 pages)
            data   : FFFFFFFD83200000 to FFFFFFFDBE800000 (  121600
 pages)

  dynamic area     : FFFFFFFDBE800000 to FFFFFFFF7F780000 (  919488
 pages)
          pool     : FFFFFFFDBE800000 to FFFFFFFDD4F2C000 (   45974
 pages)
          data     : FFFFFFFDD4F2C000 to FFFFFFFF7F780000 (  873514
 pages)
```

```
  extent hash table: FFFFFFFF7F780000 to FFFFFFFF7FF80000 (    1024
 pages)
  file hash table  : FFFFFFFF7FF80000 to FFFFFFFF80000000 (      64
 pages)
  file hash table  : FFFFFFFF7FF80000 to FFFFFFFF80000000 (      64
 pages)

qhdPermanentPoolFreePages       : FFFFFFFF80D305B8
qhdPermanentDataFreePages       : FFFFFFFF80D305C8
Non-Paged Pool allocated        : 45248 (44.1 KB)
Non-Paged Pool number of - FKBs :      403
Non-Paged Pool number of - DBMs :        3
Non-Paged Pool number of - CTXs :       10
Current Maximum Cache Size      : 8589934592 (8.0 GB)
Boottime Maximum Cache Size     : -1

Permanent Data Pages: Allocated :   121600
                      In use    :     2739
          Pool Pages: Allocated :     6400
                      In use    :      128

Dynamic Pages: Max Allowed      :   919488
               Allocated        :        0
               In use           :        0
               Min Allowed      :    20971
   Data Pages: Allowed          :   873514
               In use           :        0
   Pool Pages: Allowed          :    45974
               In use           :        0
                  PFN List      :        0
                  Non PFN List  :        0


Total Cache Memory (bytes)      : 1048621248 (1000.0 MB)

Private PFN List Stats
----------------------
Dynamic Area PFN List           : FFFFFFFF818EB340
Free physical pages on list     : 0
Pages attributed to this list   : 0
Pages being requested for return: 0
List priority                   : 0
Callback routine                : 80DF8A40
Free PFN queue head             : FFFFFFFF818EB350
  First free page               : 0000000000000000
  Last free page                : 0000000000000000

MMG Callback Counters
---------------------
MMG callback active             : 0
MMG callback count              : 0
MMG callback requeues           : 0
MMG callback requeue again      : 0
Expand attempts callback active : 0
Pages reclaimed                 : 0
Trim reclaim attempts           : 0
LRU depose calls TrimWorkingSet : 0
```

```
Zone Purges: Permanent          : 0
             Dynamic PFNLST     : 0
             Dynamic No PFNLST  : 0

Pool Zone Stats (S2 Space)         Permanent    Dynamic
SECB: Size 112,  PerPage 71
    Pages / MaxPages             12 / 6400     |||   0 /  45974
    FreePkts / TotalPkts         64 /  852     |||   0 /      0
    Hits                       5499            |||   0
    Not first page                0            |||   0
    Misses (expns/fails)         12 (   12 /0) |||   0 (      0 /
 0)

PECB: Size 176,  PerPage 45
    Pages / MaxPages             85 / 6400     |||   0 /    45974
    FreePkts / TotalPkts          6 / 3825     |||   0 /        0
    Hits                       3740            |||   0
    Not first page                0            |||   0
    Misses (expns/fails)         85 (   85 /0) |||   0 (        0 /
   0)

CFB: Size 544,  PerPage 14
    Pages / MaxPages             29 / 6400     |||   0 /    45974
    FreePkts / TotalPkts          3 /  406     |||   0 /        0
    Hits                        488            |||   0
    Not first page                0            |||   0
    Misses (expns/fails)         29 (   29 /0) |||   0 (        0 /
   0)

CVB: Size 608,  PerPage 13
    Pages / MaxPages              2 / 6400     |||   0 /    45974
    FreePkts / TotalPkts         12 /   26     |||   0 /        0
    Hits                         12            |||   0
    Not first page                0            |||   0
    Misses (expns/fails)          2 (    2 /0) |||   0 (        0 /
   0)

IOSIZE: Size 3120,  PerPage 2
    Pages / MaxPages              0 / 6400     |||   0 /    45974
    FreePkts / TotalPkts          0 /    0     |||   0 /        0
    Hits                          0            |||   0
    Not first page                0            |||   0
    Misses (expns/fails)          0 (    0 /0) |||   0 (        0 /
   0)
```

This example shows the full output from this command.

2.
```
SDA> XFC SHOW MEMORY/BRIEF
XFC Memory Summary
------------------
Current Maximum Cache Size      : 8589934592 (8.0 GB)
Boottime Maximum Cache Size     : -1

Permanent Data Pages: Allocated :   121600
                      In use    :     2739
          Pool Pages: Allocated :     6400
                      In use    :      128
```

```
   Dynamic Pages: Max Allowed      :   919488
                  Allocated        :        0
                  In use           :        0
                  Min Allowed      :    20971
      Data Pages: Allowed          :   873514
                  In use           :        0
      Pool Pages: Allowed          :    45974
                  In use           :        0
                     PFN List      :        0
                     Non PFN List  :        0


   Total Cache Memory (bytes)      : 1048621248 (1000.0 MB)
```

This example shows the brief output from this command.

9.8. XFC SHOW SUMMARY

Displays general information about the Extended File Cache.

Format

XFC SHOW SUMMARY [/STATISTICS]

Parameters

None.

Qualifiers

/STATISTICS

Additionally, displays read and write activity arranged by I/O size.

Example

```
SDA> XFC SHOW SUMMARY
XFC Summary
-----------
Extended File Cache V1.0 Let unk I/Os through (Apr 18 2002 15:01:16)
Anchor Block Address:              FFFFFFFF80D30210
Build Id:
Cache State:                       0000A010
Cache in no-cache state:           False
MaxAllowedCacheMode:               eNodeFullXFC
Minimum cache size in Pages:       0001F400 (    128000)

General
-------
Extent Hash Table Address:         FFFFFFFF7F780000
Extent Hash Table Buckets:             524287
File Hash Table Address:           FFFFFFFF7FF80000
File Hash Table Buckets:                32767
Count of private CTXs:                     10
Count of private FKBs:                    403
Count of private DIOBMs:                    3
```

```
LRU
---
LRU Priority 0 Queue Address:     FFFFFFFF80D30288
               Queue Length:      00000446 (      1094)
LRU Priority 1 Queue Address:     FFFFFFFF80D30298
               Queue Length:      00000AA5 (      2725)
qhdContexts Address               FFFFFFFF80D302B0
qhdIRPs Address                   FFFFFFFF80D302C0

Spinlock
--------
Cache Spinlock:                   8125E780
  Last Acquiring Module:          ROOT$:[XFC.TMPSRC]XFC_SYS.C;4
       Acquiring Line:            2887
       Acquiring IPL:             0

Cache Tracing
-------------
Number of trace entries:                10000
Size of trace buffer:                  800000
Current trace level:                        4
Lost trace entrys:                          0
Current trace sequence number:         318768

System Wide I/O Statistics since last reset
-------------------------------------------
Time of Last System-Wide Reset:   19-APR-2002 07:10:23.43

Total cache calls:                      4505
Total cache calls:                      4505
 - Sum of Paging I/Os:                  2493
 - and other QIOs:                      2012
 - and NoCVB or PermNoCache QIOs:          0

Total Virtual Reads:                    4197
Total Virtual Writes:                    112
Total PageIOs not cached:                196
Total Logical I/Os:                        0
Total Physical I/Os:                       0
Total bypass write I/Os:                   0

Synchronous I/O completions:             598
Physical I/O completions:                  0
Total PID completion I/Os:                 0

Total num IOs on reserved files:        1606
Total num IOs on global sections:        247
Count of stalls performed:                13

System Wide Read Percentage:           97.40 %
System Wide Cache Hit ratio:           57.90 %

System-Wide Read Statistics since last reset
--------------------------------------------
Virtual Reads:                          4197
  Sum of Read Around Count:              179
  and Read Through Count:               4018
```

```
Reads Completed:                          4197
Read Hits:                                2495
Read Cache Hit Percentage:               59.45 %
Total Synch Completion Count:              598
Read Around due to Het. Cluster:             0
Read Around due to Modifiers:                0
Read Around due to Size:                    16
Total reads past EOF:                        1
Total I/Os with read-ahead:                239
Read Hits due to read-ahead:               307
Paging I/Os:                              2493

System-Wide Write Statistics since last reset
---------------------------------------------
Virtual Writes:                            112
  Sum of Write Around Count:                 0
  and Write Through Count:                 112
Write Around due to Het. Cluster:            0
Writes Completed:                          112
Write Around due to Modifiers:               0
Write Around due to Size:                    0
Total writes past EOF:                       0

File/Volume Statistics
----------------------
Open Files:                                239
Closed Files in the Cache:                 164
Number of files truncated:                   3
Volumes in Full XFC Mode:                    0
Volumes in VIOC Compatible Mode:            13
Volumes in No Caching Mode:                  1
Volumes in Perm. No Caching Mode:            0
Volume Queue:                     FFFFFFFF80D30238

File/Volume Statistics
----------------------
FAL locks currently held:                  370
FAL locks chosen to skip:                    0
FAL locks acquired since boot:             374
FAL locks released since boot:               4
FAL locks converted:                        55

I/Os that have stalled for FAL               0
CACHE$ACCESS stalls for CFB                  0
ulStallOpQStalls                             1
Read-thro->Read-around conv.                 0
Writes converted to write-around             0
ulLockResourceExhaustionRetries:             0
ulFALLocksEverInContention:                  3
ulFALUpConversionRequests:                   3
ulFALLocksConvertedToPR:                     0
ulFALLocksConvertedToNL:                     0
FAL BlkASTs received:                        1
FAL BlkASTs ignored:                         0
ECBs Split Right:                         2229
ECBs Split Left:                          1710
ECBs Split Three Ways:                     786
ECBs Requiring no splits:                 5802
```

```
Volume Lock Statistics
----------------------
VIL Blocking ASTs received                 0
VIL Blocking ASTs stalled                  0
VIL Blocking ASTs started                  0
VIL Blocking ASTs completed                0
VIL Up-conversion requests made            0
VIL Up-conversion grants                   0
VCML Blocking ASTs received                0
VCML Blocking ASTs stalled                 0
VCML Blocking ASTs started                 0
VCML Blocking ASTs completed               0
VCML Up-conversion requests made           0
VCML Up-conversion grants                  0
Stalls on VCML up-conversion               0
Restarts on VCML up-conversion             0

Quiesce and Depose Statistics
-----------------------------
Quiesce and Depose files Stalled:          0
File Quiesce and Deposes Started:        114
File Quiesce and Deposes Cmpltd:         114
File Quiesce and Deposes Cmpltd:         114
Q&D CTX used count:                        0
Q&D CTX in use:                  False

Most recent Depose time                    0.0005 msec.
Most recent Depose ECB count               0
Maximum Depose time                        0.1125 msec.
Maximum ECBs deposed                       3
Total Depose time                          0.0002 seconds
Total ECBs deposed                         6

Pending Lock Up-conversion Statistics
-------------------------------------
Up-conversions stalled:                    0
Up-conversions started:                    0
```

This example shows the output of detailed statistics and status for the cache.

9.9. XFC SHOW TABLES

Displays both the extent hash table (EHT) and the file hash table (FHT).

Format

XFC SHOW TABLES [/ALL][/EXTENT][/FILE][/SUMMARY]

Parameters

None.

Qualifiers

/ALL

Displays the contents of the extent hash table (EHT) and file hash table (FHT). This is the default.

/EXTENT

Displays only the contents of the EHT.

/FILE

Displays only the contents of the FHT.

/SUMMARY

Displays summary information about EHT and FHT.

Description

The SHOW TABLES command outputs information about the two hash tables used by XFC to locate key data structures.

Example

```
SDA> XFC SHOW TABLES/SUMMARY
Full Map of CFB HashTable
-------------------------
FHT: Contents of 32768 buckets


 0(32366)
 1(401)
 2(1)
Total number of CFBs:    403
Longest chain length:    2
Shortest chain length:   0
Shortest chain length:   0
Average chain length:        0.01


Full Map of PECB HashTable
--------------------------
EHT: verifying 524288 buckets


 0(520501)
 1(3755)
 2(32)
Total number of PECBs:   3819
Longest chain length:    2
Shortest chain length:   0
Average chain length:        0.01
```

This example shows summary output about each of the hash tables.

9.10. XFC SHOW TRACE

Displays all or selected portions of the XFC trace buffer, starting with the most recent entry and moving backward in time.

Format

XFC SHOW TRACE [/ALL]/CONTAINING=*value* |/CPU=*cpu-num*

|/LINENUMBER=*linenumber*

|/MATCH [=[AND|OR]] |/Px=*value* |/RAW]

Parameters

None.

Qualifiers

/ALL

Displays the entire trace buffer. This is the default.

/CONTAINING=*value*

Displays only records where any of the traced parameters is equal to *value*.

/CPU=*cpu-num*

Displays only records from threads executing on CPU *cpu-num*.

/LINENUMBER=*linenumber*

Displays only records from tracepoints at line *linenumber* in the relevant source files.

/MATCH [= AND|OR]

Alters the sense of the match condition when more than one of the filter qualifiers /CPU, /LINENUMBER, /FILENAME, /Px, or /CONTAINING are specified.

/Px=*value*

Displays only records where one of the traced parameters P1, P2, P3, or P4 is equal to *value*.

/RAW

Displays contents of trace records in hexadecimal format without interpretation. By default, the values are displayed in human readable format with filenames.

Description

The SHOW TRACE command outputs the contents of each entry in the XFC trace buffer. Currently, detailed XFC tracing is enabled only for debug versions of XFC.

Example

```
SDA> XFC SHOW TRACE

XFC Trace Buffer
----------------
Sequence    Time   Label                             Line  C I P1               P2               P3               P4
     319011 19-APR 09:11:16.70 SYS $IOPOST p1, p2, p3 8811  0 4 000000000001000C 0000000000000200 00000010B9BFF800 000002000087A72D
     319010 19-APR 09:11:16.70 SYS $IOPOST            8803  0 4 FFFFFFFF81987940 0000000000000002 000000000000600B FFFFFFFF8150F200
     319009 19-APR 09:11:16.69 Sys LOGIO              5305  3 2 0000000000000000 0000000000088000 0000000000000009 0000000000000010
     319008 19-APR 09:11:16.69 Sys Logical_IO1        4989  3 2 0000000000088000 0000000000000000 FFFFFFFF8150F200 FFFFFFFF81905100
     319007 19-APR 09:11:16.69 Sys Logical_IO         4981  3 2 FFFFFFFF81987940 FFFFFFFFB9BFF800 0000000000000200 000000000087A72D
     319006 19-APR 09:11:16.69 Mem FreeContext        1829  3 8 FFFFFFFF81905910 FFFFFFFF81905F80 0000000000000000 0000000000000000
     319005 19-APR 09:11:16.69 Sys eiopCloseComplete  8276  3 8 FFFFFFFF81905910 FFFFFFFD831853A0 0000000000000000 0000000000000000
     319004 19-APR 09:11:16.69 Common Restart CFBW    332   3 8 FFFFFFFD831853A0 0000000000000000 0000000000000003 0000000000000000
     319003 19-APR 09:11:16.69 Sys eiopCloFlushed     7700  3 8 FFFFFFFF81905910 FFFFFFFD831853A0 0000000000000000 0000000000000000
     319002 19-APR 09:11:16.69 Sys eiopCloseInit      7659  3 8 FFFFFFFF81905910 FFFFFFFD831853A0 0000000000000000 0000000000000000
.
.
.
```

This example shows the output of XFC trace information.

9.11. XFC SHOW VOLUME

Displays the contents of a cache volume block (CVB).

Format

`XFC SHOW VOLUME [address]/BRIEF|/FULL| /NAME=DISK $volume_label| /STATISTICS`

Parameters

address

The address of a CVB. If no address is supplied, then all volumes are displayed.

Qualifiers

/BRIEF

Displays summary information for each volume.

/FULL

Displays a complete list of information about each volume. This is the default.

/NAME=*DISK$volume_label*

Displays information for the volume with the specified name.

/STATISTICS

Displays the read and write I/O activity for this volume. The /STATISTICS qualifier is incompatible with the /BRIEF qualifier.

Description

The SHOW VOLUME command shows state information and statistics about all volumes mounted on the system.

Examples

1.
```
SDA> XFC SHOW VOLUME/BRIEF

Summary of XFC Cached Volumes (CVBs)
------------------------------------
Volume Name        CVB                   Open    Closed        Total     Read   Read    Write      ... Response (Milliseconds)...
                                        Files     Files         I/Os     Hits  Count    Count         Hits        disk    Average
DISK$SNKRNET       FFFFFFFD8311C080        0         0            0        0      0        0
DISK$FRROOGSYS     FFFFFFFD831FFD00        0         0            0        0      0        0
DISK$V73_DENBO2    FFFFFFFD831FFAA0        0         0            0        0      0        0
DISK$DENBO2_V73    FFFFFFFD831FF840        0         1            1        0      1        0       0.0000     14.2451    14.2451
DISK$VEALSYS       FFFFFFFD831FF5E0        0         0            0        0      0        0
DISK$SCRATCH2      FFFFFFFD831FF380        0         0            0        0      0        0
DISK$SCRATCH1      FFFFFFFD831FF120        0         0            0        0      0        0
DISK$BRAMHA_SCR    FFFFFFFD831FEEC0        0         0            0        0      0        0
DISK$COMMON        FFFFFFFD831FEC60        0         0            0        0      0        0
DISK$X907_BRAMHA   FFFFFFFD831FEA00        0         0            0        0      0        0
DISK$OLDSYS        FFFFFFFD831FE7A0        0         1            1        0      1        0       0.0000      7.8946     7.8946
DISK$RAM_FRROOG    FFFFFFFD831FE540        0         0            0        0      0        0
DISK$RMSTA2_USER   FFFFFFFD831FE2E0        3         5          115       89    112        3       0.0370     20.7218     4.7135
DISK$FRROOG_RUBY   FFFFFFFD831FE080      236       157         4195     2408   4085      110       0.0789      4.8671     2.1186

Volumes found: 14
```

The above example shows the output derived from invoking the /BRIEF qualifier.

2.
```
SDA> XFC SHOW VOLUME FFFFFFFD831FE080
Cache Volume Block (CVB)
------------------------
Statistics Valid From:   19-APR-2002 07:10:23.54

Name:                  DISK$FRROOG_RUBY
CVB Address:           FFFFFFFD831FE080
Flink:                 FFFFFFFF80D30238
Blink:                 FFFFFFFD831FE300
Volume (VCB):          FFFFFFFF81905100
Unit (UCB):            FFFFFFFF8150F200
Files Queue:           FFFFFFFD831FE0C0
    Flink:               FFFFFFFD83111800
    Blink:               FFFFFFFD831FC0A0
Cached Open Files:          236
Cached Closed Files:        157
Files Ever Opened:          502
Files Ever Deposed:         109
Pages Allocated:           2726
Total QIOs:                4195
Read Hit Count:            2408
Virtual Read Count:        4085
Virtual Write Count:        110
Read Percentage:             97 %
Hit Rate:                    57 %
Average Overall I/O response time to this Volume
 in milliseconds:           2.1186
Average Cache Hit I/O response time to this Volume
 in milliseconds:           0.0789
Average Disk I/O response time to this Volume
 in milliseconds:           4.8671
Accuracy of I/O resp time:   83 %
Readahead Count:            233
Volume Caching Mode:   evcmVIOCCompatible
Mounted /NOCACHE:      False     VCML Allows Caching:   True
Quiescing:             False     Quiesce in Progress:   False
No Cache from Logio:   False     VIL Blk AST Stall:     False
Flush Pending:         False     VCML Blk AST Stall:    False
VCML Blk CTX Stall:    False     VIL Blk CTX Stall:     False
Dismount Stall:        False     Logio Stall:           False
```

```
Flush in Progress:     False     Cluster Trans Stall:   False
Dismount Pending:      False     VIL Up Needed:         False
Tqe In Use:            False     VCML Up Needed:        False
VIL blocking AST CTX:  0000000000000000
VCML blocking AST CTX: 0000000000000000
Dismount Stall CTX:    0000000000000000
LogIO Stall CTX:       0000000000000000
Up conversion CTX:     0000000000000000
VIL lock id:           0100007A
VIL LogIO lock id:     00000000
VCML lock id:          010000FF
VCML LogIO lock id:    00000000
Logical IO safety:     elogioNotSafe
LogIOMutex:            00000000818EB610
Last LogIO time:       00000000
Active I/O count:              0
Stalled Ops Queue:     FFFFFFFD831FE0B0
    Flink:               FFFFFFFD831FE0B0
    Blink:               FFFFFFFD831FE0B0


Volumes found: 1
```

This example shows the output for a specific cache volume block (CVB).

Chapter 10. SDA Extensions and Callable Routines

This chapter describes how to write, debug, and invoke an SDA Extension. This chapter also describes the routines available to an SDA Extension.

10.1. Introduction

When analysis of a dump file or a running system requires intimate knowledge of data structures that are not known to the System Dump Analyzer, the functionality of SDA can be extended by the addition of new commands into which the necessary knowledge has been built. Note that in this description, whenever a reference is made to accessing a dump file (ANALYZE/CRASH_DUMP), this also includes accessing memory in the running system (ANALYZE/SYSTEM).

For example, a user-written device driver allocates nonpaged pool and records additional data about the device there (logging different types of I/O, perhaps), and a pointer to the new structure is saved in the device-specific extension of the UCB. After a system crash, the only way to look at the data from SDA is to do the following:

- Invoke the SDA command DEFINE to define a new symbol (for example, UCB$L_FOOBAR) whose value is the offset in the UCB of the pointer to the new structure.
- Invoke the SDA commands "SHOW DEVICE <device>" and "FORMAT UCB" to obtain the address of the nonpaged pool structure.
- Invoke the SDA command "EXAMINE <address>;<length>" to display the contents of the data in the new nonpaged pool structure as a series of hexadecimal longwords.
- Decode manually the contents of the data structure from this hexadecimal dump.

An SDA extension that knows the layout of the nonpaged pool structure, and where to find the pointer to it in the UCB, could output the data in a formatted display that alerts the user to unexpected data patterns.

10.2. Description

The following discussion uses an example of an SDA extension that invokes the MBX command to output a formatted display of the status of the mailbox devices in the system. The source file, MBX$SDA.C, is provided in SYS$EXAMPLES.

An SDA extension consists of a shareable image, in this case MBX$SDA.EXE, either located in the directory SYS$LIBRARY or found by translating the logical name MBX$SDA. It contains two universal symbols: SDA$EXTEND, the entry point; and SDA$EXTEND_VERSION, the address of a longword that contains the version of the interface used (in the format of major/minor ident), which allows SDA to confirm it has activated a compatible extension. The image contains at least two modules: MBX$SDA, the user-written module that defines the two symbols and provides the code and data necessary to produce the desired formatted output; and SDA_EXTEND_VECTOR, which provides jackets for all of the callable SDA routines, and is found in SYS$LIBRARY:VMS$VOLATILE_PRIVATE_INTERFACES.OLB. The user-written portion can be split into multiple modules.

Whenever SDA receives an unrecognized command, like "SDA> MBX", it attempts to activate the shareable image MBX$SDA at the SDA$EXTEND entry point. If you choose a command name that matches the abbreviation of an existing command, SDA can be forced to activate the extension using the "DO" command. For example, if you had an SDA extension called VAL$SDA, you could not activate it with a command like "SDA> VAL" as SDA would interpret that as an abbreviation of its VALIDATE command. But VAL$SDA can be activated by issuing "SDA> DO VAL".

With or without the "DO" prefix, the rest of the command line is passed to the extension; it is up to the extension to parse it. The example extension MBX$SDA includes support for commands of the form "SDA> MBX SUMMARY" and "SDA> MBX <address>" to demonstrate this. If the extension is invoked with no arguments, it should do no more than display a simple announcement message, or prompt for input. This assists in the debugging of the extension, as described in Section 10.3.

Section 10.2.1 describes how to compile, link, and invoke an SDA extension, and describes what an SDA extension should contain.

10.2.1. Compiling and Linking an SDA Extension

The user-written module is only supported when written in HP C (minimum Version 5.2), following the pattern of the example extension, MBX$SDA.C. It should be compiled and linked using commands of the following form:

```
$cc mbx$sda + sys$library:sys$lib_c /library
$link /share -
                mbx$sda.obj, -
                sys$library:vms$volatile_private_interfaces /library, -
                sys$input /option
        symbol_vector = (sda$extend=procedure)
        symbol_vector = (sda$extend_version=data)
```

Note

1. You can include the qualifier /INSTRUCTION=NOFLOAT on the compile command line if floating-point instructions are not needed.
2. The + SYS$LIBRARY:SYS$LIB_C /LIBRARY is not needed on the compile command line if the logical name DECC$TEXT_LIBRARY is defined and translates to SYS$LIBRARY:SYS $LIB_C.TLB.
3. If the user-written extension needs to signal SDA condition codes, or output their text with $PUTMSG, you should add the qualifier /INCLUDE=SDAMSG to the parameter SYS $LIBRARY:VMS$VOLATILE_PRIVATE_INTERFACES /LIBRARY.

10.2.2. Invoking an SDA Extension

You can invoke the SDA extension as follows:

```
$define mbx$sda sys$disk:[]mbx$sda
$analyze /system
SDA>mbx summary
SDA>mbx <address>
```

10.2.3. Contents of an SDA Extension

At a minimum, the user-written module must contain:

- #include statements for DESCRIP.H and SDA_ROUTINES.H
- The global variable SDA$EXTEND_VERSION, initialized as follows:

```
        int sda$extend_version = SDA_FLAGS$K_VERSION;
```

- The routine SDA$EXTEND (prototype follows)

Optionally, the user-written module may also contain the statement:

```
#define __NEW_STARLET
```

You should use this option because it provides type checking of function arguments and gives consistency in casing and naming conventions.

The entry point in the user-written module, SDA$EXTEND, is called as a routine with three arguments and no return value. The declaration is as follows:

```
void sda$extend (
        int *transfer_table,
        struct dsc$descriptor_s *cmd_line,
        SDA_FLAGS sda_flags)
```

The arguments in this code example have the following meanings:

Table 10.1. SDA$EXTEND Arguments

<table>
<tr><th>Line of Code</th><th colspan="2">Meaning</th></tr>
<tr><td>transfer_table</td><td colspan="2">Address of the vector table in the base image. The user-written routine SDA$EXTEND must copy this to SDA$VECTOR_TABLE (declared in SDA_ROUTINES.H) before any SDA routines can be called.</td></tr>
<tr><td>cmd_line</td><td colspan="2">Address of the descriptor of the command line as entered by the user, less the name of the extension. So, if you enter "SDA> MBX" or "SDA> DO MBX", the command line is a zero length string. If you enter the command "SDA> MBX 80102030", the command line is " 80102030" (the separating space is not stripped).</td></tr>
<tr><td rowspan="5">sda_flags</td><td colspan="2">Definition for the following four bits in this structure:</td></tr>
<tr><td>Bit</td><td>Meaning</td></tr>
<tr><td>sda_flags.sda_flags$v_override</td><td>Indicates SDA has been activated with the ANALYZE/ CRASH_DUMP/OVERRIDE command</td></tr>
<tr><td>sda_flags.sda_flags$v_current</td><td>Indicates SDA has been activated with the ANALYZE/SYSTEM command or was invoked from the kept debugger during an SCD session</td></tr>
<tr><td>sda_flags.sda_flags$v_target</td><td>Indicates that SDA was invoked from the kept debugger during an SCD or SDD session or when analyzing a process dump</td></tr>
</table>

Line of Code	Meaning	
	sda_flags.sda_flags$v_process	Indicates SDA was activated with the ANALYZE/CRASH_DUMP command to analyze a process dump
	sda_flags.sda_flags$v_ia64	Indicates that SDA is analyzing an Integrity server system or dump
	None of the above bits set	Indicates SDA was activated with the ANALYZE/CRASH_DUMP command to analyze an Alpha system dump
	Other bits	Reserved to VSI:may be nonzero

The first executable statement of the routine must be to copy TRANSFER_TABLE to SDA $VECTOR_TABLE (which is declared in SDA_ROUTINES.H):

```
sda$vector_table = transfer_table;
```

If this is not done, you cannot call any of the routines described below. Any attempts to call the routines receive a status return of SDA$_VECNOTINIT. (For routines defined not to return a status, this value can be found only by examining the return value directly.)

The next statement should be one to establish a condition handler, as it is often difficult to track down errors in extensions such as access violations because the extension is activated dynamically with LIB $FIND_IMAGE_SYMBOL. A default condition handler, SDA$COND_HANDLER, is provided that outputs the following information in the event of an error:

- The error condition
- The VMS version
- A list of activated images, with start and end virtual addresses
- The signal array and register dump
- The current call frame chain

You can establish this condition handler as follows:

```
lib$establish (sda$cond_handler);
```

Note

The error condition, signal array, and register dump are output directly to SYS$OUTPUT and/or SYS $ERROR, and are not affected by the use of the SDA commands SET OUTPUT and SET LOG.

Thus, a minimal extension would be:

```
#define __NEW_STARLET 1
#include <descrip.h>
#include <sda_routines.h>
```

```
int sda$extend_version = SDA_FLAGS$K_VERSION;

void sda$extend (int *transfer_table,
                 struct dsc$descriptor_s *cmd_line,
                 SDA_FLAGS sda_flags)
  {
  sda$vector_table = transfer_table;
  lib$establish (sda$cond_handler);

  sda$print ("hello, world");
  return;
  }
```

10.3. Debugging an Extension

In addition to the "after-the-fact" information provided by the condition handler, you can debug SDA extensions using the OpenVMS Debugger. A second copy of the SDA image, SDA_DEBUG.EXE, is provided in SYS$SYSTEM. By defining the logical name SDA to reference this image, you can debug SDA extensions as follows:

- Compile your extension /DEBUG/NOOPT and link it /DEBUG or /DSF.
- Define logical names for SDA and the extension, and invoke SDA.
- Type SET BREAK START_EXTENSION at the initial DBG> prompt, and then type GO.
- Invoke the extension at the SDA> prompt.
- When Debug prompts again, use Debug commands to set breakpoints, and so on, in the extension and then type GO.
- Invoke the extension, providing the necessary arguments.

An example of the preceding steps is as follows:

```
$ cc /debug /noopt mbx$sda + sys$library:sys$lib_c /library
$ link /debug /share -
        mbx$sda.obj, -
        sys$library:vms$volatile_private_interfaces /library, -
        sys$input /option
symbol_vector = (sda$extend=procedure)
symbol_vector = (sda$extend_version=data)
$ !
$ define mbx$sda sys$disk:[]mbx$sda
$ define sda sda_debug
$ analyze /system
...
DBG> set break start_extension
DBG> go
...
SDA> mbx
break at routine START\START_EXTENSION
...
DBG> set image mbx$sda
DBG> set language c
DBG> set break /exception
```

```
DBG> go
MBX commands: 'MBX SUMMARY' and 'MBX <address>'
SDA> mbx summary
...
SDA> mbx <address>
...
%DEBUG-I-DYNMODSET, setting module MBX$SDA
%SYSTEM-E-INVARG, invalid argument
...
DBG>
```

10.4. Callable Routines Overview

The user-written routine may call SDA routines to accomplish any of the following tasks:

- Read the contents of memory locations in the dump.
- Translate symbol names to values and vice-versa, define new symbols, and read symbol table files.
- Map an address to the activated image or executive image that contains that address.
- Output text to the terminal, with page breaks, page headings, and so on (or output to a file if the SDA commands SET OUTPUT or SET LOG have been used).
- Allocate and deallocate dynamic memory.
- Validate queues/lists.
- Format data structures.
- Issue any SDA command.

Note the following points before using the callable routines described here:

- The following three routines are used to read the contents of memory locations in the dump:
  - SDA$TRYMEM is called from both SDA$GETMEM and SDA$REQMEM as the lower-level routine that actually does the work. SDA$TRYMEM returns success/failure status in R0, but does not signal any errors. Use it directly when you expect that the location being read might be inaccessible. The caller of SDA$TRYMEM handles this situation by checking the status returned by SDA$TRYMEM.
  - SDA$GETMEM signals a warning when any error status is returned from SDA$TRYMEM. Signaling a warning prints out a warning message, but does not abort the SDA command in progress. You should use this routine when you expect the location to be read to be accessible. This routine does not prevent the command currently being executed from continuing. The caller of SDA$GETMEM must allow for this by checking the status returned by SDA$GETMEM.
  - SDA$REQMEM signals an error when any error status is returned from SDA$TRYMEM. Signaling an error prints out an error message, aborts the SDA command in progress, and returns to the "SDA>" prompt. You should use this routine when you expect the location to be read to be accessible. This routine prevents the command currently being executed from continuing. The caller of SDA$REQMEM does not resume if an error occurs.
- You should use only the routines provided to output text. Do not use printf() or any other standard routine. If you do, the SDA commands SET OUTPUT and SET LOG will not produce the

expected results. Do not include control characters in output (except tab); in particular, avoid <CR>, <LF>,<FF>, and the FAO directives that create them. Use the FAO directive !AF when contents of memory returned by SDA$TRYMEM, and so on, are being displayed directly, because embedded control characters will cause undesirable results. For example, displaying process names or resource names that contain particular control characters or escape sequences can lock up the terminal.

- You should use only the routines provided to allocate and deallocate dynamic memory. Do not use malloc() and free(). Where possible, allocate dynamic memory once, the first time the extension is activated, and deallocate it only if it needs to be replaced by a larger allocation. Because SDA commands can be interrupted by invoking another command at the "Press return for more" prompt, it is very easy to cause memory leaks.

- Some routines expect 32-bit pointers, and others expect 64-bit pointers. At first this not may appear to be logical, but in fact it is. All code and data used by SDA and any extensions must be in P0 or P1 space, as SDA does not need to (and does not) use P2 space for local data storage. However, addresses in the system dump (or running system, in the case of ANALYZE/SYSTEM) are 64-bit addresses, and SDA must provide access to all locations in the dump.

  So, for example, the first two arguments to the routine SDA$TRYMEM are:

```
VOID_PQ start    /* 64-bit pointer */

void *dest       /* 32-bit pointer */
```

  They specify the address of interest in the dump and the address in local storage to which the dump contents are to be copied.

- Common Bitmask Block (CBB) routines, SDA$CBB_*xxx*, are designed for use with local copies of the CBB structures that describe the CPUs in use in a system. The CBB structures are assumed to be at least CBB$K_STATIC_BLOCK bytes in length. The definitions of the various CBB constants and field names used by these routines can be found in CBBDEF.H in SYS$LIBRARY:SYS $LIB_C.TLB.

  The set of routines is not intended to be an exhaustive set of all possible CBB-related operations, but it provides those operations known to be needed. The routines might not work as expected with CBB structures that are set up for any purpose other than to describe CPUs.

10.5. Routines

The following sections describe the SDA extension callable routines.

10.5.1. SDA$ADD_SYMBOL

Adds a symbol to SDA's local symbol table.

Format

void sda$add_symbol (char *symbol_name, uint64 symbol_value);

Arguments

symbol_name

OpenVMS usage	**char_string**
type	**character string**
access	**read only**
mechanism	**by reference**

Address of symbol name string (zero-terminated).

symbol_value

OpenVMS usage	**quadword_unsigned**
type	**quadword (unsigned)**
access	**read only**
mechanism	**by value**

The symbol value.

Description

SDA maintains a list of symbols and the corresponding values. SDA$ADD_SYMBOL is used to insert additional symbols into this list, so that they can be used in expressions and during symbolization.

Condition Values Returned

None.

Example

```
sda$add_symbol ("MBX", 0xFFFFFFFF80102030);
```

This call defines the symbol MBX to the hexadecimal valueFFFFFFFF80102030.

10.5.2. SDA$ALLOCATE

Allocates dynamic memory.

Format

`void sda$allocate (uint32 size, void **ptr_block);`

Arguments

size

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Size of block to allocate (in bytes).

ptr_block

OpenVMS usage	**address**
type	**longword (unsigned)**
access	**write only**
mechanism	**by reference**

Address of longword to receive address of block.

Description

The requested memory is allocated and the address returned. Note that this is the only supported mechanism for allocation of dynamic memory.

Related Routine

SDA$DEALLOCATE

Condition Values Returned

None.

If no memory is available, the error is signaled and the SDA session aborted.

Example

```
PCB *local_pcb;
...
sda$allocate (PCB$C_LENGTH, (void *)&local_pcb);
```

This call allocates a block of heap storage for a copy of a PCB, andstores its address in the pointer LOCAL_PCB.

10.5.3. SDA$CBB_BOOLEAN_OPER

Performs a Boolean operation on a pair of CBBs.

Format

`int sda$cbb_boolean_oper (CBB_PQ input_cbb, CBB_PQ output_cbb, int operation)`

Arguments

input_cbb

OpenVMS usage	**address**
type	**CBB structure**
access	**read only**
mechanism	**by reference**

The address of the first (input) CBB structure.

output_cbb

OpenVMS usage	**address**
type	**CBB structure**
access	**read/write**
mechanism	**by reference**

The address of the second (output) CBB structure.

operation

OpenVMS usage	**longword**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The desired operation from the following list:

CBB$C_OR	The logical sum of the two CBBs is performed and the result (B = A | B) is written to the output CBB.
CBB$C_BIC	The logical product with complement of the two CBBs is performed and the result (B = B & ~A) is written to the output CBB.

Description

The desired Boolean operation is performed on the two CBB structures, and the result is written to the second (output) structure.

Condition Values Returned

SS$_BADPARAM	The number of valid bits in the input and output CBBs is different.
SS$_WASCLR	All bits in the resulting output CBB are clear.
SS$_WASSET	At least one bit in the resulting output CBB is set.

Example

```
int status;
extern CBB active_set,
       configure_set;
CBB inactive_set;
sda$cbb_copy (&configure_set, &inactive_set);
status = sda$cbb_boolean_oper (&active_set, &inactive_set, CBB$C_BIC);
if (status == SS$_WASSET)
    sda$print ("There are inactive CPUs in the system");
```

This example shows how the set of active CPUs and the set of configured CPUs can be manipulated to create a set of inactive CPUs.

10.5.4. SDA$CBB_CLEAR_BIT

Clears the specified bit in a CBB.

Format

int sda$cbb_clear_bit (CBB_PQ cbb, int bit);

Arguments

cbb

OpenVMS usage	**address**
type	**CBB structure**
access	**read/write**
mechanism	**by reference**

The address of the CBB structure to be modified.

bit

OpenVMS usage	**longword**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The bit in the CBB to be cleared. If the bit number is -1, clears all bits.

Description

The specified bit (or all bits) in the CBB is cleared.

Condition Values Returned

SS$NORMAL	Successful completion
SS$BADPARAM	The bit number is out of range

Example

```
int status;
extern int next;
extern CBB active_set;
status = sda$cbb_clear_bit (&active_set, next);
if (!(status & 1))
    sda$print ("Bad CPU specified: !XL", next);
```

This example shows how a bit in a CBB is cleared.

10.5.5. SDA$CBB_COPY

Copies the contents of one CBB to another.

Format

`int sda$cbb_copy (CBB_PQ input_cbb, CBB_PQ output_cbb);`

Arguments

input_cbb

OpenVMS usage	**address**
type	**CBB structure**
access	**read only**
mechanism	**by reference**

The address of the CBB structure to be copied.

output_cbb

OpenVMS usage	**address**
type	**CBB structure**
access	**write only**
mechanism	**by reference**

The address of the CBB structure to receive the copy.

Description

The specified CBB is copied.

Condition Values Returned

None.

10.5.6. SDA$CBB_FFC

Locates the first clear bit in a CBB.

Format

`int sda$cbb_ffc (CBB_PQ cbb, int start_bit);`

Arguments

cbb

OpenVMS usage	**address**
type	**CBB structure**
access	**read only**
mechanism	**by reference**

The address of the CBB structure to be searched.

start_bit

OpenVMS usage	**longword**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The first bit in the CBB to be checked.

Description

The CBB structure is searched, starting at the specified bit, for a clear bit.

Condition Values Returned

bit_number	If a clear bit is found, its bit number is returned. If no clear bit is found (all bits from start_bit to cbb->cbb$l_valid_bits are set), then the number of valid bits is returned.

Example

```
int bit;
extern int start;
extern CBB active_set;
bit = sda$cbb_ffc (&active_set, start);
if (bit >= active_set.cbb$l_valid_bits)
    sda$print ("No clear bits in active set");
else
    sda$print ("First clear bit in active set = !XL", bit);
```

This example shows how the next clear bit in a CBB can be located.

10.5.7. SDA$CBB_FFS

Locates the first set bit in a CBB.

Format

`int sda$cbb_ffs (CBB_PQ cbb, int start_bit);`

Arguments

cbb

OpenVMS usage	**address**
type	**CBB structure**
access	**read only**
mechanism	**by reference**

The address of the CBB structure to be searched.

start_bit

OpenVMS usage	**longword**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The first bit in the CBB to be checked.

Description

The CBB structure is searched for a set bit, starting at the specified bit.

Condition Values Returned

bit_number	If a set bit is found, its bit number is returned. If no set bit is found (all bits from start_bit to cbb->cbb $l_valid_bits are clear), then the number of valid bits is returned.

Example

```
int bit;
extern int start;
extern CBB active_set;
bit = sda$cbb_ffs (&active_set, start);
if (bit >= active_set.cbb$l_valid_bits)
      sda$print ("No set bits in active set");
else
      sda$print ("First set bit in active set = !XL", bit);
```

This example shows how the next set bit in a CBB can be located.

10.5.8. SDA$CBB_INIT

Initializes a CBB structure to a known state.

Format

`void sda$cbb_init (CBB_PQ cbb);`

Arguments

cbb

OpenVMS usage	**address**
type	**CBB structure**
access	**read only**
mechanism	**by reference**

The address of the CBB structure to be initialized.

Description

The fields of the CBB that describe its layout are initialized as necessary for a CPU CBB. The actual bitmask is zeroed.

Condition Values Returned

None.

10.5.9. SDA$CBB_SET_BIT

Sets the specified bit in a CBB.

Format

int sda$cbb_set_bit (CBB_PQ cbb,int bit);

Arguments

cbb

OpenVMS usage	**address**
type	**CBB structure**
access	**read/write**
mechanism	**by reference**

The address of the CBB structure to be modified.

bit

OpenVMS usage	**longword**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The bit in the CBB to be set. If the bit number is -1, set all bits.

Description

The specified bit (or all bits) in the CBB is set.

Condition Values Returned

SS$NORMAL	Successful completion.
SS$BADPARAM	The bit number is out of range.

Example

```
int status;
```

```
extern int next;
extern CBB active_set;
status = sda$cbb_set_bit (&active_set, next);
if (!(status & 1))
    sda$print ("Bad CPU specified: !XL", next);
```

This example shows how a bit in a CBB is set.

10.5.10. SDA$CBB_TEST_BIT

Tests the specified bit in a CBB.

Format

int sda$cbb_test_bit (CBB_PQ cbb,int bit);

Arguments

cbb

OpenVMS usage	**address**
type	**CBB structure**
access	**read only**
mechanism	**by reference**

The address of the CBB structure to be tested.

bit

OpenVMS usage	**longword**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The bit in the CBB to be tested.

Description

The specified bit in the CBB is tested and its value returned.

Condition Values Returned

SS$_WASSET	The specified bit was set.
SS$_WASCLR	The specified bit was clear.
SS$_BADPARAM	The bit number is out of range.

Example

```
int status;
extern int next;
```

```
extern CBB active_set;
status = sda$cbb_test_bit (&active_set, next);
if (!(status & 1))
    sda$print ("Bad CPU specified: !XL", next);
else if (status == SS$_WASSET)
    sda$print ("CPU !XL was set", next);
else
    sda$print ("CPU !XL was clear", next);
```

This example shows how a bit in a CBB is tested.

10.5.11. SDA$DBG_IMAGE_INFO

Displays a list of activated images together with their virtual addressranges for debugging purposes.

Format

void sda$dbg_image_info ();

Arguments

None.

Description

A list of the images currently activated, with their start and endaddresses, is displayed. This is provided as a debugging aid for SDAextensions.

Condition Values Returned

None.

Example

```
sda$dbg_image_info ();
```

SDA outputs the list of images in the following format:

```
Current VMS Version:   "X6DX-FT1"

     Process Activated Images:

        Start VA  End VA    Image Name
        00010000  000301FF  SDA
        00032000  00177FFF  SDA$SHARE
        7B508000  7B58BFFF  DECC$SHR
        7B2D8000  7B399FFF  DPML$SHR
        7B288000  7B2C9FFF  CMA$TIS_SHR
        7B698000  7B6D9FFF  LBRSHR
        0021A000  0025A3FF  SCRSHR
        00178000  002187FF  SMGSHR
        7B1E8000  7B239FFF  LIBRTL
        7B248000  7B279FFF  LIBOTS
        80C140D0  80C23120  SYS$BASE_IMAGE
        80C036B8  80C05288  SYS$PUBLIC_VECTORS
        002C6000  002D31FF  PRGDEVMSG
```

```
        002D4000  002DA9FF  SHRIMGMSG
        002DC000  002DFFFF  DECC$MSG
        00380000  003E03FF  MBX$SDA
```

10.5.12. SDA$DEALLOCATE

Deallocates and frees dynamic memory.

Format

`void sda$deallocate (void *ptr_block, uint32 size);`

Arguments

ptr_block

OpenVMS usage	**address**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Starting address of block to be freed.

size

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Size of block to deallocate (in bytes).

Description

The specified memory is deallocated. Note that this is the only supported mechanism for deallocation of dynamic memory.

Related Routine

SDA$ALLOCATE

Condition Values Returned

None.

If an error occurs, it is signaled and the SDA session aborted.

Example

```
PCB *local_pcb;
...
```

```
sda$deallocate ((void *)local_pcb, PCB$C_LENGTH;
```

This call deallocates the block of length PCB$C_LENGTH whose address isstored in the pointer LOCAL_PCB.

10.5.13. SDA$DELETE_PREFIX

Deletes all symbols with the specified prefix.

Format

`void sda$delete_prefix (char *prefix);`

Arguments

prefix

OpenVMS usage	**char_string**
type	**character string**
access	**read only**
mechanism	**by reference**

The address of the prefix string.

Description

This routine searches the SDA symbol table and deletes all symbols that begin with the specified string.

Condition Values Returned

None.

10.5.14. SDA$DISPLAY_HELP

Displays online help.

Format

`void sda$display_help (char *library_desc, char *topic_desc);`

Arguments

library

OpenVMS usage	**char_string**
type	**character string**
access	**read only**
mechanism	**by reference**

Address of library filespec. Specify as zero-terminated ASCII string.

topic

OpenVMS usage	**char_string**
type	**character string**
access	**read only**
mechanism	**by reference**

Address of topic name. Specify as zero-terminated ASCII string.

Description

Help from the specified library is displayed on the given topic.

Condition Values Returned

None.

Example

```
sda$display_help ("SYS$HELP:SDA", "HELP");
```

This call produces the following output at the terminal:

```
HELP


     The System Dump Analyzer (SDA) allows you to inspect the contents
     of memory as saved in the dump taken at crash time or as exists
     in a running system. You can use SDA interactively or in batch
     mode. You can send the output from SDA to a listing file. You can
     use SDA to perform the following operations:

                      Assign a value to a symbol
                      Examine memory of any process
                      Format instructions and blocks of data
                      Display device data structures
                      Display memory management data structures
                      Display a summary of all processes on the system
                      Display the SDA symbol table
                      Copy the system dump file
                      Send output to a file or device
                      Read global symbols from any object module
                      Send output to a file or device
                      Read global symbols from any object module
                      Search memory for a given value

     For help on performing these functions, use the HELP command and
     specify a topic.

     Format

       HELP  [topic-name]


  Additional information available:
```

```
  Parameter

HELP Subtopic?
```

10.5.15. SDA$ENSURE

Ensures sufficient space on the current output page.

Format

`void sda$ensure (uint32 lines);`

Arguments

lines

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Number of lines to fit on a page.

Description

This routine checks and makes sure that the number of lines specifiedfit on the current page; otherwise, it issues a page break.

Condition Values Returned

None.

Example

```
sda$ensure (5);
```

This call ensures that there are five lines left on the current page,and it outputs a page break if there are not.

10.5.16. SDA$FAO

Formats data into a buffer.

Format

`char * sda$fao (char * ctrstr, char * buffer, int buflen,__optional_params);`

Arguments

ctrstr

OpenVMS usage	**char_string**

type	**character-coded text string**
access	**read only**
mechanism	**by reference**

Address of a zero-terminated FAO control string.

buffer

OpenVMS usage	**char_string**
type	**character string**
access	**write only**
mechanism	**by reference**

Address of a string buffer into which to store the formatted string.

buflen

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Maximum size of the string buffer.

prmlst

OpenVMS usage	**varying_arg**
type	**quadword (signed or unsigned)**
access	**read only**
mechanism	**by value**

Optional FAO parameters. All arguments after buflen are copied into a quadword parameter list, as used by $FAOL_64.

Description

Formats data into a buffer as a zero-terminated string.

Condition Values Returned

Address of terminating zero	SDA$FAO returns the address of the terminating zero in the output buffer. This allows successive calls to SDA$FAO to append strings.

Example

```
char faobuf [16];
char *faoptr;
faoptr = sda$fao ( "!XL",
```

```
                faobuf, sizeof (faobuf),
                0xffffffff);
sda$fao ( ".!XL",
                faoptr, sizeof (faobuf) - strlen (faobuf),
                0x80102030);
```

This example shows the use of SDA$FAO to append a formatted string to another formatted string.

10.5.17. SDA$FID_TO_NAME

Translates a file identification (FID) into the equivalent file name.

Format

`int sda$fid_to_name (char *devptr, unsigned short *fidptr, char *bufptr, int`

Arguments

devptr

OpenVMS usage	**char_string**
type	**character string**
access	**read only**
mechanism	**by reference**

The address of the device name string. The device name must be supplied in allocation-class device name (ALLDEVNAM) format, but any leading underscore or trailing colon are ignored.

fidptr

OpenVMS usage	**address**
type	**file identification**
access	**read only**
mechanism	**by reference**

The address of the three-word file identification.

bufptr

OpenVMS usage	**char_string**
type	**character string**
access	**write only**
mechanism	**by reference**

The address of a string buffer into which to store the file name string.

buflen

OpenVMS usage	**longword**
type	**longword (unsigned)**

access	**read only**
mechanism	**by value**

The maximum length of the string buffer.

Description

When analyzing the current system, this routine calls LIB$FID_TO_NAME to translate the file identification into a file name. When analyzing a dump, if there is a file data collection available and the specified disk and file identification is included in the collection, the recorded file name will be returned. Return the error condition SDA$_NOCOLLECT if there is no collection (for the entire system, this disk, or just this file).

Condition Values Returned

SDA$_SUCCESS	File identification successfully translated.
SDA$_NOCOLLECT	No collection available for the system, the specified disk, or the file identification.
Others	An error occurred when LIB$FID_TO_NAME was called.

Example

```
int status;
char buffer [132];
char *device = $1$DKA0;
unsigned short fid [3] = {1, 1, 0};
status = sda$fid_to_name (device, &fid [0], buffer, 132);
if (status & 1)
    sda$print ("Filename is !AZ", buffer);
else
    sda$print ("File ID could not be translated");
```

This example shows the translation of file ID (1,1,0) on 1DKA0:, which is 1DKA0:[000000]INDEXF.SYS;1.

10.5.18. SDA$FORMAT

Displays the formatted contents of a data structure.

Format

`void sda$format (VOID_PQ struct_addr, __optional_params);`

Arguments

struct_addr

OpenVMS usage	**address**
type	**quadword (unsigned)**
access	**read only**

mechanism	**by value**

The address in the system dump of the data structure to be formatted.

options

OpenVMS usage	**mask_longword**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The following provides more information on options:

Option	**Meaning**
None	Uses structure type from the xxx$B_TYPE and/or xxx$B_SUBTYPE field of the structure. This is the default.
SDA_OPT$M_FORMAT_TYPE	Uses the structure type given in struct_prefix.
SDA_OPT$M_FORMAT_PHYSICAL	Indicates that struct_addr is a physical address instead of a virtual address.

struct_prefix

OpenVMS usage	**char_string**
type	**character string**
access	**read only**
mechanism	**by reference**

Address of structure name string (zero-terminated).

Description

This routine displays the formatted content of a data structure thatbegins at the address specified. If no symbol prefix is passed, then SDA tries to find the symbols associated with the block type specifiedin the block-type byte of the data structure.

Condition Values Returned

None.

Example

```
PCB *local_pcb;
PHD *local_phd;
...
sda$format (local_pcb);
sda$format (local_phd, SDA_OPT$M_FORMAT_TYPE, "PHD");
```

The first call formats the structure whose system address is held in the variable LOCAL_PCB, determining the type from the type and/or subtype byte of the structure. The second call formats the structure whose system address is held in the variable LOCAL_PHD, using PHD symbols.

10.5.19. SDA$FORMAT_HEADING

Formats a new page heading.

Format

`void sda$format_heading (char *ctrstr, __optional_params);`

Arguments

ctrstr

OpenVMS usage	**char_string**
type	**character-coded text string**
access	**read only**
mechanism	**by reference**

Address of control string (zero-terminated ASCII string).

prmlst

OpenVMS usage	**varying_arg**
type	**quadword (signed or unsigned)**
access	**read only**
mechanism	**by value**

FAO parameters that are optional. All arguments after the control string are copied into a quadword parameter list as used by $FAOL_64.

Description

This routine prepares and saves the page heading to be used whenever SDA$NEW_PAGE is called. Nothing is output either until SDA$NEW_PAGE is next called, or a page break is necessary because the current page is full.

Condition Values Returned

None.

If the $FAOL_64 call issued by SDA$FORMAT_HEADING fails, the control string is used as the page heading.

Example

```
char hw_name[64];
...
sda$get_hw_name (hw_name, sizeof(hw_name));
sda$format_heading (
       "SDA Extension Commands, system type !AZ",
        &hw_name);
sda$new_page ();
```

This example produces the following heading:

```
SDA Extension Commands, system type DEC 3000 Model 400
------------------------------------------------------
```

10.5.20. SDA$GET_ADDRESS

Gets the address value of the current memory location.

Format

void sda$get_address (VOID_PQ *address);

Arguments

address

OpenVMS usage	**quadword_unsigned**
type	**quadword (unsigned)**
access	**write only**
mechanism	**by reference**

Location to store the current 64-bit memory address.

Description

Returns the current address being referenced by SDA (location ".").

Condition Values Returned

None.

Example

```
VOID_PQ current_address;
...
sda$get_address (&current_address);
```

This call stores SDA's current memory location in the long pointerCURRENT_ADDRESS.

10.5.21. SDA$GET_BLOCK_NAME

Returns the name of a structure, given its type and/or subtype.

Format

void sda$get_block_name (uint32 block_type, uint32 block_subtype, char *buffe

Arguments

block_type

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Block type in range 0 - 255 (usually extracted from xxx$b_type field).

block_subtype

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Block subtype in range 0 - 255 (ignored if the given block type has no subtypes).

buffer_ptr

OpenVMS usage	**char_string**
type	**character string**
access	**write only**
mechanism	**by reference**

Address of buffer to save block name, which is returned as a zero-terminated string.

buffer_len

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Length of buffer to receive block name.

Description

Given the block type and/or subtype of a structure, this routine returns the name of the structure. If the structure type is one that has no subtypes, the given subtype is ignored. If the structure type is one that has subtypes, and the subtype is given as zero, the name of the block type itself is returned. If an invalid type or subtype (out of range) is given, an empty string is returned.

Note

The buffer should be large enough to accommodate the largest possible block name (25 bytes plus the termination byte). The block name is truncated if it is too long for the supplied buffer.

Condition Values Returned

None.

Example

```
char buffer[32];
...
sda$get_block_name (0x6F, 0x20,
        buffer,
        sizeof (buffer));
if (strlen (buffer) == 0)
    sda$print ("Block type: no named type/subtype");
else
    sda$print ("Block type: !AZ", buffer);
```

This example produces the following output:

```
Block type: VCC_CFCB
```

10.5.22. SDA$GET_BUGCHECK_MSG

Gets the text associated with a bugcheck code.

Format

`void sda$get_bugcheck_msg (uint32 bugcheck_code, char *buffer_ptr,uint32 buff`

Arguments

bugcheck_code

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The bugcheck code to look up.

buffer_ptr

OpenVMS usage	**char_string**
type	**character string**
access	**write only**
mechanism	**by reference**

Address of buffer to save bugcheck message.

buffer_len

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Length of buffer to receive message.

Description

Gets the string representing the bugcheck code passed as the argument. The bugcheck message string is passed in the buffer (represented as a pointer and length) as a zero-terminated ASCII string.

Note

The buffer should be large enough to accommodate the largest possible bugcheck message (128 bytes including the termination byte). The text is terminated if it is too long for the supplied buffer.

Condition Values Returned

None.

Example

```
char buffer[128];
...
sda$get_bugcheck_msg (0x108, buffer, sizeof(buffer));
sda$print ("Bugcheck code 108 (hex) =");
sda$print ("!_\"!AZ\"", buffer);
```

This example produces the following output:

```
   Bugcheck code 108 (hex) =
                 "DOUBLDALOC, Double deallocation of swap file space"
```

10.5.23. SDA$GET_CURRENT_CPU

Gets the CPU database address of the currently selected CPU.

Format

`void sda$get_current_cpu (CPU **cpudb);`

Arguments

cpudb

OpenVMS usage	**address**
type	**longword (unsigned)**
access	**write only**
mechanism	**by reference**

Location to which the address of the CPU database is to be returned.

Description

This routine causes SDA to return the address of the database for the currently selected CPU.

Condition Values Returned

None.

Example

```
#include  <cpudef>
CPU  *current_cpu;
sda$get_current_cpu  (  &current_cpu  );
```

In this example, the system address of the database for the current CPU is returned in variable *current_cpu*.

10.5.24. SDA$GET_CURRENT_PCB

Gets the PCB address of the "SDA current process" currently selected.

Format

`void sda$get_current_pcb (PCB **pcbadr);`

Arguments

pcbadr

OpenVMS usage	**quadword_unsigned**
type	**quadword (unsigned)**
access	**write only**
mechanism	**by reference**

Location in which to store the current PCB address.

Description

The PCB address of the process currently selected by SDA is returned inthe specified location.

Condition Values Returned

None.

Example

```
PCB *current_pcb;
...
sda$get_current_pcb ( &current_pcb );
```

This call stores the system address of the PCB of the process currentlybeing referenced by SDA in the pointer CURRENT_PCB.

10.5.25. SDA$GET_DEVICE_NAME

Gets the device name, given the UCB address of the device.

Format

`int sda$get_device_name (VOID_PQ ucb_addr, char *name_buf, intname_len);`

Arguments

ucb_addr

OpenVMS usage	**address**
type	**quadword (unsigned)**
access	**read only**
mechanism	**by value**

System address of the Unit Control Block of the device.

name_buf

OpenVMS usage	**char_string**
type	**character string**
access	**write only**
mechanism	**by reference**

Address of buffer to receive device name.

name_len

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Length of buffer to receive device name.

Description

This routine creates and returns the name for the device described by the given UCB. The device name is returned as a zero-terminated ASCII string.

Note

The buffer should be large enough to accommodate the largest possible device name (32 bytes including the termination byte). The text is terminated if it is too long for the supplied buffer.

Condition Values Returned

SDA$_SUCCESS	Successful completion
SDA$_NOTAUCB	The address given is not the address of a UCB

SDA$_NOREAD	The data is inaccessible for some reason
Others	The data is inaccessible for some reason

Example

```
VOID_PQ address;
     char buffer[32];
     ...
     sda$parse_command ("SHOW DEVICE DKB0:");
     sda$symbol_value ("UCB", (uint64 *)&address);
     sda$get_device_name (address, buffer, 32);
     sda$print ("UCB address: !XL = \"!AZ:\"", address, buffer);
```

This example produces the following output:

```
     UCB address: 814A9A40 = "$31$DKB0:"
```

10.5.26. SDA$GET_FLAGS

Obtain environment flags that indicate how SDA is being used.

Format

`int sda$get_flags (SDA_FLAGS *flagaddr);`

Arguments

flagaddr

OpenVMS usage	**address**
type	**SDA_FLAGS structure**
access	**write only**
mechanism	**by reference**

The address of the location where the environment flags are to be returned.

Description

SDA provides a set of flag bits that indicate if it is being used to analyze the current system, a system dump, a process dump, and so on. The flag bits that can be returned are described in Table 10.1 and are defined in SDA_FLAGSDEF.H in SYS$LIBRARY:SYS$LIB_C.TLB.

Condition Values Returned

None.

Example

```
SDA_FLAGS flags;
sda$get_flags (&flags);
if (flags.sda_flags$v_current)
```

```
sda$print (Analyzing the current system);
```

This example shows the use of SDA$GET_FLAGS.

10.5.27. SDA$GET_HEADER

Returns pointers to local copies of the dump file header and the error log buffer together with the sizes of those data structures; optionally returns pointers and sizes for the crash error log entry and trap data(if any).

Format

void sda$get_header (DMP **dmp_header, uint32 *dmp_header_size, voiderrlog_buf,**

Arguments

dmp_header

OpenVMS usage	**address**
type	**longword (unsigned)**
access	**write only**
mechanism	**by reference**

Location in which to store the address of the copy of the dump file header held by SDA.

dmp_header_size

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**write only**
mechanism	**by reference**

Location in which to store the size of the dump file header.

errlog_buf

OpenVMS usage	**address**
type	**longword (unsigned)**
access	**write only**
mechanism	**by reference**

Location in which to store the address of the copy of the error log buffer held by SDA.

errlog_buf_size

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**write only**

mechanism	**by reference**

Location in which to store the size of the error log buffer.

crasherl_buf

OpenVMS usage	**address**
type	**longword (unsigned)**
access	**write only**
mechanism	**by reference**

Location in which to store the address of the copy of the crash error log entry held by SDA.

crasherl_buf_size

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**write only**
mechanism	**by reference**

Location in which to store the size of the crash error log entry.

trapinfo_buf

OpenVMS usage	**address**
type	**longword (unsigned)**
access	**write only**
mechanism	**by reference**

Location in which to store the address of the copy of the trap info, if any, held by SDA.

trapinfo_buf_size

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**write only**
mechanism	**by reference**

Location in which to store the size of the trap data, if any.

Description

This routine returns the addresses and sizes of the dump header, error logs, and optionally the crash error log entry and trap data read by SDA when the dump file is opened. If this routine is called when the running system is being analyzed with ANALYZE/SYSTEM, then the following occurs:

- Returns the address and size of SDA's dump header buffer, but the header contains zeroes
- Returns zeroes for the address and size of SDA's error log buffer, the crash error log entry and trap data

Trap data only exists if an access violation occurs while the dump is being written. Usually, the returned trapinfo_buf and trapinfo_buf_size will be zero.

Condition Values Returned

None.

Example

```
DMP *dmp_header;
uint32 dmp_header_size;
char *errlog_buffer;
uint32 errlog_buffer_size;
...
sda$get_header (&dmp_header,
        &dmp_header_size,
        (void **)&errlog_buffer,
        &errlog_buffer_size);
```

This call stores the address and size of SDA's copy of the dump file header in DMP_HEADER and DMP_HEADER_SIZE, and stores the address and size of SDA's copy of the error log buffers in ERRLOG_BUFFER and ERRLOG_BUFFER_SIZE, respectively.

10.5.28. SDA$GET_HW_NAME

Returns the full name of the hardware platform where the dump was written.

Format

`void sda$get_hw_name (char *buffer_ptr, uint32 buffer_len);`

Arguments

buffer_ptr

OpenVMS usage	**char_string**
type	**character string**
access	**write only**
mechanism	**by reference**

Address of buffer to save HW name.

buffer_len

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Length of buffer to receive HW name.

Description

Returns a zero-terminated ASCII string representing the platform hardware name and puts it in the buffer passed as the argument.

Note

The buffer should be large enough to accommodate the largest possible hardware platform name (120 bytes including the termination byte). The name is truncated if it is too long for the supplied buffer.

Condition Values Returned

None.

Example

```
char hw_name[64];
...
sda$get_hw_name (hw_name, sizeof(hw_name));
sda$print ("Platform name: \"!AZ\"", hw_name);
```

This example produces output of the form:

```
Platform name: "DEC 3000 Model 400"
```

10.5.29. SDA$GET_IMAGE_OFFSET

Maps a given virtual address onto an image or execlet.

Format

`COMP_IMG_OFF sda$get_image_offset (VOID_PQ va, VOID_PQ img_info,VOID_PQ subim`

Arguments

va

OpenVMS usage	**address**
type	**quadword (unsigned)**
access	**read only**
mechanism	**by value**

Virtual address of interest.

img_info

OpenVMS usage	**address**
type	**quadword (unsigned)**
access	**write only**
mechanism	**by reference**

Pointer to return addr of LDRIMG or IMCB block.

subimg_info

OpenVMS usage	**address**
type	**quadword (unsigned)**
access	**write only**
mechanism	**by reference**

Pointer to return addr of ISD_OVERLAY or KFERES.

offset

OpenVMS usage	**quadword_unsigned**
type	**quadword (unsigned)**
access	**write only**
mechanism	**by reference**

Pointer to address to return offset from image.

Description

Given a virtual address, this routine finds in which image it falls and returns the image information and offset. The loaded image list is traversed first to find this information. If it is not found, then the activated image list of the currently selected process is traversed. If still unsuccessful, then the resident installed images are checked.

Condition Values Returned

SDA_CIO$V_VALID	Set if image offset is found
SDA_CIO$V_PROCESS	Set if image is an activated image
SDA_CIO$V_SLICED	Set if the image is sliced
SDA_CIO$V_COMPRESSED	Set if activated image contains compressed data sections
SDA_CIO$V_ISD_INDEX	Index into ISD_LABELS table (on Alpha, only for LDRIMG execlets)

The status returned indicates the type of image if a match was found.

SDA_CIO$V_xxx flags set:	**img_info type:**	**subimg_info type:**
VALID	LDRIMG	n/a
VALID && SLICED	LDRIMG	ISD_OVERLAY
VALID && PROCESS	IMCB	n/a
VALID && PROCESS && SLICED	IMCB	KFERES_SECTION

On Integrity servers, SDA_CIO$V_SLICED will always be set if SDA_CIO$V_VALID is set.

Table 10.2 and Table 10.3 describe the ISD_LABELS index on Alpha and Integrity server systems.

Table 10.2. Alpha ISD_LABELS Index

Index	Name	Meaning
0	SDA_CIO$K_NPRO	Nonpaged read only
1	SDA_CIO$K_NPRW	Nonpaged read/write
2	SDA_CIO$K_PRO	Paged read only
3	SDA_CIO$K_PRW	Paged read/write
4	SDA_CIO$K_FIX	Fixup
5	SDA_CIO$K_INIT	Initialization

Table 10.3. Integrity server ISD_Labels Index

Index	Name	Meaning
0	SDA_CIO$K_FIX	Fixup
1	SDA_CIO$K_PROMO_CODE	Promote (code)
2	SDA_CIO$K_PROMO_DATA	Promote (data)
3	SDA_CIO$K_INIT_CODE	Initialization (code)
4	SDA_CIO$K_INIT_DATA	Initialization (data)
5	SDA_CIO$K_CODE	Code
6	SDA_CIO$K_SHORT_RW	Short data (read/write)
7	SDA_CIO$K_SHORT_RO	Short data (read only)
8	SDA_CIO$K_RW	Data (read/write)
9	SDA_CIO$K_RO	Data (read only)
10	SDA_CIO$K_SHORT_DZ	Short data (demand zero)
11	SDA_CIO$K_SHORT_TDZ	Short data (trailing demand zero)
12	SDA_CIO$K_DZERO	Demand zero
13	SDA_CIO$K_TR_DZERO	Trailing demand zero

Example

```
VOID_PQ va = (VOID_PQ)0xFFFFFFFF80102030;
COMP_IMG_OFF sda_cio;
int64 img_info;
int64 subimg_info;
int64 offset;
...
sda_cio = sda$get_image_offset (va,
        &img_info,
        &subimg_info,
        &offset);
```

For an example of code that interprets the returned COMP_IMG_OFFstructure, see the supplied example program, SYS$EXAMPLES:MBX$SDA.C.

10.5.30. SDA$GET_INPUT

Reads input commands.

Format

`int sda$get_input (char *prompt, char *buffer, uint32 buflen);`

Arguments

prompt

OpenVMS usage	**char_string**
type	**character string**
access	**read only**
mechanism	**by reference**

Address of prompt string (zero-terminated ASCII string).

buffer

OpenVMS usage	**char_string**
type	**character string**
access	**write only**
mechanism	**by reference**

Address of buffer to store command.

buflen

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Maximum length of buffer.

Description

The command entered is returned as a zero-terminated string. The string is not uppercased. If you do not enter input but simply press<return> or <ctrl/Z>, the routine returns a null string.

Condition Values Returned

SS$_NORMAL	Successful completion.
RMS$_EOF	User pressed <ctrl/Z>

Example

```
int status;
char buffer[128];
...
status = sda$get_input ( "MBX> ", buffer, sizeof (buffer) );
```

This call prompts you for input with "MBX> " and stores the responsein the buffer.

10.5.31. SDA$GET_LINE_COUNT

Obtains the number of lines currently printed on the current page.

Format

`void sda$get_line_count (uint32 *line_count);`

Arguments

line_count

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**write only**
mechanism	**by reference**

The number of lines printed on current page.

Description

Returns the number of lines that have been printed so far on thecurrent page.

Condition Values Returned

None.

Example

```
uint32 line_count;
...
sda$get_line_count (&line_count);
```

This call copies the current line count on the current page of outputto the location LINE_COUNT.

10.5.32. SDA$GETMEM

Reads dump or system memory and signals a warning if inaccessible.

Format

`int sda$getmem (VOID_PQ start, void *dest, int length,__optional_params);`

Arguments

start

OpenVMS usage	**address**
type	**quadword (unsigned)**

access	**read only**
mechanism	**by value**

Starting virtual address in dump or system.

dest

OpenVMS usage	**address**
type	**varies**
access	**write only**
mechanism	**by reference**

Return buffer address.

length

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Length of transfer.

physical

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

0: <start> is a virtual address. This is the default.

1: <start> is a physical address.

Description

This routine transfers an area from the memory in the dump file or the running system to the caller's return buffer. It performs the necessary address translation to locate the data in the dump file. SDA $GETMEM signals a warning and returns an error status if the data is inaccessible.

Related Routines

SDA$REQMEM and SDA$TRYMEM

Condition Values Returned

SDA$_SUCCESS	Successful completion
SDA$_NOREAD	The data is inaccessible for some reason.

SDA$_NOTINPHYS	The data is inaccessible for some reason.
Others	The data is inaccessible for some reason.

If a failure status code is returned, it has already been signaled as a warning.

Example

```
int status;
PCB *current_pcb;
PHD *current_phd;
 ...
status = sda$getmem ((VOID_PQ)&current_pcb->pcb$l_phd, &current_phd, 4);
```

This call returns the contents of the PCB$L_PHD field of the PCB, whosesystem address is in the pointer CURRENT_PCB, to the pointerCURRENT_PHD.

10.5.33. SDA$INSTRUCTION_DECODE

Translates one machine instruction into the assembler string equivalent.

Format

`int sda$instruction_decode (void *istream_ptr, char *buffer, uint32buflen,__c`

Arguments

istream_ptr

OpenVMS usage	**address**
type	**longword (unsigned)**
access	**read/write**
mechanism	**by reference**

Address of the pointer that points to a copy of the i-stream in a local buffer.

buffer

OpenVMS usage	**char_string**
type	**character string**
access	**write only**
mechanism	**by reference**

Address of a string buffer into which to store the output assembler string.

buflen

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**

mechanism	**by value**

Maximum size of the string buffer.

template_buffer

OpenVMS usage	**char_string**
type	**character string**
access	**write only**
mechanism	**by reference**

(Integrity servers only.) Address of a string buffer into which to store the template string.

template_buflen

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

(Integrity servers only.) Maximum size of the template buffer.

Description

Translates a machine instruction into the assembler string equivalent. Alpha instructions are always 4 bytes long; Integrity server instructions are always in bundles that are 16 bytes long. The instruction stream must first be read into local memory and then the address of a pointer to the local copy of the instruction stream is passed to the routine. For every successful translated instruction, the pointer is automatically updated to point to the next instruction on Alpha or slot on Integrity servers.

The output assembler string and optionally the template string is zero-terminated and in case of a failure a null string is returned.

The template_buffer and template_buflen arguments only apply to Integrity servers and are optional.

Condition Values Returned

SS$_NORMAL	Successful completion.
SS$_BADPARAM	Any of the following failures:
	Output buffer too small Invalid register Invalid opcode class/format Could not translate instruction

Examples

1. Alpha servers

```
int status;
VOID_PQ va = (VOID_PQ)0xFFFFFFFF80102030;
uint32 instruction;
uint32 *istream = &instruction;
char buffer[64];
```

```
...
sda$reqmem (va, &instruction, 4);
status = sda$instruction_decode (&istream, buffer, sizeof (buffer));
if ( !$VMS_STATUS_SUCCESS (status) )
  sda$print ( "SDA$INSTRUCTION_DECODE failed, status = !XL", status);
else
  sda$print ( "VA: !AZ", buffer );)
```

This example on an Alpha system reads the instruction at dump locationVA and decodes it, putting the result into BUFFER, and displays theinstruction. Pointer ISTREAM is incremented (to the next longword).

2. Integrity servers

```
int status;
VOID_PQ va = (VOID_PQ)0xFFFFFFFF80102030;
uint64 instruction [2];
uint64 *istream = &instruction;
char buffer [64];
char template [16];
sda$reqmem (va, &instruction, 16);
status = sda$instruction_decode ( &istream, buffer, sizeof (buffer),
           template, sizeof (template) );
if ( !$VMS_STATUS_SUCCESS (status) )
  sda$print ( "SDA$INSTRUCTION_DECODE failed, status = !XL", status);
else
  {
  sda$print ( "                    { !AZ", template );
  sda$print ( "VA:                 !AZ", buffer );
  while (((int)istream & 7) != 0)// local buffer only has to be quadword
 aligned
    {
    status = sda$instruction_decode ( &istream, buffer, sizeof
 (buffer) );
    if ( !$VMS_STATUS_SUCCESS (status) )
      {
      sda$print ( "SDA$INSTRUCTION_DECODE failed, status = !XL",
 status);
      break;
      }
    else
      sda$print ( "                    !AZ", buffer );
    }
  sda$print ( "                    }" );
  }
```

This example for Integrity servers reads the instruction bundle at dump location VA and decodes it, displaying each of the instructions in the bundle. Pointer ISTREAM is incremented (to the next octaword bundle).

10.5.34. SDA$NEW_PAGE

Begins a new page of output.

Format

`void sda$new_page ();`

Arguments

None.

Description

This routine causes a new page to be written and outputs the page heading (established with SDA$FORMAT_HEADING) and the current subheading (established with SDA $SET_HEADING_ROUTINE).

Condition Values Returned

None.

Example

```
sda$new_page ();
```

This call outputs a page break and displays the current page heading and subheading (if any).

10.5.35. SDA$PARSE_COMMAND

Parses and executes an SDA command line.

Format

`void sda$parse_command (char *cmd_line, __optional_params);`

Arguments

cmd_line

OpenVMS usage	**char_string**
type	**character string**
access	**read only**
mechanism	**by reference**

Address of a valid SDA command line (zero-terminated).

options

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The **options** argument has the following values:

Value	Meaning
SDA_OPT$K_PARSE_DONT_SAVE	Indicates "do not save this command." This is the default.

Value	Meaning
SDA_OPT$K_PARSE_SAVE	Indicates "save this command." That is, it can be recalled with KP0 or REPEAT.

Description

Not every SDA command has a callable extension interface. For example,to redirect SDA's output, you would pass the command string "SET OUTPUTMBX.LIS" to this parse command routine. Abbreviations are allowed.

Condition Values Returned

None.

Example

```
sda$parse_command ("SHOW ADDRESS 80102030");
```

This call produces the following output:

```
        FFFFFFFF.80102030 is an S0/S1 address

                  Mapped by Level-3 PTE at: FFFFFFFD.FFE00408
                  Mapped by Level-2 PTE at: FFFFFFFD.FF7FF800
                  Mapped by Level-1 PTE at: FFFFFFFD.FF7FDFF8
                  Mapped by Selfmap PTE at: FFFFFFFD.FF7FDFF0

                  Also mapped in SPT window at: FFFFFFFF.FFDF0408
```

The "SHOW ADDRESS" command is not recorded as the most recent command for use with the KP0 key or the REPEAT command.

10.5.36. SDA$PRINT

Formats and prints a single line.

Format

`int sda$print (char *ctrstr, __optional_params);`

Arguments

ctrstr

OpenVMS usage	**char_string**
type	**character-coded text string**
access	**read only**
mechanism	**by reference**

Address of a zero-terminated FAO control string.

prmlst

OpenVMS usage	**varying_arg**
type	**quadword (signed or unsigned)**
access	**read only**
mechanism	**by value**

Optional FAO parameters. All arguments after the control string are copied into a quadword parameter list, as used by $FAOL_64.

Description

Formats and prints a single line. This is normally output to the terminal, unless you used the SDA commands SET OUTPUT or SET LOG to redirect or copy the output to a file.

Condition Values Returned

SDA$_SUCCESS	Indicates a successful completion.
SDA$_CNFLTARGS	Indicates more than twenty FAO parameters given.
Other	Returns from the $PUT issued by SDA$PRINT (the error is also signaled). If the $FAOL_64 call issued by SDA$PRINT fails, the control string is output.

Example

```
char buffer[32];
...
sda$get_block_name (0x6F, 0x20,
        buffer,
        sizeof (buffer));
sda$print ("Block type: !AZ", buffer);
```

This example outputs the following line:

```
Block type: VCC_CFCB
```

10.5.37. SDA$READ_SYMFILE

Reads symbols from a given file.

Format

`int sda$read_symfile (char *filespec, uint32 options,__optional_params);`

Arguments

filespec

OpenVMS usage	**char_string**
type	**character string**
access	**read only**

mechanism	**by reference**

Address of file or directory specification from which to read the symbols (zero-terminated ASCII string).

options

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Indicates type of symbol file and flags, as shown in the following:

Flags	**Effect**
SDA_OPT$M_READ_FORCE	read/force <file>
SDA_OPT$M_READ_IMAGE	read/image <file>
SDA_OPT$M_READ_SYMVA	read/symva <file>
SDA_OPT$M_READ_RELO	read/relo <file>
SDA_OPT$M_READ_EXEC	read/exec [<dir>]
SDA_OPT$M_READ_NOLOG	/nolog, suppress count of symbols read
SDA_OPT$M_READ_FILESPEC	<file> or <dir> given
SDA_OPT$M_READ_NOSIGNAL	return status, without signaling errors

relocate_base

OpenVMS usage	**address**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Base address for symbols (nonsliced symbols).

symvect_va

OpenVMS usage	**address**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The symbol vector address (symbols are offsets into the symbol vector).

symvect_size

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**

mechanism	**by value**

Size of symbol vector.

loaded_img_info

OpenVMS usage	**address**
type	**longword (unsigned)**
access	**read only**
mechanism	**by reference**

The address of $LDRIMG data structure with execlet information.

Description

This command reads symbols from a given file to add symbol definitions to the working symbol table by reading GST entries. The file is usually a symbol file (.STB) or an image (.EXE). If SDA_OPT $M_READ_EXEC is specified in the options, then the filespec is treated as a directory specification, where symbol files and/or image files for all execlets may be found (as with READ/EXECUTIVE). If no directory specification is given, the logical name SDA$READ_DIR is used.

Note that when SDA reads symbol files and finds routine names, the symbol name that matches the routine name is set to the address of the procedure or function descriptor. A second symbol name, the routine name with "_C" appended, is set to the start of the routine's prologue.

Condition Values Returned

SDA$_SUCCESS	Successful completion.
SDA$_CNFLTARGS	No filename given and SDA_OPT $M_READ_EXEC not set.

Other errors are signaled and/or returned, exactly as though the equivalent SDA READ command had been used. Use HELP/MESSAGE for explanations.

Example

```
sda$read_symfile ("SDA$READ_DIR:SYSDEF", SDA_OPT$M_READ_NOLOG);
```

The symbols in SYSDEF.STB are added to SDA's internal symbol table, and the number of symbols found is not output to the terminal.

10.5.38. SDA$REQMEM

Reads dump or system memory and signals an error if inaccessible.

Format

`int sda$reqmem (VOID_PQ start, void *dest, int length,__optional_params);`

Arguments

start

OpenVMS usage	**address**
type	**quadword (unsigned)**
access	**read only**
mechanism	**by value**

Starting virtual address in dump or system.

dest

OpenVMS usage	**address**
type	**varies**
access	**write only**
mechanism	**by reference**

Return buffer address.

length

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Length of transfer.

physical

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

0: <start> is a virtual address. This is the default.

1: <start> is a physical address.

Description

This routine transfers an area from the memory in the dump file or the running system to the caller's return buffer. It performs the necessary address translation to locate the data in the dump file. SDA $REQMEM signals an error and aborts the current command if the data is inaccessible.

Related Routines

SDA$GETMEM and SDA$TRYMEM

Condition Values Returned

SDA$_SUCCESS	Successful completion.

Any failure is signaled as an error and the current command aborts.

Example

```
VOID_PQ address;
uint32 instruction;
...
sda$symbol_value ("EXE_STD$ALLOCATE_C", (uint64 *)&address);
sda$reqmem (address, &instruction, 4);
```

This example reads the first instruction of the routine EXE_STD$ALLOCATE into the location INSTRUCTION.

10.5.39. SDA$SET_ADDRESS

Stores a new address value as the current memory address (".").

Format

void sda$set_address (VOID_PQ address);

Arguments

address

OpenVMS usage	**quadword_unsigned**
type	**quadword (unsigned)**
access	**read only**
mechanism	**by value**

Address value to store in current memory location.

Description

The specified address becomes SDA's current memory address (the predefined SDA symbol ".").

Condition Values Returned

None.

Example

```
sda$set_address ((VOID_PQ)0xFFFFFFFF80102030);
```

This call sets SDA's current address to FFFFFFFF.80102030.

10.5.40. SDA$SET_CPU

Sets a new SDA CPU context.

Format

int sda$set_cpu (int cpu_id);

Arguments

cpu_id

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The desired CPU ID.

Description

This routine causes SDA to set the specified CPU as the currently selected CPU.

Condition Values Returned

SDA$_SUCCESS	Successful completion.

Any failure is signaled as an error and the current command aborts.

Example

```
int cpu_id = 2;
status = sda$set_cpu  (  cpu_id  );
```

In this example, SDA's current CPU context is set to the CPU whose number is held in the variable CPU_ID.

10.5.41. SDA$SET_HEADING_ROUTINE

Sets the current heading routine to be called after each page break.

Format

`void sda$set_heading_routine (void (*heading_rtn) ());`

Arguments

heading_rtn

OpenVMS usage	**procedure**
type	**procedure value**
access	**read only**
mechanism	**by value**

Address of routine to be called after each new page.

Description

When SDA begins a new page of output (either because SDA$NEW_PAGE was called, or because the current page is full), it outputs two types of headings. The first is the page title, and is set by calling the routine SDA$FORMAT_HEADING. This is the title that is included in the index page of a listing file when you issue a SET OUTPUT command. The second heading is typically for column headings, and as this can vary from display to display, you must write a routine for each separate heading. When you call SDA$SET_HEADING_ROUTINE to specify a user-written routine, the routine is called each time SDA begins a new page.

To stop the routine from being invoked each time SDA begins a new page, call either SDA $FORMAT_HEADING to set a new page title, or SDA$SET_HEADING_ROUTINE and specify the routine address as NULL.

If the column headings need to be output during a display (that is, in the middle of a page), and then be re-output each time SDA begins a new page, call the user-written routine directly the first time, then call SDA$SET_HEADING_ROUTINE to have it be called automatically thereafter.

Condition Values Returned

None.

Example

```
void mbx$title (void)
  {
  sda$print ("Mailbox     UCB       ...");
  sda$print ("  Unit    Address     ...");
  sda$print ("------------------------");
  return;
  }
...
sda$set_heading_routine (mbx$title);
...
sda$set_heading_routine (NULL);
```

This example sets the heading routine to the routine MBX$TITLE, and later clears it. The routine is called if any page breaks are generated by the intervening code.

10.5.42. SDA$SET_LINE_COUNT

Sets the number of lines printed so far on the current page.

Format

`void sda$set_line_count (uint32 line_count);`

Arguments

line_count

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The number of lines printed on current page.

Description

The number of lines that have been printed so far on the current pageis set to the given value.

Condition Values Returned

None.

Example

```
sda$set_line_count (5);
```

This call sets SDA's current line count on the current page of output to 5.

10.5.43. SDA$SET_PROCESS

Sets a new SDA process context.

Format

`int sda$set_process (const char *proc_name, int proc_index, intproc_addr);`

Arguments

proc_name

OpenVMS usage	**character_string**
type	**character string**
access	**read only**
mechanism	**by reference**

Address of the process name string (zero-terminated).

proc_index

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The index of the desired process.

proc_addr

OpenVMS usage	**address**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The address of the PCB for the desired process.

Description

This routine causes SDA to set the specified process as the currently selected process.

Note

The proc_name, proc_index, and proc_addr are mutually exclusive.

Condition Values Returned

SDA$_SUCCESS	Successful completion.

Any failure is signaled as an error and the current command aborts.

Example

```
status = sda$set_process  (  "JOB_CONTROL",  0,  0);
```

In this example, SDA's current process context is set to the JOB_CONTROL process.

10.5.44. SDA$SKIP_LINES

This routine outputs a specified number of blank lines.

Format

void sda$skip_lines (uint32 lines);

Arguments

lines

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Number of lines to skip.

Description

The specified number of blank lines are output.

Condition Values Returned

None.

Example

```
sda$skip_lines (2);
```

This call causes two blank lines to be output.

10.5.45. SDA$SYMBOL_VALUE

Obtains the 64-bit value of a specified symbol.

Format

`int sda$symbol_value (char *symb_name, uint64 *symb_value);`

Arguments

symb_name

OpenVMS usage	**char_string**
type	**character string**
access	**read only**
mechanism	**by reference**

Zero-terminated string containing symbol name.

symb_value

OpenVMS usage	**quadword_unsigned**
type	**quadword (unsigned)**
access	**write only**
mechanism	**by reference**

Address to receive symbol value.

Description

A search through SDA's symbol table is made for the specified symbol.If found, its 64-bit value is returned.

Condition Values Returned

SDA$_SUCCESS	Symbol found.
SDA$_BADSYM	Symbol not found.

Example

```
int status;
VOID_PQ address;
...
status = sda$symbol_value ("EXE_STD$ALLOCATE_C", (uint64 *)&address);
```

This call returns the start address of the prologue of routine

EXE_STD$ALLOCATE to location ADDRESS.

10.5.46. SDA$SYMBOLIZE

Converts a value to a symbol name and offset.

Format

```
int sda$symbolize (uint64 value, char *symbol_buf, uint32 symbol_len);
```

Arguments

value

OpenVMS usage	**quadword_unsigned**
type	**quadword (unsigned)**
access	**read only**
mechanism	**by value**

Value to be translated.

symbol_buf

OpenVMS usage	**char_string**
type	**character string**
access	**write only**
mechanism	**by reference**

Address of buffer to which to return string.

symbol_len

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Maximum length of string buffer.

Description

This routine accepts a value and returns a string that contains a symbol and offset corresponding to that value. First the value is checked in the symbol table. If no symbol can be found (either exact match or up to 0XFFF less than the specified value), the value is then checked to see if it falls within one of the loaded or activated images.

Condition Values Returned

SS$_NORMAL	Successful completion.
SS$_BUFFEROVF	Buffer too small, string truncated.

SS$_NOTRAN	No symbolization for this value (null string returned).

Example

```
VOID_PQ va = VOID_PQ(0xFFFFFFFF80102030);
char buffer [64]
status = sda$symbolize (va, buffer, sizeof(buffer));
sda$print ("FFFFFFFF.80102030 = \"!AZ\"", buffer);
```

This example outputs the following:

```
FFFFFFFF.80102030 = "EXE$WRITE_PROCESS_C+00CD0"
```

10.5.47. SDA$TRYMEM

Reads dump or system memory and returns the error status (without signaling) if inaccessible.

Format

`int sda$trymem (VOID_PQ start, void *dest, int length,__optional_params);`

Arguments

start

OpenVMS usage	**address**
type	**quadword (unsigned)**
access	**read only**
mechanism	**by value**

Starting virtual address in dump or system.

dest

OpenVMS usage	**address**
type	**varies**
access	**write only**
mechanism	**by reference**

Return buffer address.

length

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

Length of transfer.

physical

OpenVMS usage	**longword_unsigned**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

0: <start> is a virtual address. This is the default.

1: <start> is a physical address.

Description

This routine transfers an area from the memory in the dump file or the running system to the caller's return buffer. It performs the necessary address translation to locate the data in the dump file. SDA $TRYMEM does not signal any warning or errors. It returns the error status if the data is inaccessible.

Related Routines

SDA$GETMEM and SDA$REQMEM

Condition Values Returned

SDA$_SUCCESS	Successful completion.
SDA$_NOREAD	The data is inaccessible for some reason.
SDA$_NOTINPHYS	The data is inaccessible for some reason.
Others	The data is inaccessible for some reason.

Example

```
int status;
DDB *ddb;
...
status = sda$trymem (ddb->ddb$ps_link, ddb, DDB$K_LENGTH);
if ($VMS_STATUS_SUCCESS (status))
    sda$print ("Next DDB is successfully read from dump");
else
    sda$print ("Next DDB is inaccessible");
```

This example attempts to read the next DDB in the DDB list from thedump.

10.5.48. SDA$TYPE

Formats and types a single line to SYS$OUTPUT.

Format

`int sda$type (char *ctrstr, __optional_params);`

Arguments

ctrstr

OpenVMS usage	**char_string**
type	**character-coded text string**
access	**read only**
mechanism	**by reference**

Address of a zero-terminated FAO control string.

prmlst

OpenVMS usage	**varying_arg**
type	**quadword (signed or unsigned)**
access	**read only**
mechanism	**by value**

Optional FAO parameters. All arguments after the control string are copied into a quadword parameter list, as used by $FAOL_64.

Description

Formats and prints a single line to the terminal. This is unaffected by the use of the SDA commands SET OUTPUT or SET LOG.

Condition Values Returned

SDA$_SUCCESS	Indicates a successful completion.
SDA$_CNFLTARGS	Indicates more than twenty FAO parameters given.
Other	Returns from the $PUT issued by SDA$TYPE (the error is also signaled). If the $FAOL_64 call issued by SDA$TYPE fails, the control string is output.

Example

```
int status;
...
status = sda$type ("Invoking SHOW SUMMARY to output file...");
```

This example displays the message "Invoking SHOW SUMMARY to output file..." to the terminal.

10.5.49. SDA$VALIDATE_QUEUE

Validates queue structures.

Format

`void sda$validate_queue (VOID_PQ queue_header, __optional_params);`

Arguments

queue_header

OpenVMS usage	**address**

type	**quadword (unsigned)**
access	**read only**
mechanism	**by value**

Address from which to start search.

options

OpenVMS usage	**mask_longword**
type	**longword (unsigned)**
access	**read only**
mechanism	**by value**

The following table shows the flags that indicate the type of queue:

Flag	Meaning
None	Defaults to doubly-linked longword queue
SDA_OPT$M_QUEUE_BACKLINK	Validates the integrity of a doubly-linked queue using the back links instead of the forward links
SDA_OPT$M_QUEUE_LISTQUEUE	Displays queue elements for debugging
SDA_OPT$M_QUEUE_QUADLINK	Indicates a quadword queue
SDA_OPT$M_QUEUE_SELF	Indicates a self-relative queue
SDA_OPT$M_QUEUE_SINGLINK	Indicates a singly-linked queue

Description

You can use this routine to validate the integrity of doubly-linked,singly-linked or self-relative queues either with longword or quadword links. If you specify the option SDA_OPT $M_QUEUE_LISTQUEUE, the queue elements are displayed for debugging. Otherwise a one-line summary indicates how many elements were found and whether the queue is intact.

Condition Values Returned

None.

If an error occurs, it is signaled by SDA$VALIDATE_QUEUE.

Example

```
int64 temp;
int64 *queue;
...
sda$symbol_value ("EXE$GL_NONPAGED", &temp);
temp += 4;
sda$reqmem ((VOID_PQ)temp, &queue, 4);
sda$validate_queue (queue, SDA_OPT$M_QUEUE_SINGLINK);
```

This sequence validates the nonpaged pool free list, and outputs a message of the form:

```
Queue is zero-terminated, total of 204 elements in the queue
```

Part II. OpenVMS System Code Debugger and System Dump Debugger

This part describes the System Code Debugger (SCD) and the System Dump Debugger (SDD). It presents how to use SCD and SDD by doing the following:

- Building a system image to be debugged
- Setting up the target system for connections
- Setting up the host system
- Starting SCD
- Troubleshooting connections and network failures
- Looking at a sample SCD session
- Analyzing memory as recorded in a system dump
- Looking at a sample SDD session

Chapter 11. OpenVMS System Code Debugger

This chapter describes the OpenVMS System Code Debugger (SCD) and how it can be used to debug nonpageable system code and device drivers running at any interrupt priority level (IPL).

You can use SCD to perform the following tasks:

- Control the system software's execution----stop at points of interest, resume execution, intercept fatal exceptions, and so on
- Trace the execution path of the system software
- Monitor exception conditions
- Examine and modify the values of variables
- Test the effect of modifications, in some cases, without having to edit the source code, recompile, and relink

The use of SCD requires two systems:

- The host system, probably also the system where the image to be debugged has been built
- The target system, usually a standalone test system, where the image being debugged is executed
- Host and target systems must be the same architecture, that is, both must be Alpha systems or Integrity server systems.

SCD is a symbolic debugger. You can specify variable names, routine names, and so on, precisely as they appear in your source code. SCD can also display the source code where the software is executing, and allow you to step by source line.

SCD recognizes the syntax, data typing, operators, expressions, scoping rules, and other constructs of a given language. If your code or driver is written in more than one language, you can change the debugging context from one language to another during a debugging session.

To use SCD, you must do the following:

- Build a system image or device driver to be debugged.
- Set up the target kernel on a standalone system.

  The **target kernel** is the part of SCD that resides on the system that is being debugged. It is integrated with XDELTA and is part of the SYSTEM_DEBUG execlet.
- Set up the host system environment, which is integrated with the OpenVMS Debugger.

The following sections cover these tasks in more detail, describe the available user-interface options, summarize applicable OpenVMS Debugger commands, and provide a sample SCD session.

11.1. User-Interface Options

SCD has the following user-interface options:

- A DECwindows Motif interface for workstations

  When using this interface, you interact with SCD by using a mouse and pointer to choose items from menus, click on buttons, select names in windows, and so on.

  Note that you can also use OpenVMS Debugger commands with the DECwindows Motif interface.

- A character cell interface for terminals and workstations

  When using this interface, you interact with SCD by entering commands at a prompt. The sections in this chapter describe how to use the system code debugger with the character cell interface.

For more information about using the OpenVMS DECwindows Motif interface and OpenVMS Debugger commands with SCD, see the *VSI OpenVMS Debugger Manual*.

11.2. Building a System Image to Be Debugged

1. Compile the sources you want to debug, and be sure to use the /DEBUG and /NOOPT qualifiers.

   Note

   Debugging optimized code is much more difficult and is not recommended unless you know the Alpha or Integrity server architecture well. The instructions are reordered so much that single-stepping by source line will look like you are randomly jumping all over the code. Also note that you cannot access all variables. SCD reports that they are optimized away.

2. Link your image using the /DSF (debug symbol file) qualifier. Do not use the /DEBUG qualifier, which is for debugging user programs. The /DSF qualifier takes an optional filename argument similar to the /EXE qualifier. For more information, see the *VSI OpenVMS Linker Utility Manual*. If you specify a name in the /EXE qualifier, you will need to specify the same name for the /DSF qualifier. For example, you would use the following command:

   ```
   $ LINK/EXE=EXE$:MY_EXECLET/DSF=EXE$:MY_EXECLET OPTIONS_FILE/OPT
   ```

   The .DSF and .EXE file names must be the same. Only the extensions will be different, that is .DSF and .EXE.

   The contents of the .EXE file should be exactly the same as if you had linked without the /DSF qualifier. The .DSF file will contain the image header and all the debug symbol tables for .EXE file. It is not an executable file, and cannot be run or loaded.

3. Put the .EXE file on your target system.

4. Put the .DSF file on your host system, because when you use SCD to debug code in your image, it will try to look for a .DSF file first and then look for an .EXE file. The .DSF file is better because it has symbols in it. Section 11.4 describes how to tell SCD where to find your .DSF and .EXE files.

11.3. Setting Up the Target System for Connections

The target kernel is controlled by flags and devices specified when the system is booted, by XDELTA commands, by a configuration file, and by several system parameters. The following sections contain more information about these items.

Boot Flags

You can specify flags on the boot command line. Boot flags are specified as a hex number; each bit of the number represents a true or false value for a flag. The following flag values are relevant to the system code debugger.

- **8000**

  This is the SCD boot flag. It enables operation of the target kernel. If this SCD boot flag is not set, not only will it be impossible to use SCD to debug the system, but the additional XDELTA commands related to the target kernel will generate an XDELTA error message. If this boot flag is set, SYSTEM_DEBUG is loaded, and SCD is enabled.

- **0004**

  This is the initial breakpoint boot flag. It controls whether the system calls INI$BRK at the beginning and end of EXEC_INIT. Notice that if SCD is the default debugger, the first breakpoint is not as early as it is for XDELTA. It is delayed until immediately after the PFN database is set up.

- **0002**

  This is the XDELTA boot flag, which controls whether XDELTA is loaded. It behaves slightly differently when the SCD boot flag is also set.

  If the SCD boot flag is clear, this flag simply determines if XDELTA is loaded. If the SCD boot flag is set, this flag determines whether XDELTA or the system code debugger is the default debugger. If the XDELTA flag is set, XDELTA will be the default debugger. In this state, the initial system breakpoints and any calls to INI$BRK trigger XDELTA, and you must enter an XDELTA command to start using SCD. If the XDELTA boot flag is clear, the initial breakpoints and calls to INI$BRK go to SCD. You cannot use XDELTA if the XDELTA boot flag is clear.

Boot Command

The form of the boot command varies depending on the platform and type OpenVMS system. However, all SCD boot commands have the concept of boot flags, boot device, and dedicated Ethernet device. In all environments, you must specify an Ethernet device on the target system to use to communicate with the host debugger. It is currently a restriction that this device must not be used for anything else (either for booting or network software such as DECnet, TCP/IP products, and LAT products).

To use Alpha SCD, you must specify the Ethernet device with the boot command. In this example, we are using DEC 3000 Model 400 Alpha Workstation syntax. We are booting from the DKB100 disk and using the ESA0 Ethernet device. We are also setting the SCD, XDELTA, and initial (earliest) breakpoint flags:

```
>>> show device
.
```

```
.
.
>>> boot dkb100,esa0 -fl 0,8006
```

You can set these devices and flags to be the default values so that you will not have to specify them each time you boot:

```
>>> set bootdef_dev dkb100,esa0
>>> set boot_osflags 0,8006
```

To use Integrity server SCD, you can specify an Ethernet device (debug_dev) BEFORE loading the Operating System and AFTER you have selected the device/partition. Setting debug_dev is sticky. That is, you only need to set it once. Using a VSI rx2600 syntax:

A sample Integrity server Boot Menu follows.

```
          Please select a boot option

      EFI Shell [Built-in]
      PESOS - X8.2-AHI (Topaz BL2) on $1$DGA3890:[SYS2.]
      PESOS - X8.2-AHI (Topaz BL2) on $1$DGA3890:[SYS2.] sysboot
      PESOS - E8.2-ADH (Topaz BL1) on $1$DGA3891:[SYS2.]
      PESOS - E8.2-ADH (Topaz BL1) on $1$DGA3891:[SYS2.] sysboot
      Boot Option Maintenance Menu
      System Configuration Menu
```

Select the EFI Shell [Built-in].

```
        Loading.: EFI Shell [Built-in]
        EFI Shell version 1.10 [14.61]
        Device mapping table

          fs0   : Acpi(HWP0002,100)/Pci(1|0)/Scsi(Pun0,Lun0)/
HD(Part1,SigA02952
          fs1   : Acpi(HWP0002,300)/Pci(1|0)/
Fibre(WWN50001FE10011B15D,Lun2200)
          fs2   : Acpi(HWP0002,300)/Pci(1|0)/
Fibre(WWN50001FE10011B15D,Lun2200)
          fs3   : Acpi(HWP0002,300)/Pci(1|0)/
Fibre(WWN50001FE10011B15D,Lun2300)
          .
          .
          .

        Shell>
```

Select the desired device/partition:

```
Shell> fs1:
fs1:\>
```

Use the utilities in \efi\vms. Use vms_show to list the devices and vms_set to set Ethernet device (debug_dev), if necessary.

```
fs1:\> \efi\vms\vms_show device
VMS: EIA0
EFI: Acpi(000222F0,0)/Pci(3|0)/Mac(00306E39F77B)
```

```
VMS: DKB200
EFI: fs1: Acpi(000222F0,100)/Pci(1|1)/Scsi(Pun2,Lun0)

VMS: DKB0
EFI: fs0: Acpi(000222F0,100)/Pci(1|1)/Scsi(Pun0,Lun0)

VMS: EWA0
EFI: Acpi(000222F0,100)/Pci(2|0)/Mac(00306E3977C5)
.
.
.
```

Set the Ethernet device.

```
fs1:\> \efi\vms\vms_set debug_dev eia0
VMS: EIA0              0-30-6E-39-F7-CF
EFI: Acpi(000222F0,0)/Pci(3|0)/Mac(00306E39F7CF)
```

Finally, load the OS. In this example, the boot is with the SCD and initial (earliest) breakpoint flags using root 2 (SYS2), that will vary with system setups.

```
        fs1:\> \efi\vms\vms_loader -flags "2,8004"
```

You can set the flags to be the default value instead of specifying them for each and every OS load:

```
        fs1:\> set vms_flags "2,8004"
```

You can also build the entire boot device, OS load command with flags setting as a Boot Option. See the "Boot Option Maintenance Menu", described in the *VSI OpenVMS System Manager's Manual, Volume 1: Essentials*.

SCD Configuration File

The SCD target system reads a configuration file in SYS$SYSTEM named DBGTK$CONFIG.SYS. The first line of this file contains a default password, which must be specified by the host debug system to connect to the target. The default password may be the null string; in this case the host must supply the null string as the password (/PASSWORD="") on the connect command as described in Section 11.5, or no password at all. Other lines in this file are reserved by VSI. Note that you must create this file because VSI does not supply it. If this file does not exist prior to booting with SCD enabled, you can only run SCD by specifying a default password with the XDELTA ;R command described in the following section.

XDELTA Commands

When the system is booted with both the XDELTA boot flag and the SCD boot flag, the following two additional XDELTA commands are enabled:

- n\xxxx\;R ContRol SCD connection

  You can use this command to do the following:

  - Change the password which the SCD host must present
  - Disconnect the current session from SCD
  - Give control to SCD by simulating a call to INI$BRK

- Any combination of these

Optional string argument xxxx specifies the password that the system code debugger must present for its connection to be accepted. If this argument is left out, the required password is unchanged. The initial password is taken from the first line of the SYS$SYSTEM:DBGTK$CONFIG.SYS file. The new password does not remain in effect across a boot of the target system.

The optional integer argument *n* controls the behavior of the ;R command as follows:

Value of N	**Action**
+1	Gives control to SCD by simulating a call to INI $BRK
+2	Returns to XDELTA after changing the password. 2;R without a password is a no-op
0	Performs the default action
-1	Changes the password, breaks any existing connection to SCD, and then simulates a call to INI$BRK (which will wait for a new connection to be established and then give control to SCD)
-2	Returns to XDELTA after changing the password and breaking an existing connection

Currently, the default action is the same action as +1.

If SCD is already connected, the ;R command transfers control to SCD, and optionally changes the password that must be presented the next time a system code debugger tries to make a connection. This new password does not last across a boot of the target system.

- n;K Change inibrK behavior

  If optional argument *n* is 1, future calls to INI$BRK will result in a breakpoint being taken by SCD. If the argument is 0, or no argument is specified, future calls to INI$BRK will result in a breakpoint being taken by XDELTA.

SYSTEM Parameters

- **BREAKPOINTS**

  This parameter is a bitmask, enabling existing INI$BRK calls within OpenVMS in the following situations:

Bit 0	At the start of INIT
Bit 1	At the end of INIT
Bit 2	At the point in INIT just prior to starting secondary CPUs
Bit 3	If INI$BRK is called from an outer mode
Bit 4	Before calling the initialization routine of a newly-loaded executive image
Bits 5-31	Reserved by VSI

Notes on the use of BREAKPOINTS parameter:

1. Calling INI$BRK from executive mode when bit 3 of BREAKPOINTS is not set will result in process exit, or a SSRVEXCEPT bugcheck (if SYSTEM_CHECK or BUGCHECKFATAL is also set).

2. Changing BREAKPOINTS from its default value of 3 may allow the security of the system to be compromised, and should only be used with caution.

- **DBGTK_SCRATCH**

  Bits 0 through 7 specify how many pages of memory are allocated for SCD. This memory is allocated only if system code debugging is enabled with the SCD boot flag (described earlier in this section). Usually, the default value of 1 is adequate; however, if SCD displays an error message, increase this value.

  Bits 8 through 31 are reserved by VSI.

- **SCSNODE**

  Identifies the target kernel node name for SCD. See Section 11.3.1 for more information.

- **S0_PAGING**

  If the image you are debugging includes pageable code or data, set S0_PAGING to 3 to ensure that such code and data are always resident in memory. SCD cannot examine, deposit to, set breakpoints at, and so on, any locations in pageable sections that are not currently valid. [This applies only to Alpha. Integrity server executive images and drivers do not contain pageable code or data.]

- **POOLPAGING**

  If the image you are debugging uses paged pool, set POOLPAGING to zero to ensure that paged pool is always resident in memory. SCD cannot examine or deposit to any locations in paged pool that are not currently valid.

- **TIME_CONTROL** This parameter is a bitmask, disabling certain time control functions within VMS:

Bit 0	Disables system clock
Bit 1	Disables CPU sanity timeouts
Bit 2	Disables CPU spinwait timeouts

  When XDELTA or SCD is loaded (bit 1 or bit 15 of boot flags is set), the value of TIME_CONTROL is changed from its default of zero to 6 (disable CPU sanity and CPU spinwait timeouts). This is to prevent these timeouts from occurring when the system is waiting at a breakpoint. If necessary, these settings can be altered, using the SYSGEN utility or a Deposit command within XDELTA or SCD. Bit 0 should never be set.

11.3.1. Making Connections Between the Target Kernel and the System Code Debugger

It is always SCD on the host system that initiates a connection to the target kernel. When SCD initiates this connection, the target kernel accepts or rejects the connection based on whether the remote debugger presents it with a node name and password that matches the password in the target system (either the default password from the SYS$SYSTEM:DBGTK$CONFIG.SYS file, or a different password specified via XDELTA). SCD obtains the node name from the SCSNODE system parameter.

The target kernel can accept a connection from SCD any time the system is running below IPL 22, or if XDELTA is in control (at IPL 31). However, the target kernel actually waits at IPL 31 for a connection from the SCD host in two cases: when it has no existing connection to an SCD host and (1) it receives a breakpoint caused by a call to INI$BRK (including either of the initial breakpoints), or (2) when you enter a 1;R or -1;R command to XDELTA.

11.3.2. Interactions Between XDELTA and the Target Kernel/System Code Debugger

XDELTA and the target kernel are integrated into the same system. Normally, you choose to use one or the other. However, XDELTA and the target kernel can be used together. This section explains how they interoperate.

The XDELTA boot flag controls which debugger (XDELTA or the SCD target kernel) gets control first. If it is not set, the target kernel gets control first, and it is not possible to use XDELTA without rebooting. If it is set, XDELTA gets control first, but you can use XDELTA commands to switch to the target kernel and to switch INI$BRK behavior such that the target kernel gets control when INI$BRK is called.

Breakpoints always *stick* to the debugger that set them; for example, if you set a breakpoint at location "A" with XDELTA, and then you enter the commands 1;K (switch INI$BRK to the system code debugger) and ;R (start using the system code debugger) then, from SCD, you can set a breakpoint at location "B". If the system executes the breakpoint at A, XDELTA reports a breakpoint, and SCD will see nothing (though you could switch to SCD by issuing the XDELTA ;R command). If the system executes the breakpoint at B, SCD will get control and report a breakpoint (you cannot switch to XDELTA from SCD).

Notice that if you examine location A with SCD, or location B with XDELTA, you will see a BPT instruction, not the instruction that was originally there. This is because neither debugger has any information about the breakpoints set by the other debugger.

One useful way to use both debuggers together is when you have a system that exhibits a failure only after hours or days of heavy use. In this case, you can boot the system with SCD enabled (8000), but with XDELTA the default (0002) and with initial breakpoints enabled (0004). When you reach the initial breakpoint, set an XDELTA breakpoint at a location that will only be reached when the error occurs. Then proceed. When the error breakpoint is reached, possibly days later, then you can set up a remote system to debug it and enter the ;R command to XDELTA to switch control to SCD.

Here is another technique to use on Alpha when you do not know where to put an error breakpoint as previously mentioned. Boot the system with only the SCD boot flag set. When you see that the error has occurred, halt the system and initiate an IPL 14 interrupt, as you would to start XDELTA. The target kernel will get control and wait for a connection for SCD.

The equivalent technique on Integrity servers is as follows:

Boot the system with only the SCD flag set (bit 15). When you see that the error has occurred, type Ctrl/P at the console. This will give control to XDELTA (even though the XDELTA boot flag is not set) and you can now type 1;R. The target kernel will get control and wait for a connection for SCD.

11.3.3. Interactions between the Target Kernel, the System Code Debugger, and other system components

The target kernel must have exclusive use of its Ethernet device. Some system components, such as DECnet, will not start if the System Code Debugger is loaded. If there are multiple Ethernet devices, and the system is configured to give exclusive access of the SCD Ethernet device to the target kernel, the logical name DBGTK$OVERRIDE must be defined, indicating that the affected system components should start up as normal. The logical name can either be defined systemwide, or in the process where the startup command for the system component will be executed.

11.4. Setting Up the Host System

To set up the host system, you need access to all system images and drivers that are loaded (or can be loaded) on the target system. You should have access to a source listings kit or a copy of the following directories:

```
SYS$LOADABLE_IMAGES:
SYS$LIBRARY:
SYS$MESSAGE:
```

You need all the .EXE files in those directories. The .DSF files are available with the OpenVMS source listings kit.

Optionally, you need access to the source files for the images to be debugged. SCD will look for the source files in the directory where they were compiled. If your build system and host system are different, you must use the SET SOURCE command to point SCD to the location of the source code files. For an example of the SET SOURCE command, see Section 11.12.

Before making a connection to the target system, you must set up the logical name DBGHK $IMAGE_PATH, which must be set up as a search list to the area where the system images or .DSF files are kept. For example, if the copies are in the following directories:

```
DEVICE:[SYS$LDR]
DEVICE:[SYSLIB]
DEVICE:[SYSMSG]
```

you would define DBGHK$IMAGE_PATH as follows:

```
$ define dbghk$image_path DEVICE:[SYS$LDR],DEVICE:[SYSLIB],DEVICE:[SYSMSG]
```

This works well for debugging using all the images normally loaded on a given system. However, you might be using the debugger to test new code in an execlet or a new driver. Because that image is most likely in your default directory, you must define the logical name as follows:

```
$ define dbghk$image_path [],DEVICE:[SYS$LDR],DEVICE:[SYSLIB],DEVICE:
[SYSMSG]
```

If SCD cannot find one of the images through this search path, a warning message is displayed. SCD will continue initialization as long as it finds at least two images. If SCD cannot find the SYS $BASE_IMAGE and SYS$PUBLIC_VECTORS files, which are the OpenVMS operating system's main image files, an error message is displayed and the debugger exits.

If and when this happens, check the directory for the image files and compare it to what is loaded on the target system.

11.5. Starting the System Code Debugger

To start SCD on the host side, enter the following command:

```
$ DEBUG/KEEP
```

SCD displays the DBG> prompt. With the DBGHK$IMAGE_PATH logical name defined, you can invoke the CONNECT command and the optional qualifiers /PASSWORD and /IMAGE_PATH.

To use the CONNECT command and the optional qualifiers (/PASSWORD and /IMAGE_PATH) to connect to the node with name *nodename*, enter the following command:

```
DBG> CONNECT %NODE_NAME nodename /PASSWORD="password"
```

If a password has been set up on the target system, you must use the /PASSWORD qualifier. If a password is not specified, a zero length string is passed to the target system as the password.

The /IMAGE_PATH qualifier is also optional. If you do not use this qualifier, SCD uses the DBGHK $IMAGE_PATH logical name as the default. The /IMAGE_PATH qualifier is a quick way to change the logical name. However, when you use it, you cannot specify a search list. You can use only a logical name or a device and directory, although the logical name can be a search list.

Usually, SCD obtains the source file name from the object file. This is put there by the compiler when the source is compiled with the /DEBUG qualifier. The SET SOURCE command can take a list of paths as a parameter. It treats them as a search list.

11.6. Summary of System Code Debugger Commands

In general, any OpenVMS debugger command can be used in SCD. For a complete list, refer to the *VSI OpenVMS Debugger Manual*. The following are a few examples:

- Commands to manipulate the source display, such as TYPE and SCROLL.
- Commands used in OpenVMS debugger command programs, such as DO and IF.
- Commands that affect output formats, such as SET RADIX.
- Commands that manipulate symbols and scope, such as EVALUATE, SET LANGUAGE, and CANCEL SCOPE. Note that the debugger SHOW IMAGE command is equivalent to the XDELTA ;L command, and the debugger DEFINE command is equivalent to the XDELTA ;X command.
- Commands that cause code to be executed, such as STEP and GO. Note that the debugger STEP command is equivalent to the XDELTA S and O commands, and the debugger GO command is equivalent to the XDELTA ;P and ;G commands.
- Commands that manipulate breakpoints, such as SET BREAK and CANCEL BREAK. These commands are equivalent to the XDELTA ;B command. However, unlike XDELTA, there is no limit on the number of breakpoints in SCD.
- Commands that affect memory, such as DEPOSIT and EXAMINE. These commands are equivalent to the XDELTA /,!,[,",' commands.

You can also use the OpenVMS debugger command SDA to examine the target system with System Dump Analyzer semantics. This command, which is not available when debugging user programs, is described in the next section.

11.7. Using System Dump Analyzer Commands

Once a connection has been established to the target system, you can use the commands listed in the previous section to examine the target system. You can also use some System Dump Analyzer (SDA) commands, such as SHOW SUMMARY and SHOW DEVICE. This feature allows the system programmer to take advantage of the strengths of both the OpenVMS Debugger and SDA to examine the state of the target system and to debug system programs such as device drivers.

To obtain access to SDA commands, you simply type "SDA" at the OpenVMS Debugger prompt ("DBG>") at any time after a connection has been established to the target system. SDA initializes itself and then outputs the "SDA>" prompt. Enter SDA commands as required. (See Chapter 4 for more information.) To return to the OpenVMS Debugger, you enter "EXIT" at the "SDA>" prompt. Optionally, you may invoke SDA to perform a single command and then return immediately to the OpenVMS Debugger, as in the following example:

```
DBG>SDA SHOW SUMMARY
```

You may reenter SDA at any time, with or without the optional SDA command. Once SDA has been initialized, the SDA> prompt is output more quickly on subsequent occasions.

Note that there are some limitations on the use of SDA from within SCD.

- You cannot switch between processes, whether requested explicitly (SET PROCESS <name>) or implicitly (SHOW PROCESS <name>). The exception to this is that access to the system process is possible.
- You cannot switch between CPUs.
- SDA has no knowledge of the OpenVMS debugger's Motif or Windows interfaces. Therefore, all SDA input and output occurs at the terminal or window where the OpenVMS debugger was originally invoked. Also, while using SDA, the OpenVMS debugger window is not refreshed; you must exit SDA to allow the OpenVMS debugger window to be refreshed.
- When you invoke SDA from SCD with an immediate command, and that command produces a full screen of output, SDA displays the message "Press RETURN for more." followed by the "SDA>" prompt before continuing. If you enter another SDA command at this prompt, SDA does not automatically return to SCD upon completion. To do this, you must enter an EXIT command.

11.8. System Code Debugger Network Information

The SCD host and the target kernel use a private Ethernet protocol to communicate. The best way to ensure that the two systems can see each other is for them both to be on the same Ethernet segment. Otherwise, your network and its bridges must be set up to pass through the packets with the protocol 08-00-2B-80-4B and multicast address 09-00-2B-02-01-0F.

The network portion of the target system uses the specified Ethernet device and communicates through it. The network portion of the host system finds the first Ethernet device and communicates through it. If the host SCD picks the wrong device for your needs, then you can force it to use the correct device by defining the logical DBGHK$ADAPTOR as the template device name for the appropriate adaptor.

11.9. Troubleshooting Checklist

If you have trouble starting a connection, perform the following tasks to correct the problem:

- Check SCSNODE on the target system.

  It must match the name you are using in the host CONNECT command.

- Make sure that both the Ethernet and boot device have been specified correctly.

- Make sure that the host system is using the correct Ethernet device, and that the host and target systems are connected to the same Ethernet segment.

- Check the version of the operating system and make sure that both the host and target systems are running the same version of the OpenVMS operating system.

11.10. Troubleshooting Network Failures

There are three possible network errors:

- NETRETRY

  Indicates the system code debugger connection is lost

- SENDRETRY

  Indicates a message send failure

- NETFAIL

  Results from the two previous errors

The netfail error message has a status code that can be one of the following values:

Value	Status
2, 4, 6	Internal network error, submit a problem report to VSI.
8,10,14,16,18,20,26,28,34,38	Network protocol error, submit a problem report to VSI.
22,24	Too many errors on the network device most likely due to congestion. Reduce the network traffic or switch to another network backbone.
30	Target system scratch memory not available. Check DBGTK_SCRATCH. If increasing this value does not help, submit a problem report to VSI.

Value	Status
32	Ran out of target system scratch memory. Increase value of DBGTK_SCRATCH.
All others	There should not be any other network error codes printed. If one occurs that does not match the previous ones, submit a problem report to VSI.

11.11. Access to Symbols in OpenVMS Executive Images

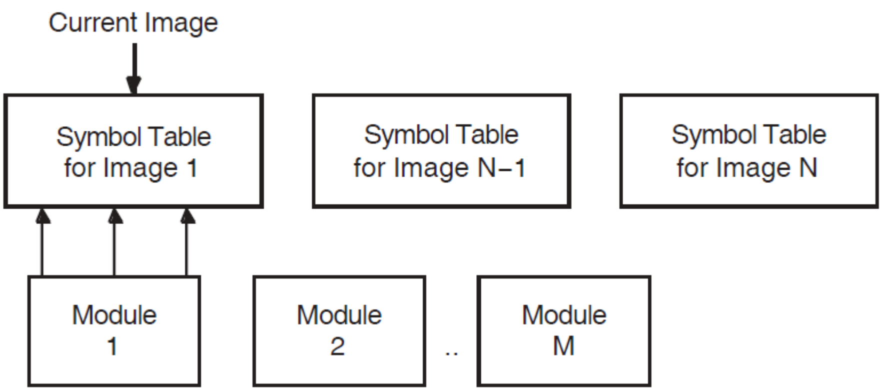
Accessing OpenVMS executive images' symbols is not always straightforward with SCD. Only a subset of the symbols may be accessible at one time and in some cases, the symbol value the debugger currently has may be stale. To understand these problems and their solutions, you must understand how the debugger maintains its symbol tables and what symbols exist in the OpenVMS executive images. The following sections briefly summarize these topics.

11.11.1. Overview of How the OpenVMS Debugger Maintains Symbols

The debugger can access symbols from any image in the OpenVMS loaded system image list by reading in either the .DSF or .EXE file for that particular image. The .EXE file contains information only about symbols that are part of the symbol vector for that image. The current image symbols for any set module are defined. (You can tell if you have the .DSF or .EXE file by doing a SHOW MODULE. If there are no modules, you have the .EXE file.) This includes any symbols in the SYS$BASE_IMAGE.EXE symbol vector for which the code or data resides in the current image. However, you cannot access a symbol that is part of the SYS$BASE_IMAGE.EXE symbol vector that resides in another image.

In general, at any one point in time, the debugger can access only the symbols from one image. It does this to reduce the time it takes to search for a symbol in a table. To load the symbols for a particular image, use the SET IMAGE command. When you set an image, the debugger loads all the symbols from the new image and makes that image the current image. The symbols from the previous image are in memory, but the debugger will not look through them to translate symbols.

There is a set of modules for each image the debugger accesses. The symbol tables in the image that are part of these modules are not loaded with the SET IMAGE command. Instead they can be loaded with the SET MODULE <module-name> or SET MODULE/ALL commands. As they are loaded, a new symbol table is created in memory under the symbol table for the image. The figure below shows what this looks like.



When the debugger needs to look up a symbol name, it first looks at the current image to find the information. If it does not find it there, it then looks into the appropriate module. It determines which module is appropriate by looking at the module range symbols which are part of the image symbol table.

To see the symbols that are currently loaded, use the debugger's SHOW SYMBOL command. This command has a few options to obtain more than just the symbol name and value. (See the *VSI OpenVMS Debugger Manual* for more details.)

11.11.2. Overview of OpenVMS Executive Image Symbols

Depending on whether the debugger has access to the .DSF or .EXE file, different kinds of symbols could be loaded. Most users will have the .EXE file for the OpenVMS executive images and a .DSF file for their private images---that is, the images they are debugging.

The OpenVMS executive consists of two base images, SYS$BASE_IMAGE.EXE and SYS$PUBLIC_VECTORS.EXE, and a number of separately loadable executive images.

The two base images contain symbol vectors. For SYS$BASE_IMAGE.EXE, the symbol vector is used to define symbols accessible by all the separately loadable images. This allows these images to communicate with each other through cross-image routine calls and memory references. For SYS$PUBLIC_VECTORS.EXE, the symbol vector is used to define the OpenVMS system services. Because these symbol vectors are in the .EXE and the .DSF files, the debugger can load these symbols no matter which one you have.

All images in the OpenVMS executive also contain global and local symbols. However, none of these symbols ever gets into the .EXE file for the image. These symbols are put in the specific module's section of the .DSF file if that module was compiled using /DEBUG and the image was linked using /DSF.

11.11.3. Possible Problems You May Encounter

Access to All Executive Image Symbols

When the current image is not SYS$BASE_IMAGE, but one of the separately loaded images, the debugger does not have access to any of the symbols in the SYS$BASE_IMAGE symbol vector. This means you cannot access (set breakpoints, and so on) any of the cross-image routines or data cells. The only symbols you have access to are the ones defined by the current image.

If the debugger has access only to the .EXE file, then only symbols that have vectors in the base image are accessible. For .DSF files, the current image symbols for any set module are defined. (You can tell if you have the .DSF or .EXE by using the SHOW MODULE command---if there are no modules you have the .EXE). This includes any symbols in the SYS$BASE_IMAGE.EXE symbol vector for which the code or data resides in the current image. However, the user cannot access a symbol that is part of the SYS$BASE_IMAGE.EXE symbol vector that resides in another image. For example, if you are in one image and you want to set a breakpoint in a cross-image routine from another image, you do not have access to the symbol. Of course, if you know in which image it is defined, you can do a SET IMAGE, SET MODULE/ALL, and then a SET BREAK.

There is a debugger workaround for this problem. The debugger and SCD let you use the SET MODULE command on an image by prefixing the image name with SHARE$ (SHARESYSBASE_IMAGE, for example). This treats that image as a module which is part of the current image. In the previous figure, think of it as another module in the module list for an image. Note, however, that only the symbols for the symbol vector are loaded. None of the symbols for the modules of the SHARE $xxx image are loaded. Therefore, this command is only useful for base images.

So, in other words, by doing SET MODULE SHARESYSBASE_IMAGE, the debugger gives you access to all cross-image symbols for the OpenVMS executive.

11.12. Sample System Code Debugging Session

This section provides a sample session that shows the use of some OpenVMS debugger commands as they apply to SCD. The examples in this session show how to work with C code that has been linked into the SYSTEM_DEBUG execlet. It is called as an initialization routine for SYSTEM_DEBUG.

To reproduce this sample session, the host system needs access to the SYSTEM_DEBUG.DSF matching the SYSTEM_DEBUG.EXE file on your target system, and to the source file C_TEST_ROUTINES.C, which is available in SYS$EXAMPLES. The target system is booted with the boot flags 0, 8004, so it stops at an initial breakpoint. The system disk is DKB200, and the network device is ESA0 in the Alpha examples and EIA0 in the Integrity server examples.

Note that the example displays from Example 11-5 onwards are all taken from an OpenVMS Integrity server system. On an OpenVMS Alpha system, some of the output is different, but the commands entered are the same on both platforms, except in one case, as noted in the accompanying text.

Example 11.1. Booting an Alpha Target System

```
>>> b -fl 0,8004 dkb200,esa0
INIT-S-CPU...
INIT-S-RESET_TC...
INIT-S-ASIC...
INIT-S-MEM...
INIT-S-NVR...
INIT-S-SCC...
INIT-S-NI...
INIT-S-SCSI...
INIT-S-ISDN...
INIT-S-TC0...
AUDIT_BOOT_STARTS ...
AUDIT_CHECKSUM_GOOD
AUDIT_LOAD_BEGINS
AUDIT_LOAD_DONE

%SYSBOOT-I-GCTFIL, Using a configuration file to boot as a Galaxy instance.


    OpenVMS (TM) Alpha Operating System, Version V8.3
    © Copyright 1976-2006 Hewlett-Packard Development Company, L.P.

DBGTK: Initialization succeeded.  Remote system debugging is now possible.

DBGTK: Waiting at breakpoint for connection from remote host.
```

A sample Integrity server Boot Menu follows (long lines wrapped for clarity).

Example 11.2. Booting an Integrity server Target System

```
Please select a boot option
```

```
  EFI Shell [Built-in]
  PESOS - X8.2-AHI (Topaz BL2) on $1$DGA3890:[SYS2.]
  PESOS - X8.2-AHI (Topaz BL2) on $1$DGA3890:[SYS2.] sysboot
  PESOS - E8.2-ADH (Topaz BL1) on $1$DGA3891:[SYS2.]
  PESOS - E8.2-ADH (Topaz BL1) on $1$DGA3891:[SYS2.] sysboot
  Boot Option Maintenance Menu
  System Configuration Menu

Select the "EFI Shell [Built-in]"

      Loading.: EFI Shell [Built-in]
      EFI Shell version 1.10 [14.61]
      Device mapping table

       fs0   : Acpi(HWP0002,100)/Pci(1|1)/Scsi(Pun0,Lun0)/HD(Part2,
               SigB3A4A931-1F2A-11D8-9EA1-AA000400FEFF)
       fs1   : Acpi(HWP0002,100)/Pci(1|1)/Scsi(Pun2,Lun0)/HD(Part1,
               SigF7B864C3)
       fs2   : Acpi(HWP0002,300)/Pci(1|0)/Fibre(WWN50001FE10011B15D,
               Lun2200)/HD(Part1,Sig51C7BEE1-070B-11D9-8099-AA000400FEFF)
       fs3   : Acpi(HWP0002,300)/Pci(1|0)/Fibre(WWN50001FE10011B15D,
               Lun2200)/HD(Part4,Sig51C7BEE0-070B-11D9-809A-AA000400FEFF)
       .
       .
       .


      Shell>

Select the desired device/partion:

      Shell> fs1:
      fs1:\>
```

Use the utilities in \efi\vms. Use vms_show to list the devices and vms_set to set Ethernet device (debug_dev), if necessary. Note that this set is sticky so it only needs to be done once. Then load the operating system with the desired flags. Note that Alpha and Integrity servers use the same flags with the same meanings.

```
fs1:\> dir \efi\vms
Directory of: fs1:\efi\vms

  09/13/04  10:13a <DIR>          2,048  .
  09/13/04  10:13a <DIR>          2,048  ..
  09/13/04  10:13a <DIR>          2,048  tools
  09/13/04  10:13a            3,101,184  ipb.exe
  09/13/04  10:13a <DIR>          2,048  update
  09/13/04  10:13a              846,336  vms_loader.efi
  09/13/04  10:13a              244,224  vms_bcfg.efi
  09/13/04  10:13a              218,112  vms_set.efi
  09/13/04  10:13a              215,040  vms_show.efi
          5 File(s)   4,624,896 bytes
          4 Dir(s)

fs1:\> \efi\vms\vms_show device
VMS: EIA0
EFI: Acpi(000222F0,0)/Pci(3|0)/Mac(00306E39F77B)
```

```
VMS: DKB200
EFI: fs1: Acpi(000222F0,100)/Pci(1|1)/Scsi(Pun2,Lun0)

VMS: DKB0
EFI: fs0: Acpi(000222F0,100)/Pci(1|1)/Scsi(Pun0,Lun0)

VMS: EWA0
EFI: Acpi(000222F0,100)/Pci(2|0)/Mac(00306E3977C5)
.
.
.
```

Set the debug_dev to one of the connected Ethernet devices:

```
fs1:\> \efi\vms\vms_set debug_dev eia0
VMS: EIA0               0-30-6E-39-F7-CF
EFI: Acpi(000222F0,0)/Pci(3|0)/Mac(00306E39F7CF)
fs1:\> \efi\vms\vms_show debug_dev
VMS: EIA0               0-30-6E-39-F7-CF
EFI: Acpi(000222F0,0)/Pci(3|0)/Mac(00306E39F7CF)
```

Boot up the OS. In this example, the boot is with the SCD and initial (early) breakpoint flags, using root 2 (SYS2), that will vary with system setups:

```
fs1:\> \efi\vms\vms_loader -flags "2,8004"

    HP OpenVMS Industry Standard 64 Operating System, V8.3
    © Copyright 1976-2006 Hewlett-Packard Development Company, L.P.

%EIA-I-BOOTDRIVER, Starting auto-negotiation
%EIA-I-BOOTDRIVER, Auto-negotiation selected 100BaseTX FDX

DBGTK: Initialization succeeded.  Remote system debugging is now
possible.

DBGTK: Waiting at breakpoint for connection from remote host.
```

Example 11.3. Invoking the Alpha System Code Debugger

```
$ define dbg$decw$display " "
$ debug/keep

         OpenVMS Alpha Debug64 Version V8.3-003


DBG>
```

Example 11.4. Invoking the Integrity server System Code Debugger

```
$ define dbg$decw$display " "
$ debug/keep

         OpenVMS I64 Debug64 Version V8.3-003
```

```
DBG>
```

Use the CONNECT command to connect to the target system. In this example, the target system's default password is the null string, and the logical name DBGHK$IMAGE_PATH is used for the image path; so the command qualifiers /PASSWORD and /IMAGE_PATH are not being used. You may need to use them.

When you have connected to the target system, the DBG> prompt is displayed. Enter the SHOW IMAGE command to see what has been loaded. Because you are reaching a breakpoint early in the boot process, there are very few images. See the example below. Notice that SYS$BASE_IMAGE has an asterisk next to it. This is the currently set image, and all symbols currently loaded in the debugger come from that image.

Example 11.5. Connecting to the Target System

```
DBG> connect %node_name TSTSYS
%DEBUG-I-INIBRK, target system interrupted
DBG> show image
 image name                      set    base address         end address

 ERRORLOG                        no     0000000000000000
 FFFFFFFFFFFFFFFF
 EXEC_INIT                       no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$ACPI                        no     0000000000000000
 FFFFFFFFFFFFFFFF
*SYS$BASE_IMAGE                  yes    0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$DKBTDRIVER                  no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$DKBTDRIVER                  no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$DKBTDRIVER                  no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$EGBTDRIVER                  no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$OPDRIVER                    no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$PKMBTDRIVER                 no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$PKMBTDRIVER                 no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$PKMBTDRIVER                 no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$PLATFORM_SUPPORT            no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$PUBLIC_VECTORS              no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$SRBTDRIVER                  no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYSTEM_DEBUG                    no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYSTEM_PRIMITIVES               no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYSTEM_SYNCHRONIZATION          no     0000000000000000
 FFFFFFFFFFFFFFFF
```

```
 total images: 18
DBG>
```

The example below shows the target system's console display during the connect sequence. Note that for security reasons, the name of the host system, the user's name, and process ID are displayed.

Example 11.6. Target System Connection Display

```
DBGTK: Connection attempt from host HSTSYS  user GUEST       process
 2E801C2F
DBGTK: Connection attempt succeeded
```

To set a breakpoint at the first routine in the C_TEST_ROUTINES module of the SYSTEM_DEBUG.EXE execlet, do the following:

1. Load the symbols for the SYSTEM_DEBUG image with the DEBUG SET IMAGE command.
2. Use the SET MODULE command to obtain the symbols for the module.
3. Set the language to be C and set a breakpoint at the routine test_c_code.

   The language must be set because C is case sensitive and test_c_code needs to be specified in lowercase. The language is normally set to the language of the main image, in this example SYS $BASE_IMAGE.EXE. Currently that is not C.

Example 11.7. Setting a Breakpoint

```
DBG> set image system_debug
%DEBUG-I-DYNLNGSET, setting language IMACRO
DBG> show module
module name                     symbols   language   size

AUX_TARGET                      no        C             0
BUFSRV_TARGET                   no        C             0
BUGCHECK_CODES                  no        BLISS         0
C_TEST_ROUTINES                 no        C             0
LIB$$UNWIND_WEAK                no        BLISS         0
LIB$EF                          no        IMACRO        0
LIB$MALLOC                      no        C             0
LIB$MALLOC_64                   no        C             0
LINMGR_TARGET                   no        C             0
OBJMGR                          no        C             0
PLUMGR                          no        C             0
POOL                            no        C             0
PROTOMGR_TARGET                 no        C             0
SOCMGR                          no        C             0
SYS$DOINIT                      yes       IMACRO   122526
TMRMGR_TARGET                   no        C             0

total modules: 16

DBG> set module c_test_routines
DBG> show module c_test_routines
module name                     symbols    size

C_TEST_ROUTINES                 yes        5672

total C modules: 1
```

```
DBG> set language c
DBG> show symbol test_c_code*
routine C_TEST_ROUTINES\test_c_code
routine C_TEST_ROUTINES\test_c_code2
routine C_TEST_ROUTINES\test_c_code3
routine C_TEST_ROUTINES\test_c_code4
routine C_TEST_ROUTINES\test_c_code5
DBG> set break test_c_code
```

Now that the breakpoint is set, you can proceed and activate the breakpoint. When that occurs, the debugger tries to open the source code for that location in the same place as where the module was compiled. Because that is not the same place as on your system, you need to tell the debugger where to find the source code. This is done with the debugger's SET SOURCE command, which takes a search list as a parameter so you can make it point to many places.

Example 11.8. Finding the Source Code

```
DBG> set source/latest sys$examples,sys$library
DBG> go
break at routine C_TEST_ROUTINES\test_c_code
   113:     x = c_test_array[0];
```

Now that the debugger has access to the source, you can put the debugger into screen mode to see exactly where you are and the code surrounding it.

Example 11.9. Using the Set Mode Screen Command

```
DBG> Set Mode Screen; Set Step Nosource

- SRC: module C_TEST_ROUTINES -scroll-
source------------------------------------
    98:     c_test_array[5] = in64;
    99:     c_test_array[6] = in32;
   100:     if (c_test_array[9] > 0)
   101:         *pVar =  (*pVar + c_test_array[17]) & c_test_array[9];
   102:     else
   103:         *pVar = (*pVar + c_test_array[17]);
   104:     c_test_array[7] = test_c_code3(10);
   105:     c_test_array[3] = test;
   106:     return c_test_array[23];
   107: }
   108: void test_c_code(void)
   109: {
   110:     int x,y;
   111:     __int64 x64,y64;
   112:
-> 113:     x = c_test_array[0];
   114:     y = c_test_array[1];
   115:     x64 = c_test_array[2];
   116:     y64 = c_test_array[3];
   117:     c_test_array[14] = test_c_code2(x64+y64,x+y,x64+x,&y64);
   118:     test_c_code4();
   119:     return;
   120: }
- OUT -
output-------------------------------------------------------------------
```

```
- PROMPT -error-program-
prompt--------------------------------------------------





DBG>
```

Now, you want to set another breakpoint inside the test_c_code3 routine. You use the debugger's SCROLL/UP command (8 on the keypad) to move to that routine and see that line 93 would be a good place to set the breakpoint. It is at a recursive call. Then you proceed to that breakpoint with the GO command.

Example 11.10. Using the SCROLL/UP DEBUG Command

```
- SRC: module C_TEST_ROUTINES -scroll-
source------------------------------------
    80: void test_c_code4(void)
    81: {
    82:     int i,k;
    83:     for(k=0;k<1000;k++)
    84:       {
    85:          test_c_code5(&i);
    86:       }
    87:     return;
    88: }
    89: int test_c_code3(int subrtnCount)
    90: {
    91:     subrtnCount = subrtnCount - 1;
    92:     if (subrtnCount != 0)
    93:         subrtnCount = test_c_code3(subrtnCount);
    94:     return subrtnCount;
    95: }
    96: int test_c_code2(__int64 in64,int in32, __int64 test, __int64*
 pVar)
    97: {
    98:     c_test_array[5] = in64;
    99:     c_test_array[6] = in32;
   100:     if (c_test_array[9] > 0)
   101:         *pVar =  (*pVar + c_test_array[17]) & c_test_array[9];
   102:     else
- OUT -
output------------------------------------------------------------
```

```
- PROMPT -error-program-
prompt-------------------------------------------------



DBG> Scroll/Up
DBG> set break %line 93
DBG> go
DBG>
```

When you reach that breakpoint, the source code display is updated to show where you currently are, which is indicated by an arrow. A message also appears in the OUT display indicating you reach the breakpoint at that line.

Example 11.11. Breakpoint Display

```
- SRC: module C_TEST_ROUTINES -scroll-
source------------------------------------
    82:     int i,k;
    83:     for(k=0;k<1000;k++)
    84:       {
    85:          test_c_code5(&i);
    86:       }
    87:     return;
    88: }
    89: int test_c_code3(int subrtnCount)
    90: {
    91:     subrtnCount = subrtnCount - 1;
    92:     if (subrtnCount != 0)
->  93:         subrtnCount = test_c_code3(subrtnCount);
    94:     return subrtnCount;
    95: }
    96: int test_c_code2(__int64 in64,int in32, __int64 test, __int64*
 pVar)
    97: {
    98:     c_test_array[5] = in64;
    99:     c_test_array[6] = in32;
   100:     if (c_test_array[9] > 0)
   101:         *pVar =  (*pVar + c_test_array[17]) & c_test_array[9];
   102:     else
   103:         *pVar = (*pVar + c_test_array[17]);
   104:     c_test_array[7] = test_c_code3(10);
- OUT -
output-------------------------------------------------------------------
break at C_TEST_ROUTINES\test_c_code3\%LINE 93
```

```
- PROMPT -error-program-
prompt-------------------------------------------------
```

```
DBG> Scroll/Up
DBG> set break %line 93
DBG> go
DBG>
```

Now you try the debugger's STEP command. The default behavior for STEP is STEP/OVER, unlike XDELTA and DELTA, which is STEP/INTO, so, normally you would expect to step to line 94 in the code. However, because you have a breakpoint inside test_c_code3 that is called at line 93, you will reach that event first.

Example 11.12. Using the Debug Step Command

```
- SRC: module C_TEST_ROUTINES -scroll-
source------------------------------------
    82:     int i,k;
    83:     for(k=0;k<1000;k++)
    84:       {
    85:          test_c_code5(&i);
    86:       }
    87:     return;
    88: }
    89: int test_c_code3(int subrtnCount)
    90: {
    91:     subrtnCount = subrtnCount - 1;
    92:     if (subrtnCount != 0)
->  93:         subrtnCount = test_c_code3(subrtnCount);
    94:     return subrtnCount;
    95: }
    96: int test_c_code2(__int64 in64,int in32, __int64 test, __int64*
 pVar)
    97: {
    98:     c_test_array[5] = in64;
    99:     c_test_array[6] = in32;
   100:     if (c_test_array[9] > 0)
   101:         *pVar =  (*pVar + c_test_array[17]) & c_test_array[9];
   102:     else
   103:         *pVar = (*pVar + c_test_array[17]);
   104:     c_test_array[7] = test_c_code3(10);
- OUT -
output------------------------------------------------------------
break at C_TEST_ROUTINES\test_c_code3\%LINE 93
break at C_TEST_ROUTINES\test_c_code3\%LINE 93
```

```
- PROMPT -error-program-
prompt-------------------------------------------------


DBG>
DBG> set break %line 93
DBG> go
DBG> Step
DBG>
```

Now, you try a couple of other commands, EXAMINE and SHOW CALLS. The EXAMINE command allows you to look at all the C variables. Note that the C_TEST_ROUTINES module is compiled with the /NOOPTIMIZE switch which allows access to all variables. The SHOW CALLS command shows you the call sequence from the beginning of the stack. In this case, you started out in the image EXEC_INIT. (The debugger prefixes all images other than the main image with SHARE$ so it shows up as SHARE$EXEC_INIT. The suffix _CODE0 is appended if the executive image is sliced.)

Example 11.13. Using the Examine and Show Calls Commands

```
- SRC: module C_TEST_ROUTINES -scroll-
source------------------------------------
    82:     int i,k;
    83:     for(k=0;k<1000;k++)
    84:       {
    85:          test_c_code5(&i);
    86:       }
    87:     return;
    88: }
    89: int test_c_code3(int subrtnCount)
    90: {
    91:     subrtnCount = subrtnCount - 1;
    92:     if (subrtnCount != 0)
->  93:         subrtnCount = test_c_code3(subrtnCount);
    94:     return subrtnCount;
    95: }
    96: int test_c_code2(__int64 in64,int in32, __int64 test, __int64*
 pVar)
    97: {
    98:     c_test_array[5] = in64;
    99:     c_test_array[6] = in32;
   100:     if (c_test_array[9] > 0)
   101:         *pVar =  (*pVar + c_test_array[17]) & c_test_array[9];
   102:     else
   103:         *pVar = (*pVar + c_test_array[17]);
   104:     c_test_array[7] = test_c_code3(10);
- OUT -
output-------------------------------------------------------------------
```

```
C_TEST_ROUTINES\test_c_code3\subrtnCount:       8
 module name     routine name     line           rel PC           abs PC
*C_TEST_ROUTINES test_c_code3       93      0000000000000DC0
 FFFFFFFF800BAFC0
*C_TEST_ROUTINES test_c_code3       93      0000000000000DE0
 FFFFFFFF800BAFE0
*C_TEST_ROUTINES test_c_code2      104      0000000000000F40
 FFFFFFFF800BB140
*C_TEST_ROUTINES test_c_code       117      00000000000010B0
 FFFFFFFF800BB2B0
                 XDT$INIT                   00000000000015C0
 FFFFFFFF880955C0
*SYS$DOINIT      EXE$INITIALIZE   1973      0000000000000360
 FFFFFFFF88094360
 SHARE$EXEC_INIT_CODE0                      000000000005C240
 FFFFFFFF803BB640
 SHARE$EXEC_INIT_CODE0                      0000000000057F20
 FFFFFFFF803B7320
 SHARE$EXEC_INIT_CODE0                      0000000000047850
 FFFFFFFF803A6C50
 SHARE$EXEC_INIT_CODE0                      0000000000042E90
 FFFFFFFF803A2290
- PROMPT -error-program-
prompt---------------------------------------------------------
DBG> set break %line 93
DBG> go
DBG> Step
DBG> examine subrtnCount
DBG> show calls
DBG>
```

If you want to proceed because you are done debugging this code, first cancel all the breakpoints and then enter the GO command. Notice, however, that you do not keep running but receive a message that you have stepped to line 94. This happens because the STEP command used earlier never completed. It was interrupted by the breakpoint on line 93.

Note that the debugger remembers all step events and only removes them once they have completed.

Example 11.14. Canceling the Breakpoints

```
- SRC: module C_TEST_ROUTINES -scroll-
source------------------------------------
    83:     for(k=0;k<1000;k++)
    84:       {
    85:          test_c_code5(&i);
    86:       }
    87:     return;
    88: }
    89: int test_c_code3(int subrtnCount)
    90: {
    91:     subrtnCount = subrtnCount - 1;
    92:     if (subrtnCount != 0)
    93:         subrtnCount = test_c_code3(subrtnCount);
->  94:     return subrtnCount;
    95: }
    96: int test_c_code2(__int64 in64,int in32, __int64 test, __int64*
 pVar)
    97: {
```

```
    98:     c_test_array[5] = in64;
    99:     c_test_array[6] = in32;
   100:     if (c_test_array[9] > 0)
   101:         *pVar =  (*pVar + c_test_array[17]) & c_test_array[9];
   102:     else
   103:         *pVar = (*pVar + c_test_array[17]);
   104:     c_test_array[7] = test_c_code3(10);
   105:     c_test_array[3] = test;
- OUT -
output------------------------------------------------------------------
 module name     routine name     line           rel PC           abs PC
*C_TEST_ROUTINES test_c_code3       93       0000000000000DC0
 FFFFFFFF800BAFC0
*C_TEST_ROUTINES test_c_code3       93       0000000000000DE0
 FFFFFFFF800BAFE0
*C_TEST_ROUTINES test_c_code2      104       0000000000000F40
 FFFFFFFF800BB140
*C_TEST_ROUTINES test_c_code      117       00000000000010B0
 FFFFFFFF800BB2B0
                 XDT$INIT                    00000000000015C0
 FFFFFFFF880955C0
*SYS$DOINIT      EXE$INITIALIZE   1973       0000000000000360
 FFFFFFFF88094360
 SHARE$EXEC_INIT_CODE0                       000000000005C240
 FFFFFFFF803BB640
 SHARE$EXEC_INIT_CODE0                       0000000000057F20
 FFFFFFFF803B7320
 SHARE$EXEC_INIT_CODE0                       0000000000047850
 FFFFFFFF803A6C50
 SHARE$EXEC_INIT_CODE0                       0000000000042E90
 FFFFFFFF803A2290
stepped to C_TEST_ROUTINES\test_c_code3\%LINE 94
- PROMPT -error-program-
prompt-----------------------------------------------
DBG> Step
DBG> examine subrtnCount
DBG> show calls
DBG> cancel break/all
DBG> go
DBG>
```

The STEP/RETURN command, a different type of step command, single steps assembly code until it finds a return instruction. This command is useful if you want to see the return value for the routine, which is done here by examining the R0 register on Alpha, or the R8 register on Integrity servers.

For more information about using other STEP command qualifiers, see the *VSI OpenVMS Debugger Manual*.

Example 11.15. Using the Step/Return Command

```
- SRC: module C_TEST_ROUTINES -scroll-
source------------------------------------
    83:     for(k=0;k<1000;k++)
    84:       {
    85:          test_c_code5(&i);
    86:       }
    87:     return;
    88: }
```

```
    89: int test_c_code3(int subrtnCount)
    90: {
    91:     subrtnCount = subrtnCount - 1;
    92:     if (subrtnCount != 0)
    93:         subrtnCount = test_c_code3(subrtnCount);
->  94:     return subrtnCount;
    95: }
    96: int test_c_code2(__int64 in64,int in32, __int64 test, __int64*
 pVar)
    97: {
    98:     c_test_array[5] = in64;
    99:     c_test_array[6] = in32;
   100:     if (c_test_array[9] > 0)
   101:         *pVar =  (*pVar + c_test_array[17]) & c_test_array[9];
   102:     else
   103:         *pVar = (*pVar + c_test_array[17]);
   104:     c_test_array[7] = test_c_code3(10);
   105:     c_test_array[3] = test;
- OUT -
output-----------------------------------------------------------------
*C_TEST_ROUTINES test_c_code3       93       0000000000000DE0
 FFFFFFFF800BAFE0
*C_TEST_ROUTINES test_c_code2      104       0000000000000F40
 FFFFFFFF800BB140
*C_TEST_ROUTINES test_c_code       117       00000000000010B0
 FFFFFFFF800BB2B0
                 XDT$INIT                    00000000000015C0
 FFFFFFFF880955C0
*SYS$DOINIT      EXE$INITIALIZE   1973       0000000000000360
 FFFFFFFF88094360
 SHARE$EXEC_INIT_CODE0                       000000000005C240
 FFFFFFFF803BB640
 SHARE$EXEC_INIT_CODE0                       0000000000057F20
 FFFFFFFF803B7320
 SHARE$EXEC_INIT_CODE0                       0000000000047850
 FFFFFFFF803A6C50
 SHARE$EXEC_INIT_CODE0                       0000000000042E90
 FFFFFFFF803A2290
stepped to C_TEST_ROUTINES\test_c_code3\%LINE 94
stepped on return from C_TEST_ROUTINES\test_c_code3\%LINE 94 to
 C_TEST_ROUTINES\test_c_code3\%LINE 94+17
C_TEST_ROUTINES\test_c_code3\%R8:       0
- PROMPT -error-program-
prompt------------------------------------------------
DBG> show calls
DBG> cancel break/all
DBG> go
DBG> step/return
DBG> examine r8
DBG>
```

After you finish the SCD session, enter the GO command to leave this module. You will encounter another INI$BRK breakpoint at the end of EXEC_INIT. An error message is displayed indicating there are no source lines, because debug information on INI$BRK is not available.

Also notice that there is no message in the OUT display for this event. That is because INI$BRKs are special breakpoints that are handled as SS$_DEBUG signals. They are a method for the system code to break into the debugger and there is no real breakpoint in the code.

Enter the SHOW IMAGE command. You will see more images displayed as the boot path has progressed further.

Finally, enter GO, allowing the target system to boot completely, because there are no more breakpoints in the boot path. The debugger will wait for another event to occur.

Example 11.16. Using the Show Image Command

```
- SRC: module C_TEST_ROUTINES -scroll-
source------------------------------------
    83:     for(k=0;k<1000;k++)
    84:       {
    85:          test_c_code5(&i);
    86:       }
    87:     return;
    88: }
    89: int test_c_code3(int subrtnCount)
    90: {
    91:     subrtnCount = subrtnCount - 1;
    92:     if (subrtnCount != 0)
    93:         subrtnCount = test_c_code3(subrtnCount);
->  94:     return subrtnCount;
    95: }
    96: int test_c_code2(__int64 in64,int in32, __int64 test, __int64*
 pVar)
    97: {
    98:     c_test_array[5] = in64;
    99:     c_test_array[6] = in32;
   100:     if (c_test_array[9] > 0)
   101:         *pVar =  (*pVar + c_test_array[17]) & c_test_array[9];
   102:     else
   103:         *pVar = (*pVar + c_test_array[17]);
   104:     c_test_array[7] = test_c_code3(10);
   105:     c_test_array[3] = test;
- OUT -
output------------------------------------------------------------------
 SYS$UTC_SERVICES                no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$VM                          no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYS$XFCACHE_MON                 no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYSDEVICE                       no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYSGETSYI                       no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYSLDR_DYN                      no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYSLICENSE                      no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYSTEM_DEBUG                    yes    0000000000000000
 FFFFFFFFFFFFFFFF
 SYSTEM_PRIMITIVES               no     0000000000000000
 FFFFFFFFFFFFFFFF
 SYSTEM_SYNCHRONIZATION          no     0000000000000000
 FFFFFFFFFFFFFFFF

 total images: 53
```

```
- PROMPT -error-program-
prompt---------------------------------------------------------
DBG> go
%DEBUG-I-INIBRK, target system interrupted
%DEBUG-I-DYNIMGSET, setting image SYS$BASE_IMAGE
%DEBUG-W-SCRNOSRCLIN, No source line for address: FFFFFFFF80000310
DBG> show image
DBG> go
```

Chapter 12. OpenVMS System Dump Debugger

This chapter describes the OpenVMS System Dump Debugger (SDD) and how you can use it to analyze system crash dumps.

SDD is similar in concept to SCD as described in Chapter 11. Where SCD allows connection to a running system with control of the system's execution and the examination and modification of variables, SDD allows analysis of memory as recorded in a system dump.

Use of the SDD usually involves two systems, although all the required environment can be set up on a single system. The description that follows assumes that two systems are being used:

- The build system, where the image that causes the system crash has been built
- The test system, where the image is executed and the system crash occurs

In common with SCD, the OpenVMS debugger's user interface allows you to specify variable names, routine names, and so on, precisely as they appear in your source code. Also, SDD can display the source code where the software was executing at the time of the system crash.

SDD recognizes the syntax, data typing, operators, expressions, scoping rules, and other constructs of a given language. If your code or driver is written in more than one language, you can change the debugging context from one language to another during a debugging session.

To use SDD, you must do the following:

- Build the system image or device driver that is causing the system crash.
- Boot a system, including the system image or device driver, and perform the necessary steps to cause the system crash.
- Reboot the system and save the dump file.
- Invoke SDD, which is integrated with the OpenVMS debugger.

The following sections cover these tasks in more detail, describe the available user-interface options, summarize applicable OpenVMS Debugger commands, and provide a sample SDD session.

12.1. User-Interface Options

SDD has the following user-interface options.

- A DECwindows Motif interface for workstations.

  When using this interface, you interact with SDD by using a mouse and pointer to choose items from menus, click on buttons, select names in windows, and so on.

  Note that you can also use OpenVMS Debugger commands with the DECwindows Motif interface.

- A character cell interface for terminals and workstations.

When using this interface, you interact with SDD by entering commands at a prompt. The sections in this chapter describe how to use the system dump debugger with the character cell interface.

For more information about using the OpenVMS DECwindows Motif interface and OpenVMS Debugger commands with SDD, see the *VSI OpenVMS Debugger Manual*.

12.2. Preparing a System Dump to Be Analyzed

To prepare a system dump for analysis, perform the following steps:

1. Compile the sources you will want to analyze, and use the /DEBUG (mandatory) and /NOOPT (preferred) qualifiers.

   Note

   Because you are analyzing a snapshot of the system, it is not as vital to use unoptimized code as it is with the system code debugger. But note that you cannot access all variables. SDD may report that they are optimized away.

2. Link your image using the /DSF (debug symbol file) qualifier. Do not use the /DEBUG qualifier, which is for debugging user programs. The /DSF qualifier takes an optional filename argument similar to the /EXE qualifier. For more information, see the *VSI OpenVMS Linker Utility Manual*. If you specify a name in the /EXE qualifier, you will need to specify the same name for the /DSF qualifier. For example, you would use the following command:

   ```
   $ LINK/EXE=EXE$:MY_EXECLET/DSF=EXE$:MY_EXECLET OPTIONS_FILE/OPT
   ```

   The .DSF and .EXE file names must be the same. Only the extensions will be different, that is, .DSF and .EXE.

   The contents of the .EXE file should be exactly the same as if you had linked without the /DSF qualifier. The .DSF file will contain the image header and all the debug symbol tables for .EXE file. It is not an executable file, and cannot be run or loaded.

3. Put the .EXE file on your test system.

4. Boot the test system and perform the necessary steps to cause the system crash.

5. Reboot the test system and copy the dump to the build system using the System Dump Analyzer (SDA) command COPY. See Chapter 4.

12.3. Setting Up the Test System

The only requirement for the test system is that the .DSF file matching the .EXE file that causes the crash is available on the build system.

There are no other steps necessary in the setup of the test system. With the system image copied to the test system, it can be booted in any way necessary to produce the system crash. Since SDD can analyze most system crash dumps, any system can be used, from a standalone system to a member of a production cluster.

Note

It is assumed that the test system has a dump file large enough for the system dump to be recorded. Any dump style may be used (full or selective, compressed or uncompressed). A properly AUTOGENed system will meet these requirements.

12.4. Setting Up the Build System

To set up the build system, you need access to all system images and drivers that were loaded on the test system. You should have access to a source listings kit or a copy of the following directories:

```
SYS$LOADABLE_IMAGES:
SYS$LIBRARY:
SYS$MESSAGE:
```

You need all the .EXE files in those directories. The .DSF files are available with the OpenVMS source listings kits.

Optionally, you need access to the source files for the images to be debugged. SDD will look for the source files in the directory where they were compiled. You must use the SET SOURCE command to point SDD to the location of the source code files if they are not in the directories used when the image was built. For an example of the SET SOURCE command, see Section 12.9.

Before you can analyze a system dump with SDD, you must set up the logical name DBGHK $IMAGE_PATH, which must be set up as a search list to the area where the system images or .DSF files are kept. For example, if the copies are in the following directories:

```
DEVICE:[SYS$LDR]
DEVICE:[SYSLIB]
DEVICE:[SYSMSG]
```

you would define DBGHK$IMAGE_PATH as follows:

```
$ define dbghk$image_path DEVICE:[SYS$LDR],DEVICE:[SYSLIB],DEVICE:[SYSMSG]
```

This works well for analyzing a system dump using all the images normally loaded on a given system. However, you might be using SDD to analyze new code either in an execlet or a new driver. Because that image is most likely in your default directory, you must define the logical name as follows:

```
$ define dbghk$image_path [],DEVICE:[SYS$LDR],DEVICE:[SYSLIB],DEVICE:
[SYSMSG]
```

If SDD cannot find one of the images through this search path, a warning message is displayed. SDD will continue initialization as long as it finds at least two images. If SDD cannot find the SYS $BASE_IMAGE and SYS$PUBLIC_VECTORS files, which are the OpenVMS operating system's main image files, an error message is displayed and the debugger exits.

If and when this happens, check the directory for the image files and compare it to what was loaded on the test system.

12.5. Starting the System Dump Debugger

To start SDD on the build system, enter the following command.

```
$ DEBUG/KEEP
```

SDD displays the DBG> prompt. With the DBGHK$IMAGE_PATH logical name defined, you can invoke the ANALYZE/CRASH_DUMP command and optional qualifier /IMAGE_PATH.

To use the ANALYZE/CRASH_DUMP command and optional qualifier (/IMAGE_PATH) to analyze the dump in file <file-name> enter the following command:

```
DBG> ANALYZE/CRASH_DUMP file-name
```

The /IMAGE_PATH qualifier is optional. If you do not use this qualifier, SDD uses the DBGHK $IMAGE_PATH logical name as the default. The /IMAGE_PATH qualifier is a quick way to change the logical name. However, when you use it, you cannot specify a search list. You can use only a logical name or a device and directory, although the logical name can be a search list.

Usually, SDD obtains the source file name from the object file. This is put there by the compiler when the source is compiled with the /DEBUG qualifier. The SET SOURCE command can take a list of paths as a parameter. It treats them as a search list.

12.6. Summary of System Dump Debugger Commands

Only a subset of OpenVMS debugger commands can be used in SDD. The following are a few examples of commands that you can use in SDD:

- Commands to manipulate the source display, such as TYPE and SCROLL
- Commands used in OpenVMS debugger command programs, such as DO and IF
- Commands that affect output formats, such as SET RADIX
- Commands that manipulate symbols and scope, such as EVALUATE, SET LANGUAGE, and CANCEL SCOPE
- Commands that read the contents of memory and registers, such as EXAMINE

Examples of commands that **cannot** be used in SDD are as follows:

- Commands that cause code to be executed, such as STEP and GO
- Commands that manipulate breakpoints, such as SET BREAK and CANCEL BREAK
- Commands that modify memory or registers, such as DEPOSIT

You can also use the OpenVMS debugger command SDA to examine the system dump with System Dump Analyzer semantics. This command, which is not available when debugging user programs, is described in the next section.

12.7. Using System Dump Analyzer Commands

Once a dump file has been opened, you can use the commands listed in the previous section to examine the system dump. You can also use some System Dump Analyzer (SDA) commands, such as SHOW SUMMARY and SHOW DEVICE. This feature allows the system programmer to take advantage of the strengths of both the OpenVMS Debugger and SDA to examine the system dump and to debug system programs such as device drivers, without having to invoke both the OpenVMS debugger and SDA separately.

To obtain access to SDA commands, you simply type "SDA" at the OpenVMS Debugger prompt ("DBG>") at any time after the dump file has been opened. SDA initializes itself and then outputs the "SDA>" prompt. Enter SDA commands as required. (See Chapter 4 for more information.) To return to the OpenVMS Debugger, you enter "EXIT" at the "SDA>" prompt. Optionally, you may invoke SDA to perform a single command and then return immediately to the OpenVMS Debugger, as in the following example:

```
DBG> SDA SHOW SUMMARY
```

SDA may be reentered at any time, with or without the optional SDA command. Once SDA has been initialized, the SDA> prompt is output more quickly on subsequent occasions.

Note that there are some limitations on the use of SDA from within SDD:

- You cannot switch between processes, whether requested explicitly (SET PROCESS <name>) or implicitly (SHOW PROCESS <name>). The exception to this is that access to the system process is possible.
- You cannot switch between CPUs.
- SDA has no knowledge of the OpenVMS debugger's Motif or Windows interfaces. Therefore, all SDA input and output occurs at the terminal or window where the OpenVMS debugger was originally invoked. Also, while using SDA, the OpenVMS debugger window is not refreshed; you must exit SDA to allow the OpenVMS debugger window to be refreshed.
- When you invoke SDA from SDD with an immediate command, and that command produces a full screen of output, SDA displays the message "Press RETURN for more." followed by the "SDA>" prompt before continuing. At this prompt, if you enter another SDA command, SDA does not automatically return to SDD upon completion. To do this, you must enter an EXIT command.

If the need arises to switch between processes or CPUs in the system dump, then you must invoke SDA separately using the DCL command ANALYZE/CRASH_DUMP.

12.8. Limitations of the System Dump Debugger

SDD provides a narrow window into the context of the system that was current at the time that the system crashed (stack, process, CPU, and so on). It does not provide full access to every part of the system as is provided by SDA. However, it does provide a view of the failed system using the semantics of the OpenVMS debugger---source correlation and display, call frame traversal, examination of variables by name, language constructs, and so on.

SDD therefore provides an additional approach to analyzing system dumps that is difficult to realize with SDA, often allowing quicker resolution of system crashes than is possible with SDA alone. When SDD cannot provide the needed data from the system dump, you should use SDA instead.

12.9. Access to Symbols in OpenVMS Executive Images

For a discussion and explanation of how the OpenVMS debugger accesses symbols in OpenVMS executive images, see Section 11.11.

12.10. Sample System Dump Debugging Session

This section provides a sample session that shows the use of some OpenVMS debugger commands as they apply to the system dump debugger. The examples in this section show how to work with a dump created as follows:

1. Follow the steps in Section 11.12, up to and including Example 11.9 (Using the Set Mode Screen Command).
2. Enter the following OpenVMS Debugger commands:

   ```
   DBG> SET BREAK TEST_C_CODE5
   DBG> GO
   DBG> DEPOSIT K=0
   DBG> GO
   ```

3. The system then crashes and a dump is written.
4. When the system reboots, copy the contents of SYS$SYSTEM:SYSDUMP.DMP to the build system with SDA:

   ```
   $ analyze/crash sys$system:sysdump.dmp
   ```

   ```
    OpenVMS (TM) system dump analyzer
    ...analyzing a selective memory dump...

    %SDA-W-NOTSAVED, global pages not saved in the dump file
    Dump taken on  1-JAN-1998 00:00:00.00
    INVEXCEPTN, Exception while above ASTDEL

    SDA> copy hstsys::sysdump.dmp
    SDA>
   ```

To reproduce this sample session, you need access to the SYSTEM_DEBUG.DSF matching the SYSTEM_DEBUG.EXE file on your test system and to the source file C_TEST_ROUTINES.C, which is available in SYS$EXAMPLES.

The example begins by invoking the system dump debugger's character cell interface on the build system.

Note that the example displays from Example 12-1 onwards are all taken from an OpenVMS Integrity server system. On an OpenVMS Alpha system, some of the output is different, but the commands entered are the same on both platforms.

Example 12.1. Invoking the System DumpDebugger

```
$ define dbg$decw$display " "
$ debug/keep

         OpenVMS I64 Debug64 Version V8.3-003


DBG>
```

Use the ANALYZE/CRASH_DUMP command to open the system dump. In this example, the logical name DBGHK$IMAGE_PATH is used for the image path, so the command qualifier /IMAGE_PATH is not being used. You may need to use it.

When you have opened the dump file, the DBG> prompt is displayed. You should now do the following:

1. Set the language to be C, the language of the module that was active at the time of the system crash.
2. Set the source directory to the location of the source of the module. Use the debugger's SET SOURCE command, which takes a search list as a parameter so you can make it point to many places.

Example 12.2. Accessing the System Dump

```
DBG> analyze/crash_dump sysdump.dmp
%SDA-W-NOTSAVED, global pages not saved in the dump file
%DEBUG-I-INIBRK, target system interrupted
%DEBUG-I-DYNIMGSET, setting image SYSTEM_DEBUG
%DEBUG-I-DYNMODSET, setting module C_TEST_ROUTINES
DBG> set language c
DBG> set source/latest sys$examples,sys$library
DBG>
```

Now that the debugger has access to the source, you can put the debugger into screen mode to see exactly where you are and the code surrounding it.

Example 12.3. Displaying the Source Code

```
DBG> Set Mode Screen; Set Step Nosource

- SRC: module C_TEST_ROUTINES -scroll-
source------------------------------------
    67:
    68:     /* We want some global data cells */
    69: volatile __int64 c_test_array[34];
    70:
    71: void test_c_code5(int *k)
    72: {
    73:     int i;
    74:     char str[100];
    75:     for(i=0;i<100;i++)
    76:       str[i]= 'a';
    77:     str[99]=0;
->  78:     *k = 9;
    79: }
    80: void test_c_code4(void)
    81: {
    82:     int i,k;
    83:     for(k=0;k<1000;k++)
    84:       {
    85:          test_c_code5(&i);
    86:       }
    87:     return;
    88: }
    89: int test_c_code3(int subrtnCount)
- OUT -
output------------------------------------------------------------
```

```
- PROMPT -error-program-
prompt-----------------------------------------------



%DEBUG-I-SCRNOTORIGSRC, original version of source file not found for
 display in SRC
        file used is SYS$COMMON:[SYSHLP.EXAMPLES]C_TEST_ROUTINES.C;1
DBG>
```

Now, you try a couple of other commands, EXAMINE and SHOW CALLS. The EXAMINE command allows you to look at all the C variables. Note that the C_TEST_ROUTINES module is compiled with the /NOOPTIMIZE switch which allows access to all variables. The SHOW CALLS command shows you the call sequence from the beginning of the stack. In this case, you started out in the image EXEC_INIT. (The debugger prefixes all images other than the main image with SHARE$ so it shows up as SHARE$EXEC_INIT.)

Example 12.4. Using the Examine and Show CallsCommands

```
DBG> Set Mode Screen; Set Step Nosource

- SRC: module C_TEST_ROUTINES -scroll-
source------------------------------------
    67:
    68:     /* We want some global data cells */
    69: volatile __int64 c_test_array[34];
    70:
    71: void test_c_code5(int *k)
    72: {
    73:     int i;
    74:     char str[100];
    75:     for(i=0;i<100;i++)
    76:       str[i]= 'a';
    77:     str[99]=0;
->  78:     *k = 9;
    79: }
    80: void test_c_code4(void)
    81: {
    82:     int i,k;
    83:     for(k=0;k<1000;k++)
    84:       {
    85:          test_c_code5(&i);
    86:       }
    87:     return;
    88: }
    89: int test_c_code3(int subrtnCount)
```

```
- OUT -
output-------------------------------------------------------------------------
C_TEST_ROUTINES\test_c_code5\i: 100
C_TEST_ROUTINES\test_c_code5\k: 0
 module name     routine name     line           rel PC           abs PC
*C_TEST_ROUTINES test_c_code5       78       0000000000000CD0
 FFFFFFFF800BAED0
*C_TEST_ROUTINES test_c_code4       85       0000000000000D60
 FFFFFFFF800BAF60
*C_TEST_ROUTINES test_c_code       118       00000000000010D0
 FFFFFFFF800BB2D0
                 XDT$INIT                    00000000000015C0
 FFFFFFFF880955C0
*SYS$DOINIT      EXE$INITIALIZE   1973       0000000000000360
 FFFFFFFF88094360
 SHARE$EXEC_INIT_CODE0                       000000000005C240
 FFFFFFFF803BB640
 SHARE$EXEC_INIT_CODE0                       0000000000057F20
 FFFFFFFF803B7320
 SHARE$EXEC_INIT_CODE0                       0000000000047850
 FFFFFFFF803A6C50
 SHARE$EXEC_INIT_CODE0                       0000000000042E90
 FFFFFFFF803A2290
- PROMPT -error-program-
prompt---------------------------------------------------

%DEBUG-I-SCRNOTORIGSRC, original version of source file not found for
 display in SRC
        file used is SYS$COMMON:[SYSHLP.EXAMPLES]C_TEST_ROUTINES.C;1
DBG> examine i,k
DBG> show calls
DBG>
```

Part III. OpenVMS Alpha Watchpoint Utility

This part describes the Alpha Watchpoint utility. It presents how to use the Watchpoint utility by doing the following:

- Loading the watchpoint driver
- Creating and deleting watchpoints
- Looking at watchpoint driver data
- Acquiring collected watchpoint data
- Looking at the protection attributes and access fault mechanism
- Looking at some watchpoint restrictions

Chapter 13. Watchpoint Utility (Alpha Only)

The Alpha Watchpoint utility (WP) enables you to monitor write access to user-specified locations. The chapter contains the following sections:

Section 13.1 presents an introduction of the Watchpoint utility.

Section 13.2 describes how to load the watchpoint driver.

Section 13.3 describes the creation and deletion of watchpoints and the constraints upon watchpoint locations.

Section 13.4 contains detailed descriptions of the watchpoint driver data structures, which you might need to know to analyze collected watchpoint data.

Section 13.5 discusses acquiring collected watchpoint data.

Section 13.6 describes the watchpoint protection facility.

Section 13.7 describes the utility's restrictions.

13.1. Introduction

A watchpoint is a data field to which write access is monitored. The field is from 1 to 8 bytes long and must be contained within a single page. Typically, watchpoints are in nonpaged pool. However, subject to certain constraints (see Section 13.3.1), they can be defined in other areas of system space. The Watchpoint facility can simultaneously monitor a large number (50 or more) watchpoints.

The utility is implemented in the WPDRIVER device driver and the utility program WP. This document concentrates on the device driver, which can be invoked directly or through the WP utility.

For information on the WP utility, see its help files, which can be displayed with the following DCL command:

```
$ HELP/LIBRARY=SYS$HELP:WP
```

Once the driver has been loaded, a suitably privileged user can designate a watchpoint in system space. Any write to a location designated as a watchpoint is trapped. Information is recorded about the write, including its time, the register contents, and the program counter (PC) and processor status longword (PSL) of the writing instruction. Optionally, one or both of the following user-specified actions can be taken:

- An XDELTA breakpoint (see the note below) or SCD breakpoint which occurs just after the write to the watchpoint
- A fatal watchpoint bugcheck which occurs just after the write to the watchpoint

You define a watchpoint by issuing QIO requests to the watchpoint driver; entering commands to the WP utility, which issues requests to the driver; or, from kernel mode code, invoking a routine within the watchpoint driver.

The WPDRIVER data structures store information about writes to a watchpoint. This information can be obtained either through QIO requests to the WPDRIVER, commands to the WP utility, XDELTA commands issued during a requested breakpoint, or SDA commands issued during the analysis of a requested crashdump.

Note

For simplicity, this chapter only mentions XDELTA. Any reference to XDELTA breakpoints also implies SCD breakpoints.

13.2. Initializing the Watchpoint Utility

From a process with CMKRNL privilege, run the SYSMAN utility to load the watchpoint driver, SYS$WPDRIVER.EXE. Enter the following commands:

```
$ RUN SYS$SYSTEM:SYSMAN
SYSMAN> IO CONNECT WPA0:/NOADAPTER/DRIVER=SYS$WPDRIVER
SYSMAN> EXIT
```

SYSMAN creates system I/O data structures for the pseudo-device WPA0, loads WPDRIVER, and invokes its initialization routines. WPDRIVER initialization includes the following actions:

- Allocating nonpaged pool and physical memory for WPDRIVER data structures
- Appropriating the SCB vector specific to access violations
- Recording in system space the addresses of the WPDRIVER routines invoked by kernel mode code to create and delete watchpoints

Memory requirements for WPDRIVER and its data structures are:

- Device driver and UCB---approximately 3K bytes of nonpaged pool
- Trace table and a related array---36 bytes for each of system parameter WPTTE_SIZE trace table entries
- Watchpoint restore entries---system parameter WPRE_SIZE pages of physically contiguous memory
- Each watchpoint---176 bytes of nonpaged pool

It is advisable to load the watchpoint driver relatively soon after system initialization to ensure its allocation of physically contiguous memory. If the driver cannot allocate enough physically contiguous memory, it does not set WPA0: online. If the unit is offline, you will not be able to use the watchpoint utility.

13.3. Creating and Deleting Watchpoints

There are three different ways to create and delete watchpoints:

- An image can assign a channel to device WPA0: and then request the Queue I/O Request ($QIO) system service to create or delete a watchpoint.
- Code running in kernel mode can dispatch directly to routines within the WPDRIVER to create and delete watchpoints.

- You can enter commands to the WP utility.

The first two methods are described in detail in the sections that follow.

13.3.1. Using the $QIO Interface

An image first assigns a channel to the pseudo-device WPA0: and then issues a $QIO request on that channel. The process must have the privilege PHY_IO; otherwise, the $QIO request is rejected with the error SS$_NOPRIV.

The table below shows the functions that the driver supports.

Table 13.1. Driver Supported Functions

Function	Activity
IO$_ACCESS	Creates a watchpoint
IO$_DEACCESS	Deletes a watchpoint
IO$_RDSTATS	Receives trace information on a watchpoint

The IO$_ACCESS function requires the following device/function dependent arguments:

- P2---Length of the watchpoint. A number larger than 8 is reduced to 8.
- P3---Starting address of the watchpoint area.

The following are the constraints on the watchpoint area. It must be:

- Nonpageable system space.
- Write-accessible from kernel mode.
- Within one page. If it is not, the requested length is reduced to what will fit within the page containing the starting address.
- Within a page accessed only from kernel mode and by instructions that incur no pagefaults.
- Within a page whose protection is not altered while the watchpoint is in place.
- Outside of certain address ranges. These are the WPDRIVER code, its data structures, and the system page table.

Because of the current behavior of the driver, there is an additional requirement that there be no "unexpected" access violations referencing a page containing a watchpoint. See Section 13.7 for further details.

To specify that an XDELTA breakpoint or a fatal bugcheck occur if the watchpoint is written, use the following I/O function code modifiers:

- IO$M_CTRL to request an XDELTA breakpoint
- IO$M_ABORT to request a fatal bugcheck

For an XDELTA breakpoint to be taken, OpenVMS must have been booted specifying that XDELTA and/or the SCD be resident (bit 1 or bit 15 in the boot flags must be set). If both watchpoint options are requested, the XDELTA breakpoint is taken first. At exit from the breakpoint, the driver crashes the system.

A request to create a watchpoint can succeed completely, succeed partially, or fail. The table below shows the status codes that can be returned in the I/O status block.

Table 13.2. Returned Status Codes

Status Code	Meaning
SS$_NORMAL	Success.
SS$_BUFFEROVF	A watchpoint was established, but its length is less than was requested because the requested watchpoint would have straddled a page boundary.
SS$_EXQUOTA	The watchpoint could not be created because too many watchpoints already exist.
SS$_INSFMEM	The watchpoint could not be created because there was insufficient nonpaged pool to create data structures specific to this watchpoint.
SS$_IVADDR	The requested watchpoint resides in one of the areas in which the WPDRIVER is unable to create watchpoints.
SS$_WASSET	An existing watchpoint either coincides or overlaps with the requested watchpoint.

The following example MACRO program assigns a channel to the WPA0 device and creates a watchpoint of 4 bytes, at starting address 80001068. The program requests neither an XDELTA breakpoint nor a system crash for that watchpoint.

```
                $IODEF
                .PSECT   RWDATA,NOEXE,RD,WRT,LONG
                                          ;
       WP_IOSB:  .BLKL    2               ; I/O status block.
       WP_ADDR:  .LONG    ^X80001068      ; Address of watchpoint to
create.
       WP_NAM:   .ASCID   /WPA0:/         ; Device to which to assign
channel.
       WP_CHAN:  .BLKW    1               ; Channel number.
                 .PSECT   PROG,EXE,NOWRT
                                          ;
       START:    .CALL_ENTRY

                  $ASSIGN_S DEVNAM=WP_NAM,CHAN=WP_CHAN
                  BLBC    R0,RETURN

                  $QIOW_S CHAN=WP_CHAN,-
                          FUNC=#IO$_ACCESS,-
                          IOSB=WP_IOSB,-
                          P2=#4,-
                          P3=WP_ADDR
                  BLBC    R0,RETURN
                  MOVL    WP_IOSB,R0      ; Move status to R0.
       RETURN:    RET                     ; Return to caller.
                 .END     START
```

A watchpoint remains in effect until it is explicitly deleted. (Note, however, that watchpoint definitions do not persist across system reboots.) To delete an existing watchpoint, issue an IO$_DEACCESS QIO request.

The IO$_DEACCESS function requires the following device/function dependent argument: P3 - Starting address of the watchpoint to be deleted.

The table below shows the status values that are returned in the I/O status block.

Table 13.3. Returned Status Values

Status Value	Meaning
SS$_NORMAL	Success.
SS$_IVADDR	The specified watchpoint does not exist.

Section 13.5 describes the use of the IO$_RDSTATS QIO request.

13.3.2. Invoking WPDRIVER Entry Points from System Routines

When the WPDRIVER is loaded, it initializes two locations in system space with the addresses of routines within the driver. These locations, WP$CREATE_WATCHPOINT and WP $DELETE_WATCHPOINT, enable dispatch to create and delete watchpoint routines within the loaded driver. Input arguments for both routines are passed in registers.

Code running in kernel mode can execute the following instructions:

```
JSB    @G^WP$CREATE_WATCHPOINT ; create a watchpoint
```

and

```
JSB    @G^WP$DELETE_WATCHPOINT ; delete a watchpoint
```

Both these routines save IPL at entry and set it to the fork IPL of the WPDRIVER, IPL 11. Thus, they should not be invoked by code threads running above IPL 11. At exit, the routines restore the entry IPL.

These two locations contain an RSB instruction prior to the loading of the driver. As a result, if a system routine tries to create or delete a watchpoint before the WPDRIVER is loaded, control immediately returns.

WP$CREATE_WATCHPOINT has the following register arguments:

- R0---User-specified watchpoint options
  - Bit 1 equal to 1 specifies that a fatal OPERCRASH bugcheck should occur after a write to the watchpoint area.
  - Bit 2 equal to 1 specifies that an XDELTA breakpoint should occur after a write to the watchpoint area.
- R1---Length of the watchpoint area
- R2---Starting address of the watchpoint area

Status is returned in R0. The status values and their interpretations are identical to those for the QIO interface to create a watchpoint. The only difference is that the SS$_NOPRIV status cannot be returned with this interface.

WPS$DELETE_WATCHPOINT has the following register argument:

- R2---Starting address of the watchpoint area

Status is returned in R0. The status values and their interpretations are identical to those for the QIO interface.

13.4. Data Structures

The WPDRIVER uses three different kinds of data structures:

- One watchpoint restore entry (WPRE) for each page of system space in which one or more active watchpoints are located
- One watchpoint control block (WPCB) for each active watchpoint
- Trace table entries (WPTTEs) in a circular trace buffer which maintains a history of watchpoint writes

These data structures are described in detail and illustrated in the sections that follow.

13.4.1. Watchpoint Restore Entry (WPRE)

There is one WPRE for each system page that contains a watchpoint. That is, if nine watchpoints are defined which are in four different system pages, four WPREs are required to describe those pages. When WPDRIVER is loaded, its initialization routine allocates physically contiguous memory for the maximum number of WPREs. The number of pages to be allocated is specified by system parameter WPRE_SIZE.

The WPDRIVER allocates WPREs starting at the beginning of the table and maintains a tightly packed list. That is, when a WPRE in the middle of those in use is "deallocated," its current contents are replaced with the contents of the last WPRE in use. The number in use at any given time is in the driver variable WP$L_WP_COUNT. The system global EXE$GA_WP_WPRE points to the beginning of the WPRE table.

The WPRE for a page contains information useful for:

- Determining whether a given access violation refers to an address in the page associated with this WPRE
- Restoring the original SPTE value for the associated page
- Reestablishing the modified SPTE value when watchpoints are reenabled
- Invalidating the translation buffer when the SPTE is modified
- Locating the data structures associated with individual watchpoints defined in this system page

13.4.2. Watchpoint Control Blocks (WPCB)

The WPCBs associated with a given system page are singly-linked to a list header in the associated WPRE. A WPCB is allocated from a nonpaged pool when a watchpoint is created. A WPCB contains static information about the watchpoint such as the following:

- Its starting address and length
- Original contents of the watchpoint at the time it was established
- User-specified options for this watchpoint

In addition, the WPCB contains dynamic data associated with the most recent write reference to the watchpoint. This data includes the following:

- Number of times that the watchpoint has been written.
- Address of the first byte within the watchpoint that was modified at the last write reference.
- PC-PSL pair that made the last write reference.
- System time at the last write reference.
- Contents of the general registers at the time of the last write reference.
- A copy of up to 15 bytes of instruction stream data beginning at the program counter (PC) of the instruction that made the last write reference. The amount of instruction stream data that is copied here is the lesser of 15 bytes and the remaining bytes on the page containing the PC.
- Contents of the watchpoint before the last write reference.
- Contents of the watchpoint after the last write reference. This value is presumably the current contents of the watchpoint.
- A pointer to an entry in the global circular trace buffer where all recent references to watchpoints are traced.

13.4.3. Trace Table Entries (WPTTEs)

Whenever a watchpoint is written, all the relevant data is recorded in the WPCB associated with the watchpoint. In addition, to maintain a history, the WPDRIVER copies a subset of the data to the oldest WPTTE in the circular trace buffer. Thus, the circular trace buffer contains a history of the last N references to watchpoints. The driver allocates nonpaged pool to accommodate the number of trace table entries specified by the system parameter WPTTE_SIZE. The WPTTEs for all watchpoints are together in the table, but the ones for a particular watchpoint are chained together.

The subset of data in a WPTTE includes the following:

- Starting address of the watchpoint
- Relative offset of the first byte modified on this reference
- Opcode of the instruction that modified the watchpoint
- A relative backpointer to the previous WPTTE of this watchpoint
- PC-PSL of the write reference
- System time of the write reference
- Contents of the watchpoint before this reference

13.5. Analyzing Watchpoint Results

Analyzing watchpoint results is a function of the mode in which the WPDRIVER is used. For example, if you have only one watchpoint and have specified that an XDELTA breakpoint and/or a bugcheck occur on a write to the watchpoint, then when the reference occurs, simply find the program counter (PC) that caused the reference.

This PC (actually the PC of the next instruction) and its processor status longword (PSL) are on the stack at the time of the breakpoint and/or bugcheck. The layout that follows is the stack as it appears within an XDELTA breakpoint. Examined from a crash dump, the stack is similar but does not contain the return address from the JSB to INI$BRK.

```
+---------------------------------------+
|address in WPDRIVER from JSB G^INI$BRK| :SP
|PC of next instruction                |
|PSL at watchpoint access              |
+---------------------------------------+
```

Furthermore, R0 contains the address of the WPCB associated with that watchpoint. You can examine the WPCB to determine the original contents of the watchpoint area and the registers at the time of the write.

Definitions for the watchpoint data structures are in SYS$LIBRARY:LIB.MLB. Build an object module with its symbol definitions by entering the following DCL commands:

```
$ MACRO/OBJ=SYS$LOGIN:WPDEFS SYS$INPUT: + SYS$LIBRARY:LIB/LIB
        $WPCBDEF   GLOBAL   !n.b. GLOBAL must be capitalized
        $WPREDEF   GLOBAL
        $WPTTEDEF  GLOBAL
        .END
CTRL/Z
```

Then, within SDA, you can format watchpoint data structures. For example, enter the following SDA commands:

```
SDA>READ SYS$LOGIN:WPDEFS.OBJ
SDA>FORMAT @R0 /TYPE=WPCB   !type definition is required
SDA>DEF WPTTE = @R0 + WPCB$L_TTE
SDA>FORMAT WPTTE /TYPE=WPTTE
```

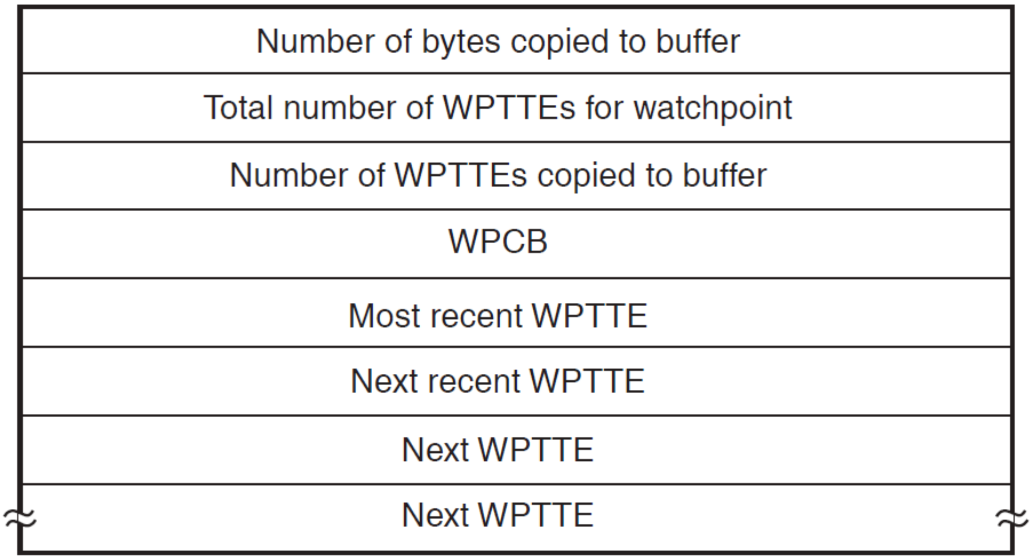
An alternative to crashing the system or using XDELTA to get watchpoint information is the QIO function IO$_RDSTAT. This function returns watchpoint control block contents and trace table entries for a particular watchpoint.

It requires the following device/function dependent arguments:

- P1---Address of buffer to receive watchpoint data.
- P2---Length of the buffer. The minimum size buffer of 188 bytes is only large enough for WPCB contents.
- P3---Watchpoint address.

The data returned in the buffer has the format shown in the figure below.

Figure 13.1. Format of Data Returned in Buffer



13.6. Watchpoint Protection Overview

The overall design of the watchpoint facility uses protection attributes on system pages and the access violation fault mechanism. To establish a watchpoint within a page of system space, the WPDRIVER changes the protection of the page to disallow writes. The WPDRIVER modifies the access violation vector to point to its own routine, WP$ACCVIO.

Any subsequent write to this page causes an access violation and dispatch to WP$ACCVIO. Thus, the WPDRIVER gains control on all write references to watchpoints and can monitor such accesses.

When WP$ACCVIO is entered, it raises IPL to 31 to block all other threads of execution. It first must determine whether the faulting address (whose reference caused the access violation) is within a page containing a watchpoint. However, any major amount of CPU processing at this point might access an area in system space whose protection has been altered to establish watchpoints. As a result, such processing might cause a reentry into WP$ACCVIO. To avoid recursive reentry, WP$ACCVIO first restores all SPTEs that it had modified to their values prior to the establishment of any watchpoints. From this point until this set of SPTEs are remodified, no watchpoints are in effect. Now WP$ACCVIO can determine whether the reference was to a page containing a watchpoint.

To determine whether the reference is to a watchpoint page, WP$ACCVIO compares the faulting address to addresses of pages whose protection has been altered by WPDRIVER. If the faulting address is not in one of these pages, then WP$ACCVIO passes the access violation to the usual OpenVMS service routine, EXE$ACVIOLAT. If the faulting address is within a page containing a watchpoint, more extensive processing is required.

As a temporary measure, WP$ACCVIO first records all data related to the reference in its UCB. It cannot immediately associate the access violation with a particular watchpoint. This ambiguity arises from imprecision in the faulting virtual address recorded at the access violation. The CPU need merely place on the stack "some virtual address in the faulting page."

As a result, when a reference to a page with a watchpoint results in an access violation, the watchpoint driver first merely captures the data in its UCB. The data captured at this point includes the following:

- PC and PSL of the faulting instruction

- Current system time
- Values of all the general registers from R0 through SP
- A copy of up to 15 bytes of the instruction stream, beginning at the PC previously captured

If the reference later turns out not to be one to a watchpoint, the captured data is discarded. If the reference is to a watchpoint, the data is copied to the WPCB and circular trace buffer.

The watchpoint driver distinguishes between these two possibilities by reexecuting the faulting instruction under a controlled set of circumstances.

Once the instruction has reexecuted, WP$TBIT can determine whether watchpoint data has been modified by comparing the current contents of all watchpoints within the page of interest to the contents that they had prior to this reference. Because the driver has run at IPL 31 since the write access that caused an access violation, any change in the contents is attributable to the reexecuted instruction. If the contents of a watchpoint are different, WP$TBIT copies the data temporarily saved in its UCB to the WPCB associated with this watchpoint and records a subset of this data in a WPTTE.

The driver can cause either or both an XDELTA breakpoint or a bugcheck, depending on what action was requested with the watchpoint definition. If an XDELTA breakpoint was requested, the driver invokes XDELTA. After the user proceeds from the XDELTA breakpoint, if a bugcheck was not requested, the driver restores the SPTEs of pages containing watchpoints, the saved registers and IPL, and REIs to dismiss the exception.

13.7. Restrictions

The WPDRIVER can monitor only those write references to system space addresses that arise in a CPU. I/O devices can write to memory and thereby modify watchpoints without the WPDRIVER's becoming aware of the write.

Because a write access to a watchpoint is determined by comparing the contents of the watchpoint before and after the write, a write of data identical to the original contents is undetectable.

Because the WPDRIVER modifies SPTEs, a device page that directly interprets tables may experience access violations when it attempts to write into a memory page whose protection has been modified to monitor watchpoints. In other words, a page containing a watchpoint should not also contain a buffer for such a controller.

When you create a watchpoint, you should ensure that the system is quiet with respect to activity affecting the watchpoint area. Otherwise, an inconsistent copy of the original contents of the watchpoint area may be saved. WPDRIVER raises IPL to 11 to copy the watchpoint area's original contents. This means that if the area is modified from a thread of execution running as the result of an interrupt above 11, WPDRIVER can copy inconsistent contents. An inconsistent copy of the original contents may result in spuriously detected writes and missed writes.

If the page containing the watchpoint area is written by an instruction that incurs a page fault, the system can crash with a fatal PGFIPLHI bugcheck. As described in the previous section, after detecting an attempt to write to a page with a watchpoint, the WPDRIVER re-executes the writing instruction at IPL 31. Page faults at IPL 31 are not allowed.

If an outer access mode reference to a watchpointed page causes an access violation, the system will likely crash. When an access violation occurs on a page with a watchpoint, the current driver does not probe the intended access and faulting mode against the page's original protection code. Instead, it assumes that any access violation to that page represents a kernel mode instruction that can be reexecuted at IPL 31. The driver's subsequent attempt to REI, restoring a program status longword (PSL) with an outer mode and IPL 31, causes a reserved operand fault and, generally, a fatal INVEXCEPTN bugcheck.

You must be knowledgeable about the accesses to the page with the watchpoint and careful in using the driver. You should test the watchpoint creation on a standalone system. You should leave the watchpoint in effect long enough to have some confidence that pagefaults in instructions accessing that page are unlikely.

An attempt to CONNECT a WPA unit other than zero results in a fatal WPDRVRERR bugcheck.

The WPDRIVER is suitable for use only on a single CPU system. That is, it should not be used on a symmetric multiprocessing system. There are no plans to remove this restriction in the near future.

Part IV. OpenVMS System Service Logging Utility

This part describes the System Service Logging utility. It explains how to:

- Start logging
- Stop logging
- Display logged information

Chapter 14. System Service Logging

This chapter presents an overview of the System Service Logging utility and describes the System Service Logging commands.

14.1. Overview

System service logging (SSLOG) is used to record system service activity in a process. Its primary purpose is to troubleshoot process failure or misbehavior. This utility is available on OpenVMS Alpha and Integrity server platforms.

Once enabled, the SSLOG mechanism records information about system services requested by code running in the context of that process. The system services logged are:

- Executive and kernel-mode services
- Within privileged shareable image services
- Within the OpenVMS executive

SSLOG does not log the mode of caller services.

SSLOG information is initially recorded in process space buffers. When a buffer is full, it is written to a disk file in the process's default disk and directory. After the disk file is closed, you can analyze it with the ANALYZE/SSLOG utility.

Recorded Information

SSLOG records the following information for each service:

- Service identification
- Location of service request - image and offset
- Access mode of requester
- Service arguments (passed by value; only the addresses of arguments passed by reference)
- Timestamp
- Completion status
- Kernel thread, POSIX thread (PTHREAD), and CPU identifiers

The information is recorded as follows:

- It is initially recorded in a ring of P2 space buffers with each process having its own P2 space buffers.
- A full buffer is written to a disk file. By default, the file is SSLOG.DAT in the current default disk and directory. However, if the logical name SSLOG is defined, its equivalence string is used to form the log file name.

14.2. Enabling Logging

To enable any system service logging, check that the dynamic system parameter SYSSER_LOGGING is 1. If not, set it to a value of 1. Once logging is enabled, you can start system service logging for a particular process by DCL command, as shown in the following example.

```
$ SET PROCESS /SSLOG=(STATE=ON,COUNT=4)
```

By default, execution of this command affects the current process. To target another process, use the /ID qualifier or specify the process by name.

Use the COUNT keyword to specify the number of P2 space buffers to allocate for the process you are logging.

Buffers are pageable and therefore are charged against PGFLQUOTA. They are not deallocated until the process is deleted.

For additional information on this command, see the full description of the the section called “SET PROCESS/SSLOG” command.

14.3. Disabling Logging

There are two ways to disable logging, depending on whether you want the option to enable logging again on the same process.

- If you might want to re-enable logging on this process, use the following command to disable logging:

  ```
  $ SET PROCESS /SSLOG=(STATE=OFF)
  ```

  You can then re-enable logging later by executing the same command with STATE=ON.

- If you want to permanently end logging on this process, use the following command to close and truncate the log file:

  ```
  $ SET PROCESS /SSLOG=(STATE=UNLOAD)
  ```

  After you execute this command, you cannot enable logging on this process again.

14.4. Displaying Logged Information

You display logged information with the DCL command ANALYZE/SSLOG *filename* , where the default filename is SSLOG.DAT. For additional information on this command and examples, see the command the section called “ANALYZE/SSLOG”.

ANALYZE/SSLOG

Displays the collected data.

Format

`ANALYZE/SSLOG [/BRIEF | /FULL | /NORMAL | /STATISTICS] [/OUTPUT=filename] [/SELECT`

Parameters

filespec

Optional name of the log file to be analyzed. The default filename is SSLOG.DAT.

Qualifiers

/BRIEF

Displays abbreviated logged information.

/FULL

Displays logged information, error status messages and sequence numbers.

/NORMAL (Default)

Displays basic logged information.

/STATISTICS[=BY_STATUS]

Displays statistics on system services usage; accepts BY_STATUS keyword. Outputs a summary of the services logged with a breakdown by access mode. Output is ordered with the most frequently requested services first. If BY_STATUS is included, the summary is further separated by completion status. Output is displayed up to 132 columns wide.

/OUTPUT=filename

Identifies the output file for storing the results of the log analysis. An asterisk (*) and percent sign (%) are not allowed as wildcards in the file specification. There is no default file type or filename. If you omit the qualifier, results are output to the current SYS$OUTPUT device.

/SELECT=([option[,...]])

Selects entries based on your choice of options. You must specify at least one of the following:

Keyword	Meaning
ACCESS_MODE= *mode*	Selects data by access mode.
IMAGE= *image-name*	Selects data by image name.
STATUS[= *n*]	Selects data by status. *n* is optional. /SELECT=STATUS displays all entries that have an error status.
SYSSER= *service-name*	Selects data by service name.

/WIDE

Provides for a display of logged information up to 132 columns wide.

Description

The ANALYZE/SSLOG command displays the collected logged data. Note that a system service log must be analyzed on the same platform type as the one on which it was created; for example, a log created on an OpenVMS Alpha system must be analyzed on an OpenVMS Alpha system.

Examples

The following examples demonstrate usage of the ANALYZE/SSLOG command.

1.
```
$ ANALYZE /SSLOG /BRIEF
START   1.1     00000414 HERE               IA64       !25-MAY-2004
 14:55:17.77
        NAK   ::SYSTEM                               4  65024

SYS$EXIT_INT                            sts: --------  acmode: U   !
14:55:17.80
       image:                         IMAGE_MANAGEMENT+00047ed0  argct:
 01
SYS$RMSRUNDWN                           sts: 00010001  acmode: S   !
14:55:17.80
       image:                                      DCL+00070370  argct:
 02
SYS$DCLAST                              sts: 00000001  acmode: E   !
14:55:17.80
       image:                                      RMS+000e5840  argct:
 03
SYS$RMS_CLOSE                           sts: 00010001  acmode: E   !
14:55:17.80
       image:                                      RMS+000d66c0  argct:
 03
SYS$SETEF                               sts: 00000009  acmode: E   !
14:55:17.80
       image:                                      RMS+00125df0  argct:
 01
SYS$RMS_CLOSE                           sts: 00010001  acmode: E   !
14:55:17.80
       image:                                      RMS+000d66c0  argct:
 03
SYS$SETEF                               sts: 00000009  acmode: E   !
14:55:17.80
       image:                                      RMS+00125df0  argct:
 01
SYS$ERNDWN                              sts: 00000001  acmode: S   !
14:55:17.80
       image:                         IMAGE_MANAGEMENT+000274d0  argct:
 01
SYS$CMKRNL                              sts: 8318ae00  acmode: E   !
14:55:17.80
       image:                         IMAGE_MANAGEMENT+00027890  argct:
 02
[...]
```

The above example shows abbreviated SSLOG output.

The first entry displayed is a START message that describes the enabling of system service logging. The major and minor version numbers associated with this log file are both 1. Logging was initiated by process ID 0000041416 whose username was SYSTEM. This log file is from an OpenVMS Integrity server platform. The timestamp shows when logging was started. The process whose services were logged was named HERE and ran on node NAK. Logging was done into four buffers of 65024 bytes each.

Each subsequent entry describes a system service request. The leftmost column is the service name. The next item displayed is the hexadecimal completion status from that service request. If the status is displayed as "--------", one of the following circumstances occurred:

- The buffer filled and was written to disk before the service completed.
- The service returned to the system service dispatcher at an interrupt priority level (IPL) above 2. Because the process space buffers are pageable and page faults are not allowed above IPL 2, completion status cannot be logged when a service returns above IPL 2.

The next item displayed is the access mode from which the service was requested, followed by the time at which the service was requested. The next line shows the image and offset within the image of the service request and the number of arguments with which the service was requested. Service arguments are not displayed when you enter the command ANALYZE/SSLOG/BRIEF.

2.
```
$ ANALYZE /SSLOG /FULL

START  version: 1.2 process: 0000042f                  ! 5-JUN-2006
 14:03:20.07
       username: SYSTEM                            node: XK150S
 platform: ALPHA
       buffer count: 6    size: 65024   start_flags:  00000003

SYS$SETEXV                          acmode: U                     !
14:03:20.20
       sts: %SYSTEM-S-NORMAL, normal successful completion

       image:                   PROCESS_MANAGEMENT_MON+00008f3c  argct:
 04
       arg  1:0000000000000002  2:ffffffff818e8510  3:0000000000000000
       arg  4:0000000000000000
       entry number: 00000002    number at completion: 00000002
    cpu id:   000   kernel thread ID:  0000  Pthread ID:
 0
[...]
SYS$GETDVI                          acmode: U                     !
14:03:20.28
       sts: %SYSTEM-S-NORMAL, normal successful completion

       image:                        SYSTEM_PRIMITIVES+00054dec  argct:
 08
       arg  1:0000000000000000  2:0000000000000000  3:000000000004000c
       arg  4:000000007ae59e10  5:000000007ae59e08  6:0000000000000000
       arg  7:0000000000000000  8:0000000000000000
       entry number: 00000193    number at completion: 00000193
    cpu id:   000   kernel thread ID:  0000  Pthread ID:
 1

MOUNTSHR                                :00010000    acmode: U     !
14:03:20.28
       sts: %SYSTEM-S-NORMAL, normal successful completion

       image:                                 MOUNTSHR+0009008c  argct:
 02
       arg  1:0000000000000003  2:0000000000000000
       entry number: 00000194    number at completion: 00000195
```

```
     cpu id:   000   kernel thread ID:  0000  Pthread ID:
 1

SYS$SETPRT                         acmode: E                      !
14:03:20.28
       sts: %SYSTEM-S-NORMAL, normal successful completion

       image:                                 MOUNTSHR+00091d94  argct:
 05
       arg  1:000000007ff8bf88  2:0000000000000000  3:0000000000000000
       arg  4:0000000000000004  5:0000000000000000
       entry number: 00000195    number at completion: 00000195
    cpu id:   000   kernel thread ID:  0000  Pthread ID:
 1

SYS$SETSFM                         acmode: U                      !
14:03:20.28
       sts: %SYSTEM-S-NORMAL, normal successful completion

       image:                                 MOUNTSHR+000900a8  argct:
 01
       arg  1:0000000000000000
       entry number: 00000196    number at completion: 00000196
    cpu id:   000   kernel thread ID:  0000  Pthread ID:
 1

MOUNTSHR                               :00010000    acmode: U     !
14:03:20.28
       sts: %SYSTEM-S-NORMAL, normal successful completion

       image:                                 MOUNTSHR+000901ac  argct:
 02
       arg  1:0000000000000001  2:000000007ae5a080
       entry number: 00000197    number at completion: 0000019B
     cpu id:   000   kernel thread ID:  0000  Pthread ID:
 1

[...]
```

The above example shows full SSLOG output.

In the /FULL display, the START entry also shows the flags with which logging was initiated:

- Bit 0, when set, means that service arguments were logged.
- Bit 1, which is always set, means that the P2 space buffers are being written to a file.

The /FULL display shows the arguments for each system service request, as well as its entry number, and interprets the completion status. The display includes kernel thread and POSIX thread identifiers in addition to the identifier of the CPU on which the system service began.

The system service name is not available for services implemented in privileged shareable images. Instead the image name and an internally generated service number are displayed.

When logging is initiated for a particular service, an entry sequence number is associated with that entry. The sequence number is incremented with each attempt to log a system service. The /FULL display shows the sequence number associated with each service request and the number current at the time the service completed. If the service requests no other loggable system services, the two numbers are identical; otherwise, the two numbers differ.

Note that the number at completion is 0 for a service whose completion status could not be logged.

In this example, the number when the second MOUNTSHR system service request is issued is 19716, and the number at completion is 19B16. From this you can infer that four other services were requested as part of processing MOUNTSHR system service request, namely, the services whose entry numbers are 19816 through 19B16.

3.
```
$ ANALYZE /SSLOG /BRIEF /WIDE

START   1.2    0000042e  XK150S ::USER              ALPHA  2 65024  ! 5-
JUN-2006 10:52:51.95
service                           status     mode imagename+offset
                 time
-------                           ------     ---- ----------------
                 ----
SYS$SETEXV                        00000001   U
 PROCESS_MANAGEMENT_MON+00008f3c    !10:52:52.06
SYS$SETPRT                        00000001   U
 PROCESS_MANAGEMENT_MON+0005274c    !10:52:52.06
SYS$SETPRT                        00000024   U
 PROCESS_MANAGEMENT_MON+0005274c    !10:52:52.06
SYS$SETPRT                        00000024   U
 PROCESS_MANAGEMENT_MON+0005274c    !10:52:52.06
SYS$IMGACT                        00000001   U
 IMAGE_MANAGEMENT+000163b8    !10:52:52.06
SYS$CMKRNL                        00000001   U
 LOGINOUT+00030174    !10:52:52.06
SYS$GETJPI                        00000001   U
 PROCESS_MANAGEMENT_MON+000527e4    !10:52:52.06
SYS$GETDVI                        00000001   U
 SYSTEM_PRIMITIVES+00054dec    !10:52:52.06
SYS$SETPRV                        00000001   U
 LOGINOUT+0003323c    !10:52:52.06
SYS$SETPRV                        00000001   U
 LOGINOUT+00033278    !10:52:52.06
SYS$PERSONA_EXPORT_ARB            00000001   K
 PROCESS_MANAGEMENT_MON+0004e9e8    !10:52:52.06
SYS$TRNLNM                        000001bc   U
 LOGINOUT+000365f8    !10:52:52.06
SYS$SETPRV                        00000001   U
 LOGINOUT+00030a08    !10:52:52.06
[...]
SYS$ASSIGN_LOCAL                  00000154   E
 IO_ROUTINES_MON+0001a544    !10:52:52.14
SYS$CMKRNL                        8180e100   E
 MOUNTSHR+000964a8    !10:52:52.14
missing entry numbers: curr:1082 prev: 721

SYS$SYNCH_INT                     --------   S
 PROCESS_MANAGEMENT_MON+00035634    !10:52:52.15
SYS$SYNCH_INT                     --------   S
 PROCESS_MANAGEMENT_MON+00035634    !10:52:52.15
SYS$RMS_FLUSH                     00018001   S
 RMS+00056808    !10:53:52.10
```

```
SYS$QIO                           00000001   E
 RMS+000742bc    !10:53:52.10
[...]
```

The above example shows abbreviated SSLOG output in a wide format.

Sometimes system services are requested too quickly for logging to keep up. When a buffer fills, it is written asynchronously to the log file. If there are only two buffers, as in this example, the second can fill while the first is still being written and thus not yet available. In that case, entries are lost.

Because each attempt to log a service request has an entry number associated with it, the ANALYZE/SSLOG utility can detect gaps in entry numbers. In this example, the line that begins "missing entry numbers" indicates a gap of 361 entries.

4.
```
$ ANALYZE /SSLOG /NORMAL

START  version: 1.1 process: 00000414 HERE             !25-MAY-2004
 14:55:17.77
       username: SYSTEM                           node: NAK
 platform: IA64

     buffer count: 4    size: 65024   start_flags:  00000003
SYS$EXIT_INT                        sts: --------  acmode: U   !
14:55:17.80
       image:                     IMAGE_MANAGEMENT+00047ed0  argct:
 01
       arg  1:0000000010000001
        entry number: 00000002    number at completion: 00000000

SYS$RMSRUNDWN                       sts: 00010001  acmode: S   !
14:55:17.80
       image:                                  DCL+00070370  argct:
 02
       arg  1:000000007ffabf14  2:0000000000000000
        entry number: 00000003    number at completion: 00000008

SYS$DCLAST                          sts: 00000001  acmode: E   !
14:55:17.80
       image:                                  RMS+000e5840  argct:
 03
       arg  1:ffffffff832f70b0  2:0000000000000002  3:0000000000000000
        entry number: 00000004    number at completion: 00000004

SYS$RMS_CLOSE                       sts: 00010001  acmode: E   !
14:55:17.80
       image:                                  RMS+000d66c0  argct:
 03
       arg  1:000000007ff67e20  2:0000000000000000  3:0000000000000000
        entry number: 00000005    number at completion: 00000006

SYS$SETEF                           sts: 00000009  acmode: E   !
14:55:17.80
       image:                                  RMS+00125df0  argct:
 01
       arg  1:000000000000001e
        entry number: 00000006    number at completion: 00000006
```

```
SYS$RMS_CLOSE                          sts: 00010001  acmode: E   !
14:55:17.80
       image:                                       RMS+000d66c0  argct:
 03
       arg  1:000000007ff67e20  2:0000000000000000  3:0000000000000000
        entry number: 00000007    number at completion: 00000008

[...]
```

The above example shows normal SSLOG output in narrow format.

The difference between the /NORMAL and /FULL displays is that the service completion status is interpreted in a /FULL display.

5. `$ ANALYZE /SSLOG /WIDE`

```
START  version: 1.1 process: 20200224 HERE2 !28-APR-2004 14:17:58.54
       username: USER                       node: NODEAZ  platform:
 ALPHA

SYS$EXIT_INT                     sts: --------  acmode: U  image:
 IMAGE_MANAGEMENT+00010838    !14:17:58.82
argct:01  1:0000000010000001


SYS$RMSRUNDWN                    sts: 00010001  acmode: S  image:
       DCL.EXE+000804b0    !14:17:58.82
argct:02  1:000000007ff9cb34  2:0000000000000000



SYS$DCLAST                       sts: 00000001  acmode: E  image:   RMS
+0004e200    !14:17:58.82
argct:03  1:00000000811338b0  2:0000000000000002  3:0000000000000000



SYS$RMS_CLOSE                    sts: 00010001  acmode: E  image:   RMS
+000484b8    !14:17:58.82
argct:03  1:000000007ff8beb0  2:0000000000000000  3:0000000000000000



SYS$SETEF                        sts: 00000009  acmode: E  image:   RMS
+0005fe70    !14:17:58.82
argct:01  1:000000000000001e



SYS$RMS_CLOSE                    sts: 00010001  acmode: E  image:   RMS
+000484b8    !14:17:58.82
argct:03  1:000000007ff8beb0  2:0000000000000000  3:0000000000000000



SYS$SETEF                        sts: 00000009  acmode: E  image:   RMS
+0005fe70    !14:17:58.82
argct:01  1:000000000000001e
```

```
[...]
```

The above example shows normal (default) SSLOG output in a wide format.

6. `$ ANALYZE /SSLOG /WIDE /FULL`

```
START  version: 1.1 process: 00000415 HERE                          !11-
MAY-2006 10:41:38.82
       username: SYSTEM                           node: NAK
 platform: IA64

SYS$EXIT_INT                 sts: --------  acmode: U  image:
 IMAGE_MANAGEMENT+00047600    !10:41:38.85
argct:01  1:0000000010000001         entry number: 00000002    number at
 completion: 00000000
    cpu id:   000   kernel thread ID:  0000  Pthread ID:
 0

SYS$RMSRUNDWN                      acmode: S   image:           DCL
+0006fdb0                !10:41:38.85
       sts: %RMS-S-NORMAL, normal successful completion
argct:02  1:000000007ffabf14  2:0000000000000000
         entry number: 00000003    number at completion: 00000008
    cpu id:   000   kernel thread ID:  0000  Pthread ID:
 0

SYS$DCLAST                         acmode: E   image:           RMS
+000e3ca0                !10:41:38.85
       sts: %SYSTEM-S-NORMAL, normal successful completion
argct:03  1:ffffffff842f68b0  2:0000000000000002  3:0000000000000000
         entry number: 00000004    number at completion: 00000004
    cpu id:   000   kernel thread ID:  0000  Pthread ID:
 0

SYS$RMS_CLOSE                      acmode: E   image:           RMS
+000d4d90                !10:41:38.85
       sts: %RMS-S-NORMAL, normal successful completion
argct:03  1:000000007ff67e20  2:0000000000000000  3:0000000000000000
         entry number: 00000005    number at completion: 00000006
    cpu id:   000   kernel thread ID:  0000  Pthread ID:
 0

SYS$SETEF                          acmode: E   image:           RMS
+00123740                !10:41:38.85
       sts: %SYSTEM-S-ACCVIO, access violation, reason mask=!XB, virtual
 address=!XH, PC=!XH, PS=!XL
argct:01  1:000000000000001e
         entry number: 00000006    number at completion: 00000006
    cpu id:   000   kernel thread ID:  0000  Pthread ID:
 0

SYS$RMS_CLOSE                      acmode: E   image:           RMS
+000d4d90                !10:41:38.85
       sts: %RMS-S-NORMAL, normal successful completion
argct:03  1:000000007ff67e20  2:0000000000000000  3:0000000000000000
         entry number: 00000007    number at completion: 00000008
    cpu id:   000   kernel thread ID:  0000  Pthread ID:
 0
```

```
)
```

The above example shows full SSLOG output in a wide format.

7.
```
$ ANALYZE /SSLOG /WIDE /SELECT=(IMAGE=DCL,SYSSER=SYS$IMGACT)-
_$ /OUTPUT=SSL_SEL2.LOG SSLOG.DAT

START  version: 1.1 process: 2020041b SYSTEM
          !30-AUG-2004 18:30:28.79
       username: SYSTEM                           node: WFGLX4
 platform: ALPHA

SYS$IMGACT                    sts: 00000001  acmode: S  image:
       DCL+0007eb40    !18:30:44.26
argct:08 1:000000007ff9cd58 2:000000007ff9cd50 3:000000007ffcf800
 4:0000000000000000
         5:0000000000000000 6:0000000000000000 7:0000000000000000
 8:0000000000000000
        entry number: 0000002E    number at completion: 000000B7

SYS$IMGACT                    sts: 00000001  acmode: S  image:
       DCL+0007eb40    !18:30:49.81
argct:08 1:000000007ff9cd58 2:000000007ff9cd50 3:000000007ffcf800
 4:0000000000000000
         5:0000000000000000 6:0000000000000000 7:0000000000000000
 8:0000000000000000
        entry number: 00000195    number at completion: 00000203

SYS$IMGACT                    sts: 00000001  acmode: S  image:
       DCL+0007eb40    !18:31:06.19
argct:08 1:000000007ff9cd58 2:000000007ff9cd50 3:000000007ffcf800
 4:0000000000000000
         5:0000000000000000 6:0000000000000000 7:0000000000000000
 8:0000000000000000
        entry number: 000003FB    number at completion: 0000046A

STOP
          !30-AUG-2004 18:31:06.19
```

The above example selects only those entries that describe SYS$IMGACT requests made from DCL and writes the analysis to file SSL_SEL2.LOG. (Parts of the display have been moved left to fit within manual page boundaries.)

8.
```
$ ANALYZE /SSLOG /STATISTICS /OUTPUT=SSL_STAT.LOG SSLOG.DAT

START  version: 1.1 process: 2020041b SYSTEM          !30-AUG-2004
 18:30:28.79
       username: SYSTEM                           node: WFGLX4
 platform: ALPHA

    buffer count: 2    size: 65024   start_flags:  00000003

Service                              Count      User       Super
 Exec       Kernel     Rate/sec
--------                             ------     ------     ------
 ------     ------     --------
SYS$TRNLNM                              168          4          0
 164          0          4.5
```

```
SYS$RMS_SEARCH                         129        129          0
   0          0          3.4
SYS$QIO                                121          0          0
  94         27          3.2
SYS$SYNCH_INT                           92         88          4
   0          0          2.5
SYS$RMS_PUT                             85         85          0
   0          0          2.3
SYS$CMKRNL                              55          0          0
  55          0          1.5
SYS$SETPRT                              51         36          0
  15          0          1.4
SYS$DASSGN                              49          0          0
  24         25          1.3
SYS$GETDVI                              46          2          0
  44          0          1.2
SYS$ASSIGN_LOCAL                        44          0          0
  44          0          1.2
SYS$MGBLSC                              40          0          0
  40          0          1.1
SYS$CRMPSC                              27          0          0
  27          0          0.7
SYS$GETJPI                              22         22          0
   0          0          0.6
SYS$RMS_OPEN                            21          0          0
  21          0          0.6
SYS$DEQ                                 19          0          0
   8         11          0.5
SYS$IMGACT                              18         15          3
   0          0          0.5
SYS$CRETVA                              16          0          0
  16          0          0.4
SYS$ENQ                                 15          0          0
   8          7          0.4
SYS$SETRWM                              12          0          0
   6          6          0.3
SYS$DELTVA                              12          0          0
   0         12          0.3
SYS$PERSONA_ASSUME                      12          0          0
  12          0          0.3
SYS$EXPREG                              12          9          0
   3          0          0.3
SYS$RMS_CLOSE                            7          1          0
   6          0          0.2
SYS$CLRCLUEVT                            6          0          0
   0          6          0.2
SYS$SETEF                                6          0          0
   6          0          0.2
SYS$DACEFC                               6          0          0
   0          6          0.2
SYS$PERSONA_EXTENSION_LOOKUP             6          0          0
   0          6          0.2
SYS$GETSYI                               5          5          0
   0          0          0.1
SYS$DCLAST                               5          0          0
   5          0          0.1
SYS$RMSRUNDWN                            3          0          3
   0          0          0.1
```

```
SYS$ERNDWN                                3           0           3
   0           0           0.1
SYS$SETEXV                                3           3           0
   0           0           0.1
SYS$KRNDWN                                3           0           3
   0           0           0.1
SYS$EXIT_INT                              3           3           0
   0           0           0.1
SYS$RMS_GET                               3           0           3
   0           0           0.1
SYS$DCLEXH                                3           0           3
   0           0           0.1
SYS$PERSONA_EXPORT_ARB                    3           0           0
   0           3           0.1
SYS$DALLOC                                3           0           0
   0           3           0.1
SYS$SETPFM                                3           0           0
   0           3           0.1
SYS$PERSONA_CLONE                         2           0           0
   2           0           0.1
SYS$PERSONA_DELETE                        2           0           0
   2           0           0.1
SYS$RMS_CREATE                            2           2           0
   0           0           0.1
SYS$RMS_CONNECT                           2           2           0
   0           0           0.1
SYS$SET_PROCESS_PROPERTIESW               1           1           0
   0           0           0.0
SYS$RMS_PARSE                             1           1           0
   0           0           0.0
SYS$PROCESS_SCAN                          1           1           0
   0           0           0.0
SYS$SETPRV                                1           1           0
   0           0           0.0
```

The above example shows the use of the /STATISTICS qualifier. The output lists the most frequently requested service first. Each entry shows the total number of requests for that service, a breakdown by access mode, and the rate per second.

Note that only OpenVMS executive services are listed in a /STATISTICS display; services in privileged shareable images are omitted.

9.
```
$ ANALYZE /SSLOG /STATISTICS=BY_STATUS

START  version: 1.1 process: 2020041b SYSTEM           !30-AUG-2004
 18:30:28.79
       username: SYSTEM                            node: WFGLX4
 platform: ALPHA

     buffer count: 2    size: 65024   start_flags:  00000003

Service                              Count       User        Super
 Exec        Kernel      Status    Rate/sec
--------                             ------      ------      ------
 ------      ------      -------   --------
SYS$TRNLNM                              168          4           0
 164          0        All          4.5
```

```
                                             46          0          0
  46          0     000001BC       1.2
                                            122          4          0
 118          0     00000001       3.3
 SYS$RMS_SEARCH                             129        129          0
   0          0       All          3.4
                                              2          2          0
   0          0     00018001       0.1
                                            126        126          0
   0          0     00010001       3.4
                                              1          1          0
   0          0     000182CA       0.0
 SYS$QIO                                    121          0          0
  94         27       All          3.2
                                              4          0          0
   0          4     0000026C       0.1
                                            117          0          0
  94         23     00000001       3.1
 SYS$SYNCH_INT                               92         88          4
   0          0       All          2.5
                                             92         88          4
   0          0     00000000       2.5
 SYS$RMS_PUT                                 85         85          0
   0          0       All          2.3
                                             84         84          0
   0          0     00018001       2.2
                                              1          1          0
   0          0     00000000       0.0
 [...]
```

The above example shows the use of /STATISTICS = BY_STATUS. Similar to the previous example, it also has an additional line for each status returned by a system service.

RUN/SSLOG_ENABLE

Creates a process with system service logging enabled.

Requires CMEXEC, CMKRNL, or SETPRV privilege to log argument values. The SYSGEN parameter SYSSER_LOGGING must be enabled or the command will fail.

Refer to online help or the *VSI OpenVMS DCL Dictionary* for other qualifiers that can be used with the RUN command when creating a process.

Format

RUN /SSLOG_ENABLE[=(COUNT=n [,FLAGS=[NO]ARG])]

Parameters

COUNT=n

Specifies how many P2-space buffers to log. The default is 2.

FLAGS=[NO]ARG

Specifies whether or not service argument values are to be logged. The default is ARG, which requires privileges. If the value is ARG but you lack privilege, no argument values are logged.

If both **COUNT** and **FLAGS** are specified, they must be separated by a comma. If only one is specified, the parentheses may be omitted.

Qualifiers

None.

Description

The RUN/SSLOG_ENABLE command creates a process with system service logging enabled.

When enabling SSLOG for a process, you can specify the number of buffers to be used for logging. Buffers are allocated in P2 space and are charged against the process's paging file quota. Each buffer is 65,02410 bytes or FE0016 bytes. The buffer space remains allocated and the quota charged until the process is deleted.

Before you delete the process, stop the logging and close the log file by executing the SET PROCESS/SSLOG=STATE=UNLOAD command. The log file does not close automatically.

To analyze the log file, use the DCL command ANALYZE/SSLOG.

Examples

1. `$ RUN /SSLOG_ENABLE SSLOG_TEST.EXE`

   This command creates a new process to run the image SSLOG_TEST.EXE and log the results.

2. `$ RUN /SSLOG_ENABLE SSLOG_TEST.EXE /PROCESS_NAME=SUBA`

   This command creates a new process named SUBA to run the image SSLOG_TEST.EXE and log the results.

SET PROCESS/SSLOG

Enables or disables system service logging on the current process or on a specified process.

Requires GROUP privilege to change other processes in your group. Requires WORLD privilege to change processes outside your group. Requires CMEXEC, CMKRNL, or SETPRV privilege to log argument values. SYSGEN parameter SYSSER_LOGGING must be enabled or the command will fail.

Refer to online help or the *VSI OpenVMS DCL Dictionary* for other SET PROCESS command qualifiers.

Format

`SET PROCESS/SSLOG=(STATE={ON|OFF|UNLOAD} [,COUNT=n] [,FLAGS=[NO]ARGUMENTS]) [`

Parameters

process-name

Specifies the name of the process for which logging is to be enabled or disabled.

COUNT=n

Specifies how many P2-space buffers to log. The default is 2.

FLAGS=[NO]ARG

Specifies whether or not service argument values are to be logged. The default is ARG, which requires privileges. If the value is ARG but you lack privilege, no argument values are logged.

STATE=state

Turns system service logging on or off. Possible states are:

ON	Enables system service logging.
OFF	Disables (turns off) system service logging; logging can still be reenabled.
UNLOAD	Stops logging and closes the log file, which is named SSLOG.DAT by default.

Qualifiers

/IDENTIFICATION=identification_number

Specify to target a specific process by number.

Description

The SET PROCESS/SSLOG command:

- Enables or disables system service logging
- Opens the log file used to log data
- Can specify a specific process by name or ID (identification number)
- Can stop logging and close the file of logged data

When enabling SSLOG for a process, you specify the number of buffers to be used for logging. The buffers are allocated in P2 space and are charged against the process's paging file quota. Each buffer is 65,02410 bytes or FE0016 bytes. The buffer space remains allocated and the quota charged until the process is deleted.

Between the time when SSLOG is first enabled and when the log file is closed, logging can be stopped and resumed.

Before you delete the process, stop the logging and close the log file. The log file does not close automatically.

To analyze the log file, use the DCL command ANALYZE/SSLOG.

Examples

1. `$ SET PROCESS /SSLOG=(STATE=ON,COUNT=4)`

This command turns on system service logging with four P2 space buffers, each having a size of FE0016 bytes. If the process has SETPRV, CMKRNL, or CMEXEC privilege, argument values are logged.

2. `$ SET PROCESS /SSLOG=(STATE=UNLOAD)`

   This command stops logging and closes the log file.