VMS System Dump Analyzer Utility Manual

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This manual explains how to use the System Dump Analyzer (SDA) to investigate system failures and examine a running system.

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Preface

Intended Audience

The *VMS System Dump Analyzer Utility Manual* is primarily intended for the system programmer who must investigate the causes of system failures and debug kernel mode code, such as a device driver. This programmer should possess some knowledge of VMS data structures to properly interpret the results of System Dump Analyzer (SDA) commands.

The *VMS System Dump Analyzer Utility Manual* also includes information required by the system manager in order to maintain the system resources necessary to capture and store system crash dumps. Those who need to determine the cause of a hung process or improve system performance may refer to this manual for instructions for using SDA to analyze a running system.

Document Structure

The *VMS System Dump Analyzer Utility Manual* includes the following four sections:

- The first section provides an introduction to the functions of the System Dump Analyzer (SDA), a description of its features, a discussion of key concepts, and an illustration of its use. It includes instructions for maintaining the optimal environment for the analysis of system failures, and notes the requirements for processes invoking SDA.
- The second section outlines the following aspects of SDA usage:
  - Invoking SDA
  - Exiting from SDA
  - Recording the output of an SDA session
  - Required privileges
- The third section describes those qualifiers to the ANALYZE command that govern the behavior of SDA.
- The last section describes the function, format, and parameters of each SDA command. It also provides examples of situations in which specific commands are useful.

Associated Documents

The *VMS System Dump Analyzer Utility Manual* presumes an understanding of the material discussed in the following documents:

- VMS naming conventions as described in the *Guide to Creating VMS Modular Procedures*
- VMS operational concepts as described in the *Introduction to VMS System Management, Guide to Setting Up a VMS System, Guide to Maintaining a VMS System,* and *Guide to VMS Performance Management*
- VMS data structures and concepts as described in the *VAX/VMS Internals and Data Structures* and the *VMS Device Support Manual*

Investigators of VAXcluster failures will find the discussions in the *VMS VAXcluster Manual* and the *VMS Show Cluster Utility Manual* helpful in understanding the output of several SDA commands.

Conventions

Typographical conventions used in this book include the following:

- The term "quotation marks" refers to double quotation marks ("). The term "apostrophe" refers to a single quotation mark (').
- Terms that serve as parameters to commands and qualifiers appear in boldface in the text of the manual. For example:

  The value **csid** is the cluster system identification number (CSID) of the node to be displayed.

- Terms that serve as variables in a mathematical expression or a file specification appear in italic print:

  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.

- In format descriptions, brackets indicate that the enclosed item is optional. (Brackets are not, however, optional in the syntax of a directory name in a file specification or in the syntax of a substring specification in an assignment statement.)

  FORMAT*[/qualifier] location*

- In format descriptions, stacked lists of items are enclosed in either braces or brackets. In either case, the parameters or qualifiers in the stack are optional in the syntax of the command.

  When *braces* enclose the list, you can include *only one* of the items from the list in the command. For example:

  EVALUATE { */CONDITION_VALUE* / */PSL* / */PTE* / */SYMBOLS* } *expression*

When *brackets* enclose the list, you can generally include *more than one* item from the stack in the command. Incompatible qualifiers and parameters are given special mention in the syntax descriptions.

SHOW POOL [*/FREE* | */HEADER* | */SUMMARY* | */TYPE=block-type*] [*range* | */ALL* | */IRP* | */LRP* | */NONPAGED* | */PAGED* | */SRP*]

- In format descriptions, a horizontal ellipsis indicates that additional parameters, values, or information can be entered. For example:

  SET RMS = (*option[,...]*)

  In examples, a horizontal ellipsis also indicates that columns of information have been omitted from the display. For example:

```
SDA>  SHOW HEADER
Dump file header
----------------
7FF03944 . . . 00000000  ................N...D9.. 00000000
00000000 . . . 80185200  .R..................... 00000020
00000000 . . . 00000000  ........................ 00000040
00020000 . . . 00000000  ........................ 00000060
```

- In format descriptions, parentheses indicate that you should enclose the choices you select in parentheses if you select more than one. For example:

  SET RMS = (*option[,...]*)

- In interactive examples, all output lines or prompting characters that the system prints or displays appear in black letters. All user-entered commands are shown in red letters. For example:

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

- In interactive examples, a symbol with a 1- to 6-character abbreviation indicates that you press a key on the terminal, for example, RET.

- In interactive examples, the symbol CTRL/x indicates that you must press the key labeled CTRL while you simultaneously press another key: for instance, CTRL/C.

- In interactive examples, a vertical ellipsis means either that not all the data that the system would display in response to the particular command is shown or that not all the data a user would enter is shown. For example:

```
SDA> READ SYS$SYSTEM:SYSDEF.STB
SDA> FORMAT 800B81F0
800B81F0   UCB$L_FQFL              80000F10
           UCB$L_RQFL
    .
    .
    .
           UCB$L_FIRST             8002CA00
```

New and Changed Features

This manual applies to Version 5.0 of the VMS operating system.

The following list summarizes the major changes to the previous edition of the manual.

- The context of certain SDA commands now depends on the definition of both the SDA current process and the SDA current CPU. The descriptions of the following commands have been altered to reflect the behavior of SDA in analyzing a Version 5.0 multiprocessor system failure:
  - SET PROCESS
  - SHOW CRASH
  - SHOW PROCESS
  - SHOW STACK

  The following new commands have been added to the manual:

SET CPU	Selects a processor to become the SDA current CPU
SHOW CPU	Displays information about the state of a processor at the time of the system failure
SHOW SPINLOCKS	Displays the data structures that provide system synchronization in a VAX multiprocessing system

  Section 4 discusses the implications of changing SDA CPU and process context.

- Version 5.0 changes in the composition of the VMS executive and its corresponding loaded images may be evident in the names of certain symbols displayed in the output of various commands (such as SHOW STACK) in an SDA session. To aid in identifying locations within the executive image, SDA provides the following features:
  - A new command, SHOW EXECUTIVE, lists the location and size of each loadable image that is part of the Version 5.0 VMS executive.
  - The /EXECUTIVE qualifier has been added to the READ command to facilitate the loading of symbols into the SDA symbol table to further identify global locations within the VMS executive.

  The description of the SHOW EXECUTIVE command includes a discussion of the components of the Version 5.0 VMS executive.

- Several options have been added to the SET RMS and SHOW PROCESS/RMS commands, allowing the display of the following RMS structures: recovery unit block (RUB), recovery unit stream block (RUSB), recovery unit file block (RUFB), shared file synchronization block (SFSB), global buffer synchronization block (GFSB), and network work area (NWA). These commands also allow the display of the structures associated with process I/O by means of the [NO]PIO option.

- When invoked, SDA reads into its symbol table a subset of SYS$SYSTEM:SYSDEF.STB, called SYS$SYSTEM:REQSYSDEF.STB, that it requires to identify certain locations in memory. SDA reads REQSYSDEF.STB in addition to reading the system symbol table

(SYS$SYSTEM:SYS.STB). See Section 2.4 for a description of this procedure.

- The symbol MP and the symbol table file (MP.STB) are no longer available to SDA in Version 5.0.
- Instructions on inducing a system failure on newer VAX processors have been added to Section 8.
- A new system parameter, DUMPSTYLE, when set, allows a system whose memory capacity exceeds the disk space available for storing crash dumps to preserve a subset of memory contents for analysis by SDA. (See the discussion in Section 1.1.1 for a discussion of this feature.)
- Various minor revisions, as well as some reorganization of material, may be apparent throughout the manual. In addition, some examples have been added and others have been corrected to better reflect the operation of SDA under VMS Version 5.0.

SDA Description

When a fatal error causes the system to fail, the VMS operating system copies the contents of memory to a system dump file, recording the hardware context of each processor in the system as well. The System Dump Analyzer (SDA) provides a means of interpreting the contents of this file, thus enabling you to examine the status of each processor at the time of the failure and investigate the probable causes of the crash. To do so, you invoke SDA by means of the DCL command ANALYZE/CRASH_DUMP.

You can 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 crash (SHOW CRASH)
- Select a specific processor in a multiprocessing system as the subject of analysis (SET CPU).
- Display the contents of a specific process stack or the interrupt stack of a specific processor (SHOW 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)
- Evaluate an expression in hexadecimal and decimal, interpreting its value as a symbol, a condition value, a page-table entry (PTE), or a processor status longword (PSL) (EVALUATE)
- Examine the contents of memory locations, optionally interpreting them as VAX MACRO instructions, a PTE, or a PSL (EXAMINE)
- Display device status as reflected in system data structures (SHOW DEVICE)
- Format system data structures (FORMAT)
- Validate the integrity of the links in a queue (VALIDATE)
- Display a summary of all processes on the system (SHOW SUMMARY)
- Examine the memory of any process (SHOW PROCESS)
- Display the RMS data structures of a process (SHOW PROCESS/RMS)
- Display memory management data structures (SHOW POOL, SHOW PFN_DATA, SHOW PAGE_TABLE)
- Display lock management data structures (SHOW RESOURCE, SHOW LOCK)
- Display VAXcluster management data structures (SHOW CLUSTER, SHOW CONNECTIONS, SHOW RSPID, SHOW PORTS)
- Display multiprocessor synchronization information (SHOW SPINLOCKS)

- Display the layout of the loadable executive images (SHOW EXECUTIVE)
- 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 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 send DIGITAL a Software Performance Report (SPR) and 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 in this mode of operation. Although the analysis of a running system may be instructive, you should undertake such an operation with the caution that system context, process context, and a processor's hardware context remain fluid during any given display. A user in a multiprocessing environment should especially note that it is highly possible that a process running SDA could be rescheduled to a different processor frequently during analysis. It is thus advisable to avoid the examination of the hardware context of processors in a running system.

1 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.

1.1 The System Dump File

The VMS operating system will attempt to write information into the system dump file only if the system parameter DUMPBUG is set.[1] If DUMPBUG is set and the operating system fails, VMS writes the contents of the error-log buffers, processor registers, and physical memory into the system dump file, overwriting its previous contents.

If the system dump file is too small, VMS cannot copy all of memory to the file when a system failure occurs. For most systems, this means that the system's page table (SPT) is not included in the dump. SDA cannot analyze a dump unless the SPT is included in the dump in its entirety.

The file SYS$SYSTEM:SYSDUMP.DMP is furnished as an empty file in the VMS software distribution kit. In order to successfully store a crash dump, you must make SYS$SYSTEM:SYSDUMP.DMP large enough to hold all the information to be written when the system fails. If this is not possible, you can have VMS write dumps into the system paging file, SYS$SYSTEM:PAGEFILE.SYS. You can enlarge or adjust the size of either of these files by using the CREATE command of the System Generation Utility (SYSGEN), as described in the *VMS System Generation Utility Manual.*

[1] The DUMPBUG parameter is set by default. To examine and/or change its value, consult the *VMS System Generation Utility Manual.*

To calculate the correct size for SYS$SYSTEM:SYSDUMP.DMP, use the following formula:

```
size-in-blocks(SYS$SYSTEM:SYSDUMP.DMP)
        = size-in-pages(physical-memory)
        + number-of-error-log-buffers
        + 1
```

You can use the DCL command SHOW MEMORY to determine the total size of physical memory on your system. In addition, you must account for any MA780 multiport memory installed on your system. There are a variable number of error log buffers in any given VAX system, depending upon the setting of the *ERRORLOGBUFFERS* system parameter. (See the *VMS System Generation Utility Manual* for additional information about this parameter.)

If SYS$SYSTEM:SYSDUMP.DMP does not exist, the VMS operating system writes the dump of physical memory into SYS$SYSTEM:PAGEFILE.SYS, the system's paging 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. If it is clear, VMS uses the entire paging file for paging and any dump written to the paging file is lost.[2]

To calculate the minimum size for SYS$SYSTEM:PAGEFILE.SYS, use the following formula:

```
size-in-blocks(SYS$SYSTEM:PAGEFILE.SYS)
        = size-in-pages(physical-memory)
        + number-of-error-log-buffers
        + 1
        + 1000
```

Note that this formula calculates the minimum size requirement for saving a dump in the system's paging file. Generally, the paging file must be larger than this for most systems to avoid hanging the system (see the *Guide to Setting Up a VMS System*). Use of SYS$SYSTEM:PAGEFILE.SYS to take system crash dumps presumes that you will later free the space occupied by the dump for use by the pager. Generally, you include SDA commands in the site-specific startup command procedure (SYS$MANAGER:SYSTARTUP.COM) that do this. Otherwise, your system may hang during the startup procedure.

A common method for doing this is to copy the dump from SYS$SYSTEM:PAGEFILE.SYS to another file, using the SDA COPY command. Although the DCL COPY command can also be used to copy a dump file, only the SDA COPY command causes the pages occupied by the dump to be freed from the system's paging file.

Occasionally, you may want to free the pages in the paging file that are taken up by the dump without having to copy the dump elsewhere. When you issue the ANALYZE/CRASH_DUMP/RELEASE 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] The SAVEDUMP parameter is clear by default. To examine and/or change its value, consult the *VMS System Generation Utility Manual*.

1.1.1 Dump File Style

In certain VAX 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. In normal circumstances, if the system dump file cannot accommodate all of memory, SDA cannot analyze the dump.

To preserve those portions of memory that contain information most useful in determining the causes of system failures, a system manager sets the static system parameter DUMPSTYLE to 1. When the DUMPSTYLE parameter is set, AUTOGEN attempts to create a dump file large enough to contain ample information for SDA to analyze a failure. When the DUMPSTYLE parameter is clear, the default case, AUTOGEN attempts to create a dump file large enough to contain all of physical memory.

A comparison of full and subset style dump files appears in Table SDA–1.

Table SDA–1 Comparison of Full and Subset Dump Files

	Full	Subset
Available Information	Complete contents of physical memory in use, stored in order of increasing physical address (for instance, system and global page tables are stored last).	System page table, global page table, system space memory, and process and control regions (plus global pages) for all saved processes.
Unavailable Information	Contents of paged-out memory at the time of the crash.	Contents of paged-out memory at the time of the crash, process and control regions of unsaved processes, and memory not mapped by a page table (such as the free and modified lists).
SDA Command Limitations	None.	The following commands are not useful for unsaved processes: SHOW PROCESS /CHANNELS, SHOW PROCESS/RMS, SHOW STACK, and SHOW SUMMARY/IMAGE.

1.2 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. For this reason, the system manager should 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 your 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 paging file, SYS$SYSTEM:PAGEFILE.SYS, because it releases those pages occupied by the dump to the pager.

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, VMS does not set the new file to NOBACKUP.

As included in the VMS distribution kit, SYS$SYSTEM:SYSDUMP.DMP is protected against world access. Because a dump file can contain privileged information, it is a good idea for the system manager to continue to protect dump files from universal read access.

1.3 Invoking SDA in the Site-Specific Startup Command Procedure

Because a listing of the SDA output is an important source of information in determining the cause of a system failure, it is a good idea to have SDA produce such a listing after every failure. The system manager can ensure the creation of a listing by modifying the site-specific startup command procedure SYS$MANAGER:SYSTARTUP.COM so that it invokes SDA when the system is booted.

When invoked in the site-specific startup procedure, SDA executes the specified commands only if the system is booting immediately after a system failure. SDA examines a flag in the dump file's header that indicates whether it has already processed the file. If the flag is set, SDA merely exits. If the flag is clear, SDA executes the specified commands and sets the flag. This flag is clear when the operating system initially writes a crash dump, except for those resulting from an operator-requested shutdown (for instance, SYS$SYSTEM:OPCCRASH.COM or SYS$SYSTEM:SHUTDOWN.COM).

The following example shows typical commands that might be added to your site-specific startup command procedure to produce an SDA listing after each failure.

```
$ !
$ !      Print dump listing if system just failed
$ !
$ ANALYZE/CRASH_DUMP SYS$SYSTEM:SYSDUMP.DMP
   COPY SYS$SYSTEM:SAVEDUMP.DMP       ! Save dump file
   SET OUTPUT LPA0:SYSDUMP.LIS        ! Create listing file
   SHOW CRASH         ! Display crash
                      ! information
   SHOW STACK         ! Show current stack
   SHOW SUMMARY       ! List all active
                      ! processes
   SHOW PROCESS/PCB/PHD/REG          ! Display current process
   SHOW SYMBOL/ALL    ! Print system symbol
                      ! table
   EXIT
```

The COPY command in the preceding example saves the contents of the file SYS$SYSTEM:SYSDUMP.DMP. If your system's startup command file does not save a copy of the contents of this file, this crash dump information will be lost in the next system failure, when the system saves the information on the new failure, overwriting the contents of SYS$SYSTEM:SYSDUMP.DMP.

If you are using the SYS$SYSTEM:PAGEFILE.SYS as the crash dump file, you must include SDA commands in SYS$MANAGER:SYSTARTUP.COM that free the space occupied by the dump so that the pager can use it. For instance:

```
$ ANALYZE/CRASH_DUMP SYS$SYSTEM:PAGEFILE.SYS
   .
   .
   .
   COPY dump_filespec
   EXIT
```

2 Analyzing a System Dump

SDA performs certain tasks prior to bringing a dump into memory, presenting its initial displays, and accepting command input. This section describes those tasks, which include

- Verifying that the process invoking it is suitably privileged to read the dump file
- Mapping the contents of the specified dump file
- Reading the system symbol tables (SYS$SYSTEM:SYS.STB and SYS$SYSTEM:REQSYSDEF.STB)
- Executing the commands in the SDA initialization file

For detailed information on the investigation of a system failure, see Section 6.

2.1 Requirements

In order to be able to analyze a dump file, your process must have

- *Read access* both to the file that contains the dump and to copies of the symbol tables SYS$SYSTEM:SYS.STB (the system symbol table) and SYS$SYSTEM:REQSYSDEF.STB (the required subset of the symbols in the file SYSDEF.STB). SDA reads these tables by default. As included in the VMS distribution kit, SYS$SYSTEM:SYSDUMP.DMP, SYS$SYSTEM:SYS.STB, and SYS$SYSTEM:REQSYSDEF.STB are protected against world access. Either a system UIC or SYSPRV privilege thus is needed for a process to read the dump file.
- *Sufficient virtual address space* for SDA to map the entire dump and any required symbol tables, plus space to be used for the stacks. To ensure that SDA has the correct amount of virtual address space, the value of the system parameter VIRTUALPAGECNT must be larger than the size of the system's dump file by approximately 3000 pages. Further increases in the parameter may be required if your particular installation places extra heavy demands upon the virtual address space of the process.

2.2 Invoking SDA

If your process satisfies these conditions, 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, SDA prompts you for the name of the file, as follows:

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

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.

2.3 Mapping the Contents of the Dump File

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

The SPT appears at the largest physical addresses in a typical VMS configuration. As a result, if a dump file is too small, the SPT cannot be written to it in the event of system failure.

If SDA cannot find the SPT in the dump file, it displays either of the following messages:

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

```
%SDA-E-SHORTDUMP, the dump only contains m out of n pages of physical memory
```

If either of these error messages is displayed, you cannot analyze the crash dump, but must take steps to ensure that any subsequent dump can be preserved. To do this, you must increase the size of the dump file as indicated in Section 1.1 or adjust the system DUMP_STYLE parameter as discussed in Section 1.1.1.

Under certain conditions, some memory locations might not be saved in the system dump file. For instance, during halt/restart bugchecks, the contents of general registers are not preserved. If such a bugcheck occurs, SDA indicates in the SHOW CRASH display that the contents of the registers were destroyed. 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.

Also, you should note that 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' not in physical memory
```

When analyzing a subset dump file, if you use an SDA command to access a virtual address that has a corresponding physical address but was not saved in the dump file, SDA generates the following error message:

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

2.4 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. This file, named SYS$SYSTEM:SYS.STB by default, contains most of the global symbols used by the VMS operating system. If SDA cannot find the system symbol table file—or is given a file that is not a system symbol table in the /SYMBOL qualifier to the ANALYZE command—it halts with a fatal error. SDA also reads into its symbol table a subset of SYS$SYSTEM:SYSDEF.STB, called SYS$SYSTEM:REQSYSDEF.STB, that it requires to identify locations in memory.

When SDA finishes building its symbol table, it displays a message identifying itself and the immediate cause of the crash. In the following example, the cause of the crash was an illegal exception occurring at an IPL above IPL$_ASTDEL or while using the interrupt stack.

```
VAX/VMS System dump analyzer

Dump taken on 28-Jan-1989  18:10:09.79
INVEXCEPTN, Exception while above ASTDEL or on interrupt stack
```

2.5 Executing the SDA Initialization File (SDA$INIT)

After displaying the crash 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 SYS$SYSTEM:SYSDEF.STB
```

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

```
READ/EXECUTIVE SYS$LOADABLE_IMAGES
```

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

```
SDA>
```

The *SDA>* prompt indicates that you can use SDA interactively and enter SDA commands.

3 Analyzing a Running System

Occasionally VMS encounters an internal problem that hinders system performance without causing a system failure. By allowing you to examine the running system, SDA provides the means to search for the solution to the problem without disturbing the operating system. For example, you can 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 (see the *Guide to VMS Performance Management*).

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 the system symbol table (SYS$SYSTEM:SYS.STB) and symbol table SYS$SYSTEM: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 2.4 and 2.5, respectively). SDA subsequently displays its identification message and prompt, as follows:

```
VAX/VMS System analyzer

SDA>
```

The *SDA>* 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 undertaking an analysis of a running system, you should take into account the following considerations:

- 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. When using SDA to analyze a running system, you should thus use caution in interpreting its displays. Because system states change frequently, it is possible that the information SDA displays may be inconsistent with the actual, volatile state of the system at any moment.
- Certain SDA commands are illegal in this mode, such as SHOW CPU and SET CPU. Use of these commands results in the 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. Also, the "Time of system crash" information refers to the time at which the ANALYZE/SYSTEM command was given.

4 SDA Context

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

When the subject of analysis is a VMS uniprocessor system, SDA's context is solely *process context*. That is, SDA can interpret its process-specific commands in the context of either the process current on the uniprocessor or some other process in some other scheduling state. When you initially invoke SDA to analyze a crash dump, its process context defaults to that of the process that was current at the time of the crash. 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. You can change SDA's process context by issuing any of the following commands:

SET PROCESS/INDEX=**nn**
SET PROCESS **name**
SHOW PROCESS/INDEX=**nn**

When you invoke SDA to analyze a crash dump from a VMS 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, such as the reason for the bugcheck exception, the currently executing process, the current IPL, the contents of processor-specific registers, the interrupt stack pointer (ISP), and the spin locks 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.[3]

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

SET CPU **cpu-id**
SHOW CPU **cpu-id**
SHOW CRASH

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.

Likewise, changing process context can involve a switch of CPU context as well. For instance, if you issue a SET PROCESS command for a process that is current on another CPU, SDA will automatically change its CPU context to that of the CPU on which that process is current. The following commands can have this effect if the **name** or index number (**nn**) refers to a current process.

SET PROCESS **name**
SET PROCESS/INDEX=**nn**
SHOW PROCESS **name**
SHOW PROCESS/INDEX=**nn**

5 SDA Command Format

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

[3] When you are analyzing a running system, CPU context is not accessible to SDA. Therefore, the SET CPU and SHOW CPU commands are not permitted.

5.1 General Command Format

SDA uses a command format similar to that used by the DCL interpreter. You issue commands in this general 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, and SE stands for SET.

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 the following 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. Likewise, the default directory is the directory specified in the most recent SET DEFAULT command. See the *VMS 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, but 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.

5.2 Expressions

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

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

As mentioned, numerals are one possible component of an expression. The following sections describe the use of the other components.

5.2.1 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.

5.2.2 Arithmetic and Logical Operators

There are two types of arithmetic and logical operators, both of which are listed in Table SDA–2.

- *Unary operators* affect the value of the expression that follows them.
- *Binary operators* combine the operands that precede and follow them.

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 32-bit operands.

Table SDA–2 SDA Operators

Operator	Action
Unary Operators	
#	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 a virtual address, then uses the contents of that address as value
G	Adds 80000000_{16} to the value of the expression[1]
H	Adds $7FFE0000_{16}$ to the value of the expression[2]
Binary Operators	
+	Addition
–	Subtraction
*	Multiplication
&	Logical AND
|	Logical OR

[1]The unary operator G corresponds to the first virtual address in system space. For example, the expression GD40 can be used to represent the address $80000D40_{16}$.

[2]The unary operator H corresponds to a convenient base address in the control region of a process ($7FFE0000_{16}$). You can therefore refer to an address such as $7FFE2A64_{16}$ as H2A64.

Table SDA–2 (Cont.) SDA Operators

Operator	Action
Binary Operators	
\	Logical XOR
/	Division[3]
@	Arithmetic shifting

[3]In division, SDA truncates the quotient to an integer, if necessary, and does not retain a remainder.

5.2.3 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.

5.2.4 Symbols

Names of symbols can contain from 1 to 31 alphanumeric characters and can include the dollar sign ($) and underscore (_) characters. Symbols can take values from $-7FFFFFFF_{16}$ to $7FFFFFFF_{16}$.

By default, SDA copies symbols into its symbol table from SYS$SYSTEM:SYS.STB and SYS$SYSTEM:REQSYSDEF.STB. Additional symbols can be taken from other symbol tables or object modules and added to the SDA symbol table with the READ command. You can also use the DEFINE command to create symbols and add them to the symbol table.

In addition, SDA provides the symbols described in Table SDA–3:

Table SDA–3 SDA Symbols

Symbol	Meaning
. (period)	Current location
AP	Argument pointer[1]
CLUSTRLOA	Base address of loadable VAXcluster code
*nn*DRIVER	Base address of a driver prologue table (DPT); such a symbol exists for each loaded device driver in the system[2]
ESP	Executive stack pointer[1]
FP	Frame pointer[1]
FPEMUL	Base address of the code that emulates floating-point instructions

[1]The value of those symbols representing the current SDA process context changes whenever you issue a command that changes this context (see Section 4). These symbols include the general purpose registers (R0 through R11, AP, FP, PC, and SP); the perprocess stack pointers (USP, SSP, KSP); the page table base and length registers (P0BR, P0LR, P1BR, and P1LR); and the processor status longword (PSL).

[2]The notation *nn* within the symbol *nn*DRIVER represents a 2-letter, generic device /controller name (for example, *LP*DRIVER).

Table SDA–3 (Cont.) SDA Symbols

Symbol	Meaning
G	80000000_{16}, the base address of system space
H	$7FFE0000_{16}$
KSP	Kernel stack pointer[1]
MCHK	Address within loadable CPU-specific routines
MSCP	Address of loadable MSCP server code
POBR	Base register for the program region (P0)[1]
POLR	Length register for the program region (P0)[1]
P1BR	Base register for the control region (P1)[1]
P1LR	Length register for the control region (P1)[1]
PC	Program counter[1]
PSL	Processor status longword[1]
R0 through R11	General registers[1]
RMS	Base address of the RMS image
SCSLOA	Base address of loadable common SCS services
SP	Current stack pointer of a process[1]
SSP	Supervisor stack pointer[1]
SYSLOA	Base address of loadable processor-specific system code
USP	User stack pointer[1]

[1]The value of those symbols representing the current SDA process context changes whenever you issue a command that changes this context (see Section 4). These symbols include the general purpose registers (R0 through R11, AP, FP, PC, and SP); the perprocess stack pointers (USP, SSP, KSP); the page table base and length registers (P0BR, P0LR, P1BR, and P1LR); and the processor status longword (PSL).

When SDA displays an address, it displays that address both in hexadecimal and as a symbol, if possible. If the address is within FFF_{16} of the value of a symbol, SDA displays the symbol plus the offset from the value of that symbol to the address. If more than one symbol's value is within FFF_{16} of the address, SDA displays the symbol whose value is the closest. If no symbols have values within FFF_{16} of the address, SDA displays no symbol. (For an example, see the description of the SHOW STACK command.)

6 Investigating System Failures

This section discusses how the VMS operating system handles internal errors, and suggests procedures that can aid you in determining the causes of these errors. To conclude, 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 the last part of this document, where all the SDA commands are discussed in alphabetical order.

6.1 General Procedure for Analyzing System Failures

When the VMS 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 such error.

To resolve the problem, you must find the reason for the bugcheck. Most failures are caused by errors in user-written device drivers or other privileged code not supplied by DIGITAL. 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 DIGITAL. A hardware failure requires the attention of DIGITAL Field Service. To diagnose an error in code supplied by DIGITAL, you need listings of that code, which is available from DIGITAL on microfiche.

Start the search for the error by locating the line of code that signaled the bugcheck. Invoke SDA and use the SHOW CRASH command to display the content of the program counter (PC). The content of the PC is the address of the next instruction after the instruction that signaled the bugcheck.

The PC often contains an address in the exception handler, which signaled the bugcheck but did not cause it. In this case, the address of the instruction that caused the bugcheck is located on the stack. Use the SHOW STACK command to display the contents of the stack. See Section 6.2 for information on how to proceed for several types of bugchecks.

Once you have found the address of the instruction that caused the bugcheck, you need to find the module in which the failing instruction resides. Use the SHOW DEVICE command to determine whether the instruction is part of a device driver.

If it is not part of a driver, 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 programs.

If it is not within a driver or other code not supplied by DIGITAL, perform the following steps:

1 Issue the SDA command

```
SDA> SHOW EXECUTIVE
```

This command shows the location and size of each of the loadable images that make up the VMS executive.

2 Compare the suspected address with the addresses of these system images.

3 If the address is in fact within one of these images, issue the command

```
SDA> READ/EXECUTIVE  SYS$LOADABLE_IMAGES:
```

This command loads the symbols that define locations within the loadable portion of the VMS executive.

4 Examine the failing address by issuing the command

```
SDA> EXAMINE @PC
```

SDA then displays the address in the PC as an offset from the nearest global symbol. This symbol may be the module's starting address, although it is possible that the code you are examining may not be in the module whose name is displayed.

Now, to determine the general cause of the system failure, examine the code that signaled the bugcheck.

6.2 Fatal Bugcheck Conditions

There are several conditions that cause VMS to issue a bugcheck. Normally, these occasions are rare. When they do occur, it is likely that they are in the nature of a fatal exception or an illegal page fault occurring within privileged code. This section describes the symptoms of these bugchecks. A discussion of other exceptions and VMS condition handling in general appears in the *VMS System Services Volume*.

6.2.1 Fatal Exceptions

An exception is fatal when it occurs while the following conditions exist:

- The process is using the interrupt stack.
- 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, VMS reports the approximate cause of the 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:

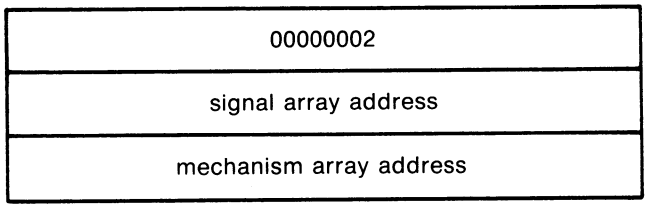
```
FATALEXCPT, Fatal executive or kernel mode exception

INVEXCEPTN, Exception while above ASTDEL or on interrupt stack

SSRVEXCEPT, Unexpected system service exception
```

Although there are several possible exception conditions, access violations are most common. When the hardware detects an access violation, information useful in finding the cause of the violation is pushed onto either the kernel stack or the interrupt stack. If the access violation occurred when it was using the interrupt stack, VMS places this information on the interrupt stack.

The INVEXCEPTN and SSRVEXCEPT bugchecks place three argument lists, or arrays, on the stack:

The first argument list appears near the top of the stack (see Figure SDA–1) and contains the number 2 in its first longword, indicating that the following two longwords complete the array.[4] These two longwords contain the addresses on the stack of the *signal array* and *mechanism array*.

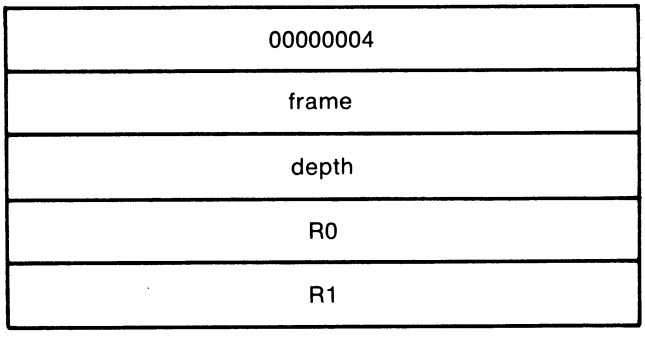
Figure SDA–1 First Argument List on the Stack



ZK-1920-84

The *mechanism array* (see Figure SDA–2) appears lower on the stack, at the address specified in the first argument list. Its first longword contains a 4, indicating that the four subsequent longwords complete the array. These four longwords are used by the VMS procedures that search for a condition handler and report exceptions.

Figure SDA–2 Mechanism Array



ZK-1921-84

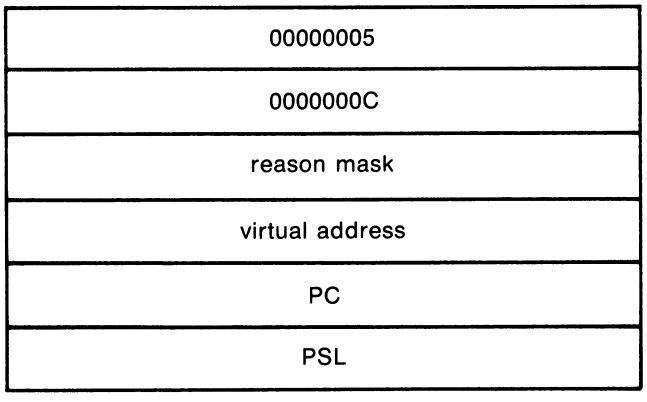
[4] This array sometimes does not appear on the stack. The mechanism and signal arrays, however, may still be present.

The values contained in the mechanism array are defined as follows:

Value	Meaning
00000004	Number of longwords that follow. In a mechanism array, this value is always 4.
Frame	Address of the FP (frame pointer) of the establisher's call frame.
Depth	Depth of the VMS search for a condition handler.
R0	Contents of R0 at the time of the exception.
R1	Contents of R1 at the time of the exception.

The *signal array* (see Figure SDA–3) appears somewhat further down the stack, at the address specified in the first argument list. A signal array contains the exception code, zero or more exception parameters, the PC, and the PSL. The size of a signal array can thus vary from exception to exception.

Figure SDA–3 Signal Array



ZK-1922-84

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

Value	Meaning
00000005	Number of longwords that follow. For access violations, this value is always 5.
0000000C	Exception code. The value $0C_{16}$ represents an access violation. You can identify the exception code by using the SDA command EVALUATE/CONDITION.
Reason mask	Longword mask. If bit 0 of this 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.
Virtual address	Virtual address that the failing instruction tried to reference.
PC	PC whose execution resulted in the exception.
PSL	PSL at the time of the exception.

If VMS encounters a fatal exception, you can find the code that signaled it by examining the PC in the signal array. Use the SHOW STACK command to display the stack in use when the failure occurred, then locate the mechanism and signal arrays. Once you obtain the PC, which points to the instruction that signaled the exception, you can identify the module where the instruction is located by following the instructions in Section 7.3.

6.2.2 Illegal Page Faults

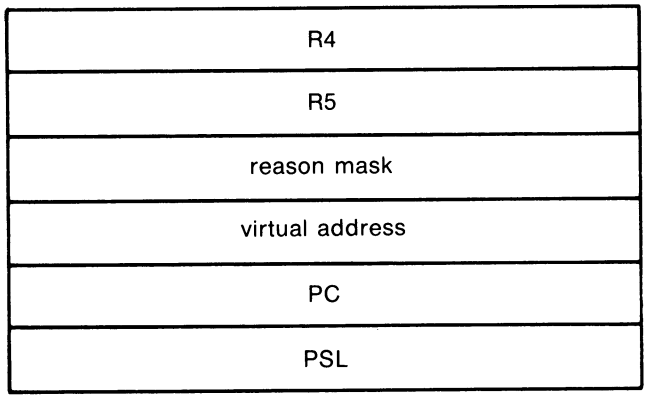
VMS signals a PGFIPLHI bugcheck when a page fault occurs while the interrupt priority level (IPL) is greater than 2 (IPL$_ASTDEL). When VMS fails because of an illegal page fault, it prints the following message on the console terminal:

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

When an illegal page fault occurs, the stack appears as pictured in Figure SDA–4. Six longwords describe the exception:

Longword	Contents
R4	Contents of R4 at the time of the bugcheck.
R5	Contents of R5 at the time of the bugcheck.
Reason mask	Longword mask. If bit 0 of this 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 an "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.
Virtual address	Virtual address being referenced by the instruction that caused the page fault.
PC	PC containing the address of the instruction that caused the page fault.
PSL	PSL at the time of the page fault.

Figure SDA–4 Stack Following an Illegal Page-Fault Error



ZK-1923-84

If the operating system detects a page fault while the IPL is higher than IPL$_ASTDEL, you can obtain the address of the instruction that caused the fault by examining the PC pushed onto the current operating stack. Follow the steps outlined in Section 7.3 to determine which module issued the instruction.

7 A Sample System Failure

This section steps through the analysis of a system failure using, as an example, a printer driver. Three events lead up to this failure:

1. The line printer goes off line for three hours.
2. The line printer comes back on line.
3. The VMS operating system signals a bugcheck, writes information to the system dump file, and shuts itself down.

The following sections describe the actions you should take when investigating the causes of this system crash.

7.1 Identifying the Bugcheck

First, invoke SDA to analyze the system dump file. The initialization message indicates the type of bugcheck that occurred as follows:

```
VAX/VMS System dump analyzer

Dump taken on 31-JAN-1989 16:34:31.23
INVEXCEPTN, Exception while above ASTDEL or on interrupt stack

SDA>
```

VMS encountered an exception that caused it to signal a bugcheck, and it has created the signal and mechanism arrays on the current operating stack.

7.2 Identifying the Exception

Use the SHOW STACK command to display the current operating stack. In this case, it is the interrupt stack. The following example shows the interrupt stack and the signal and mechanism arrays. See the description of the SHOW STACK command for a complete description of the format of the stack display.

```
CPU 01 Processor stack
----------------------
Current operating stack (INTERRUPT)
        8006A378    8000844B    ACP$WRITEBLK+0A0
    .
    .
    .
  SP => 8006A398    7FFDC340
        8006A39C    8006A3A0
        8006A3A0    80004E7D    EXE$REFLECT+0D4
        8006A3A4    04080009
        8006A3A8    00000004
        8006A3AC    7FFDC368
        8006A3B0    FFFFFFFD
        8006A3B4    8001774E
        8006A3B8    0000074F
        8006A3BC    00000001
        8006A3C0    00000005
        8006A3C4    0000000C
        8006A3C8    00000000
        8006A3CC    80069E00
        8006A3D0    8005D003
        8006A3D4    04080000
        8006A3D8    80009604    EXE$FORKDSPTH+01C
    .
    .
    .
```

The mechanism array begins at address $8006A3A8_{16}$ and ends at address $8006A3B8_{16}$. Its first longword contains 00000004_{16}. The signal array begins at address $8006A3C0_{16}$ and ends at $8006A3D4_{16}$. Its first longword contains 00000005_{16} and its second longword contains $0000000C_{16}$. Examination of the signal array shows that

- The exception code is $0C_{16}$, indicating an access violation.
- The reason mask is zero, indicating that the instruction caused a protection violation (instead of a length violation) when it tried to read the location (rather than write to it).
- The virtual address that the instruction attempted to reference was $80069E00_{16}$.
- The PC of the instruction that referred to the bad virtual address was $8005D003_{16}$.

Issuing the SDA command EVALUATE/PSL 04080000 makes the following information apparent:

- The IPL was 8 at the time of the exception (shown by bits 16 through 20 of the PSL).
- The current operating stack was the interrupt stack (bit 26 of the PSL is set to 1).
- The process was executing in kernel mode at the time of the exception (shown by bits 24 and 25 of the PSL).

Use the SHOW PAGE_TABLE command to display the system page table, as shown in the example following. The page containing location $80069E00_{16}$ is not available to any access mode (a null page); thus the virtual address is not valid.

```
SDA> SHOW PAGE_TABLE
System page table
-----------------

ADDRESS   SVAPTE   PTE       TYPE  PROT  BITS PAGTYP  LOC STATE TYPE REFCNT   BAK       SVAPTE  FLINK  BLINK
   .
   .
   .
80068400  80777B08 7C40FFC8  STX   UR       K
80068600  80777B0C 7C40FFC8  STX   UR       K
80068800  80777B10 7C40FFC8  STX   UR       K
80068A00  80777B14 7C40FFC8  STX   UR       K
80068C00  80777B18 7C40FFC8  STX   UR       K
80068E00  80777B1C 7C40FFC8  STX   UR       K
80069000  80777B20 7C40FFC8  STX   UR       K
80069200  80777B24 7C40FFC8  STX   UR       K
80069400  80777B28 7C40FFC8  STX   UR       K
80069600  80777B2C 7C40FFC8  STX   UR       K
80069800  80777B30 7C40FFC8  STX   UR       K
80069A00  80777B34 780016C9  TRANS UR       K SYSTEM FREELST 00   01    0   0040FFC8   80777B34  03AF   0E15
80069C00  80777B38 78000E15  TRANS UR       K SYSTEM FREELST 00   01    0   0040FFC8   80777B38  16C9   2592
-------- 40 NULL PAGES
   .
   .
   .
```

7.3 Locating the Source of the Exception

Because the printer went off line and then came back on line, as shown on the console listing, the problem might exist in the driver code. SDA can help you to determine which driver might contain the faulty code.

7.3.1 Finding the Driver by Using the Program Counter

The first step in determining whether the failing instruction is within a driver is to examine the PC in the signal array using the EXAMINE/INSTRUCTION command. This has two results:

1. It displays, if possible, the contents of the address as a VAX MACRO instruction.
2. It identifies the address as an offset from the symbol, *nn*DRIVER, if the address lies within the first FFF_{16} bytes of such a symbol. SDA defines a symbol in the form of *nn*DRIVER for each device driver connected to the system. This symbol represents the base of the driver prologue table (DPT). Each DPT is part of the device driver it describes and is immediately followed by that driver's code.

In the following example, the instruction that caused the exception is located within the printer driver.

```
SDA> EXAMINE/INSTRUCTION 8005D003
LPDRIVER+2B3   MOVB    (R3)+,(R0)
```

If SDA is unable to find a symbol within FFF_{16} bytes of the memory location you specify, it displays the location as an absolute address. This often, but not always, means the instruction that caused the exception is not part of a device driver.

To determine whether an instruction is or is not part of a driver, use the SHOW DEVICE command to display the starting addresses and lengths of all the drivers in the system. If the address of the failing instruction falls within the range of addresses shown for a given driver, the failing instruction is a part of that driver. The following example shows a partial list of the drivers in the display generated by the SHOW DEVICE command.

```
I/O data structures

                          DDB list
                          --------

   Address     Controller      ACP       Driver      DPT    DPT size
   -------     ----------      ---       ------      ---    --------

   80000ECC     HELIUM$DBA     F11XQP    DBDRIVER   800F7AD0  08FD
   80001040     OPA                      OPERATOR   80001622  0061
   8000126C     MBA                      MBDRIVER   800015B0  0578
   80001460     NLA                      NLDRIVER   800015E9  05A3
   801E2800     HELIUM$DMA     F11XQP    DMDRIVER   800B5CB0  0AA0
   801E2980     HELIUM$DLA     F11XQP    DLDRIVER   800B6A50  08D0
    .
    .
    .
```

7.3.2 Calculating the Offset into the Driver's Program Section

The offsets that SDA displays from *nn*DRIVER are actually offsets from the DPT. As such, these offsets do not exactly correspond to the offsets shown in driver listings, which represent offsets from the beginning of the program section (PSECT) in which a given instruction appears. Because a driver usually contains more than one PSECT, you must use the driver's map to determine the location of the failing instruction within the driver listing.

To calculate the location of the instruction within the driver listing, refer to the "Program Section Synopsis" section of the driver's map. Determine in which PSECT the offset given by SDA occurs and subtract the base of the PSECT from the offset. You can then use the resulting figure as an index into the driver listing.

If SDA does not display the address as an offset from *nn*DRIVER, but the address *is* within the address range of a driver in the SHOW DEVICE display, you must first subtract the address of the DPT from the failing address. Using the result as the offset, you can then follow the steps previously outlined for determining the index of the instruction into a driver listing.

7.4 Finding the Problem Within the Routine

To find the problem within the routine, examine the printer's driver code. In the system failure discussed in this example, the instruction that caused the exception is MOVB (R3)+,(R0). To check the contents of R3, use the EXAMINE command as follows:

```
SDA> EXAMINE R3

R3: 80069E00 "...."
```

The invalid virtual address, as recorded in the signal array, is stored in R3. In the following driver code excerpt, the instruction in question appears at line 599. It is likely that the contents of R3 have been incremented too many times.

```
581 STARTIO:
582       MOVL    UCB$L_IRP(R5),R3      ;Retrieve address of I/O packet
583       MOVW    IRP$L_MEDIA+2(R3),-
584               UCB$W_BOFF(R5)        ;Set number of characters to print
585       MOVL    UCB$L_SVAPTE(R5),R3   ;Get address of system buffer
586       MOVAB   12(R3),R3             ;Get address of data area
587       MOVL    UCB$L_CRB(R5),R4      ;Get address of CRB
588       MOVL    @CRB$L_INTD+VEC$L_IDB(R4),R4 ;Get device CSR address
589 ;
590 ; START NEXT OUTPUT SEQUENCE
591 ;
592
593 10$:  ADDL3   #LP_DBR,R4,R0         ;Calculate address of data buffer register
594       MOVZWL  UCB$W_BOFF(R5),R1     ;Get number of characters remaining
595       MOVW    #^X8080,R2            ;Get control register test mask
596       BRB     25$                   ;Start output
597 20$:  BITW    R2,(R4)❶              ;Printer ready or have paper problem?
598       BLEQ    30$                   ;If LEQ not ready or paper problem
599       MOVB    (R3)+,(R0)❷           ;Output next character
600       ASHL    #1,G^EXE$GL_UBDELAY,-(SP)    ;Delay 3*2 u-seconds
601 24$:  SOBGEQ  (SP),24$              ;Delay loop calibrated to machine speed
602       ADDL    #4,SP                 ;Pop extra longword off stack
603 25$:  SOBGEQ  R1,20$❸               ;Any more characters to output?
604       BRW     70$                   ;All done, BRW to set return status
```

7.4.1 Examining the Routine

The MOVB instruction is part of a routine that reads characters from a buffer and writes them to the printer. The routine contains the loop of instructions that starts at the label 20$ and ends at 25$. This loop executes once for each character in the buffer, performing these five steps:

❶ The driver checks the printer's status register to see if the printer is ready.

❷ If the printer is ready, the driver gets a character from the buffer and moves it to the printer's data register, to which R0 points

❸ It then decrements R1, which contains the count of characters left to print. If R1 contains a number greater than zero, control is passed back to the instruction at 20$, and the loop begins again.

Steps 1 and 2 are repeated until the contents of R1 are 0 or the printer signals that it is not ready.

If the printer signals that it is not ready, the driver transfers control to 30$ (line 598), the beginning of a routine that waits for an interrupt from the printer. When the printer becomes ready, it interrupts the driver, and execution of the loop resumes.

Examine the code to determine which variables control the loop.

The byte count (BCNT) is the number of characters in the buffer. Note that BCNT is set by a function decision table (FDT) routine and that this routine sets the value of BCNT to the number of characters in the buffer. In line 586, the starting address of a buffer that is BCNT bytes in size is moved into R3.

Note also that the number of characters left to be printed is represented by the byte offset (BOFF), the offset into the buffer at which the driver finds the next character to be printed. This value controls the number of times the loop is executed.

Because the exception is an access violation, either R3 or R0 must contain an incorrect value. You can determine that R0 is probably valid by the following logic:

- The instruction at 10$ (ADDL3 #LP_DBR,R4,R0) places an address in R0 and R0 is not modified again until the failing instruction (line 599).
- The value in R4 at the time that the instruction at 10$ is executed was derived from the addresses of the device's unit control block (UCB) (line 587) and CRB (line 599). Although it is possible that these data structures may contain wrong information, it is unlikely.

Thus, the contents of R3 seem to be the cause of the failure.

The most likely reason that the contents of R3 are wrong is that the MOVB instruction at line 599 executes too many times. You can check this by comparing the contents of UCB$W_BOFF and UCB$W_BCNT. If UCB$W_BOFF contains a larger value than that in UCB$W_BCNT, then R3 contains a value that is too large, indicating that the MOVB instruction has incremented the contents of R3 too many times.

7.4.2 Checking the Values of Key Variables

Because the start-I/O routine requires that R5 contain the address of the printer's UCB, and because several other instructions reference R5 without error before any instruction in the loop does, you can assume that R5 contains the address of the right UCB. To compare BOFF and BCNT, use the command FORMAT @R5 to display the contents of the UCB, as shown in the following session:

```
SDA> READ SYS$SYSTEM:SYSDEF.STB
SDA> FORMAT @R5

8005D160    UCB$L_FQFL      800039A8
            UCB$L_RQFL
            UCB$W_MB_SEED
            UCB$W_UNIT_SEED
8005D164    UCB$L_FQBL      800039A8
            UCB$L_RQBL
8005D168    UCB$W_SIZE          0122
8005D16A    UCB$B_TYPE        10
8005D16B    UCB$B_FIPL      34
            UCB$B_FLCK
    .
    .
    .
8005D1C8    UCB$L_SVAPTE    80062720
8005D1CC    UCB$W_BOFF          0795
8005D1CE    UCB$W_BCNT      006D
8005D1D0    UCB$B_ERTCNT          00
8005D1D1    UCB$B_ERTMAX        00
8005D1D2    UCB$W_ERRCNT    0000
    .
    .
    .
SDA>
```

If you have only one printer in your system configuration, you need not use the FORMAT command. Instead, you can use the command SHOW DEVICE LP. Because only one printer is connected to the VAX processor, only one UCB is associated with a printer for SDA to display.

The output produced by the FORMAT @R5 command shows that UCB$W_BOFF contains a value greater than that in UCB$W_BCNT; it should be smaller. Therefore, the value stored in BOFF is incorrect.

Thus, the value of BOFF is not the number of characters that remain in the buffer. This value is used in calculating an address that is referenced at an elevated IPL. When this address is within a null page (unreadable in all access modes), an attempt to reference it causes the system to fail.

7.4.3 Identifying and Fixing the Defective Code

Examine the printer driver code to locate all instructions that modify UCB$W_BOFF. The value changes in two circumstances:

- Immediately after the driver detects that the printer is not ready and that the problem is not a paper problem (line 609).
- When the wait-for-interrupt routine's timeout count of 12 seconds is exhausted (lines 616 and 630). At this time, the contents of R1, plus one, are stored in UCB$W_BOFF (line 631).

When the printer times out, the driver should not modify UCB$W_BOFF. It does so, however, in line 631. The driver should modify the contents of UCB$W_BOFF only when it is certain that the printer printed the character. When the printer times out, this is not the case. Furthermore, the wait-for-interrupt routine preserves only registers R3, R4, and R5, so only these registers can be used unmodified after the execution of the wait-for-interrupt routine. Thus the use of R1 in line 631 is an error.

To correct the problem, change the WFIKPCH argument (line 616) so that, when the printer times out, the WFIKPCH macro transfers control to 50$ rather than to 40$.

```
607
608 30$: BNEQ    40$                     ;If NEQ paper problem
609     ADDW3   #1,R1,UCB$W_BOFF(R5) ;Save number of characters remaining
610     DEVICELOCK -
611             LOCKADDR=UCB$L_DLCK(R5),-  ;Lock device interrupts
612             SAVIPL=-(SP)            ;Save current IPL
613     BITW    #^X80,LP_CSR(R4)        ;Is it ready now?
614     BNEQ    35$                     ;If NEQ, yes, it's ready
615     BISB    #^X40,LP_CSR(R4)        ;Set interrupt enable
616     WFIKPCH 40$,#12                 ;Wait for ready interrupt
617     IOFORK                          ;Create a fork process
618     BRB     10$                     ;  ...and start next output
619
620 35$:
621     DEVICEUNLOCK -
622             LOCKADDR=UCB$L_DLCK(R5),-  ;Unlock device interrupts
623             NEWIPL=(SP)+            ;Restore IPL
624     CLRW    LP_CSR(R4)              ;Disable device interrupts
625     BRB     10$                     ;Go transfer more characters
```

```
626 ;
627 ; PRINTER HAS PAPER PROBLEM
628 ;
629
630 40$: CLRL    UCB$L_LP_OFLCNT(R5)  ;Clear offline counter
631      ADDW3   #1,R1,UCB$W_BOFF(R5) ;Save number of characters remaining
632 50$: CLRW    LP_CSR(R4)           ;Disable printer interrupt
633      IOFORK                       ;Lower to fork level
634      BBS     #UCB$V_CANCEL,UCB$W_STS(R5),80$  ;If set, cancel I/O operation
635      TSTW    LP_CSR(R4)           ;Printer still have paper problem?
636      BLSS    55$                  ;If LSS yes
637      MOVL    #15,UCB$L_LP_TIMEOUT(R5)  ;Set timeout value
638      BRB     10$                  ; ...and start next output
```

8 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 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 (if it is "hung"), see the examples of causing system failures at the end of this section.

If you are generating a system crash in response to a system hang, be sure to record the PC at the time of the system halt as well as the contents of the general registers. Submit this information to DIGITAL, along with the Software Performance Report (SPR), and a copy of the generated system dump file.

8.1 Meeting Crash Dump Requirements

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

1. 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.

2. There must be a crash dump file in SYS$SYSTEM: 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 1.1) or, if the DUMPSTYLE system parameter is set, large enough to accommodate a subset dump (see Section 1.1.1).

   If SYSDUMP.DMP is not present, VMS attempts to write crash dumps to PAGEFILE.SYS. In this case, the SAVEDUMP system parameter must be 1 (the default is 0).

3. The system DUMPBUG parameter must be 1 (the default is 1).

8.2 Examples of How to Cause System Failures

The following examples show the sequence of console commands needed to cause a system failure on each type of VAX processor. In each instance, after halting the processor and examining its registers, you place the equivalent of −1 (for example $FFFFFFFF_{16}$) into the PC. The value placed in the PSL sets the processor access mode to kernel and the IPL to 31. After these commands are executed, an INVEXCEPTN bugcheck is reported on the console terminal, followed by a listing of the contents of the processor registers.

The console volume of most processors contains a command file named either CRASH.COM or CRASH.CMD that you can execute to perform these commands. Note that the console sessions recorded in this section omit much of the information the console displays in response to the listed commands.

VAX 8530/8550/8700/8800/8830/8850

The following series of console commands causes a system failure on the VAX 8530/8550/8700/8800/8830/8850 systems. (Note that the console prompt for the VAX 8830 and 8850 systems is PS-CIO-0> and not > > > .)

```
$ CTRL/P
>>> SET CPU CURRENT_PRIMARY
>>> HALT
?00       Left CPU -- CPU halted
          PC = 8001911C
>>> @CRASH
!
! Command procedure to force VMS bugcheck via access violation
!
SET VERIFY
SET CPU CURRENT_PRIMARY     !Select primary
EXAMINE PSL                 !Display PSL
        M 00000000 00420008
EXAMINE/I/NEXT 4 0
    .
    .
    .

DEPOSIT PC FFFFFFFF         !Set PC=-1 to force ACCVIO
DEPOSIT PSL 41F0000         !Set IPL=31, interrupt stack
CONTINUE                    !Execute from PC=-1
```

VAX 8200/8250/8300/8350 and VAX 6200 Series

The following console commands cause a system failure on a VAX 8200/8250 /8300/8350 system or a VAX 6200 series system. In these systems, the HALT command is a NOP; a CTRL/P automatically halts the processor.

```
$ CTRL/P

        PC = 80008B1F
>>> E P
>>> E/I 0
>>> E/I +
>>> E/I +
>>> E/I +
>>> E/I +
>>> D/G F FFFFFFFF
>>> D P 41F0000
>>> C
```

VAX 8600/8650/8670

The following console commands cause a system failure on the VAX 8600 /8650/8670 systems.

```
$ CTRL/P
>>> @CRASH

    SET QUIET OFF           !Make clearer
    SET ABORT OFF           !Don't abort on E/VIR command
    HALT
        CPU stopped, INVOKED BY CONSOLE (CSM code 11)
        PC 80008B1F
    UNJAM                   !Clear the way
    E PSL                   !Display PSL
        U PSL 00000000
    E/I/N:4 0               !Display stack pointers
    .
    .
    .
    E SP                    !Get current stack pointers
        G 0E 80000C40
    E/vir/next:40 @         !Dump top of stack
    .
    .
    .
    D PC FFFFFFFF           !Invalidate the PC
    D PSL 1F0000            !Kernel mode, IPL 31
    SET ABORT ON            !Restore abort flag
    SET QUIET ON            !Shut output off
    CONTINUE                !Force a machine check
```

VAX–11/780 and VAX–11/785

The following console commands cause a system failure on the VAX–11/780 and VAX–11/785 processors.

```
$ CTRL/P
>>> @CRASH
HALT                        !Halt system, examine PC,
HALTED AT 80008A89

EXAMINE PSL                 !PSL,
00000000

EXAMINE/INTERN/NEXT:4 0     !and all stack pointers

DEPOSIT PC = -1             !Invalidate PC
DEPOSIT PSL = 1F0000        !Kernel mode, IPL 31

 CONTINUE
```

VAX–11/750

The following code causes a system failure on a VAX–11/750. On a VAX–11/750 processor, the HALT command is a NOP; a CTRL/P automatically halts the processor.

```
$ CTRL/P
>>> H
>>> E P
>>> E/I 0
>>> E/I +
>>> E/I +
>>> E/I +
>>> D/G F FFFFFFFF
>>> D P 1F0000
>>> C
```

MicroVAX 3600 Series, MicroVAX II, and MicroVAX I

To force a crash of a MicroVAX, you must first halt the processor. (Once the processor is halted, press the HALT button again so that it is popped out and is not illuminated.) Then, issue the following console commands:

```
>>> E PSL
>>> E/I/N:4 0
>>> D PC FFFFFFFF
>>> D PSL 1F0000
>>> C
```

VAX–11/725 and VAX–11/730

The following console commands cause a system failure on a VAX–11/725 or a VAX–11/730 (as well as on VAXstation II systems and MicroVAX 2000 systems). CTRL/P automatically halts the processor.

```
$ CTRL/P
>>> H
>>> E PSL
>>> E/I/N:4 0
>>> D PC FFFFFFFF
>>> D PSL 1F0000
>>> C
```

SDA Usage Summary

The System Dump Analyzer is a utility that you can use to help determine the causes of system failures. This utility is also useful for examining the running system.

FORMAT

ANALYZE [*/CRASH_DUMP [/RELEASE] filespec* | */SYSTEM*]

/SYMBOL=system-symbol-table

COMMAND PARAMETER

filespec

Name of the file that contains the dump you want to analyze. At least one field of the **filespec** is required, and it can be any field. The default **filespec** is the highest version of SYSDUMP.DMP in your default directory.

usage summary

You invoke SDA to analyze a system dump by issuing the command

```
$ ANALYZE/CRASH_DUMP filespec
```

If you do not specify **filespec**, SDA prompts you for it.

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.

You invoke SDA to analyze a running system by issuing the command

```
$ ANALYZE/SYSTEM
```

To examine a running system, your process must have change-mode-to-kernel (CMKRNL) privilege. 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 command

```
$ SET OUTPUT SYS$OUTPUT
```

To send a copy of all the commands you type and 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.

SDA QUALIFIERS

The qualifiers described in the following section determine whether the object of an SDA session is a crash dump or a running system and help create the environment of an SDA session.

/CRASH_DUMP
/RELEASE
/SYMBOL
/SYSTEM

/CRASH_DUMP

Invokes SDA to analyze the specified dump file.

FORMAT

/CRASH_DUMP *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**, SDA prompts you for it.

DESCRIPTION

See Section 2 for additional information on crash dump analysis.

EXAMPLES

1
```
$ ANALYZE/CRASH_DUMP SYS$SYSTEM:SYSDUMP.DMP
$ ANAL/CRASH SYS$SYSTEM
```

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

2
```
$ ANAL/CRASH SYS$SYSTEM:PAGEFILE.SYS
```

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

/RELEASE

Invokes SDA to release those blocks in the specified system paging file occupied by a crash dump.

FORMAT

/RELEASE *filespec*

PARAMETER

filespec

Name of the system page file (SYS$SYSTEM:PAGEFILE.SYS). 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**, SDA prompts you for it.

DESCRIPTION

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

When you specify the /RELEASE qualifier in the ANALYZE command, you must also

1. Use the /CRASH_DUMP qualifier.
2. Include the name of the system paging file (SYS$SYSTEM:PAGEFILE.SYS) as the **filespec**.

If you do not specify the system paging file or the specified paging 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
```

EXAMPLE

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

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

/SYMBOL

Specifies a system symbol table for SDA to use in place of the system symbol table it uses by default (SYS$SYSTEM:SYS.STB).

FORMAT

/SYMBOL *=system-symbol-table*

PARAMETER

system-symbol table

File specification of the VMS SDA system symbol table needed to define symbols required by SDA to analyze a dump from a particular VMS 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 SYS$SYSTEM:SYS.STB by default. When you *do* specify the /SYMBOL qualifier, SDA assumes the default disk and directory to be *SYS$DISK*: that is, the disk and directory specified in your last SET DEFAULT command. If SDA is given a file that is not a system symbol table in the /SYMBOL qualifier, it halts with a fatal error.

DESCRIPTION

The /SYMBOL qualifier allows you to specify a system symbol table, other than SYS$SYSTEM:SYS.STB, to load into the SDA symbol table. This may be necessary, for instance, in order to analyze a crash dump taken on a processor running a different version of VMS.

You can use the /SYMBOL qualifier whether you are analyzing a system dump or a running system.

EXAMPLE

```
$ ANALYZE/CRASH_DUMP/SYMBOL=SYS$CRASH:SYS.STB SYS$SYSTEM
```

This command invokes SDA to analyze the crash dump stored in SYS$SYSTEM:SYSDUMP.DMP, using the system symbol table at SYS$CRASH:SYS.STB.

/SYSTEM

Invokes SDA to analyze a running system.

FORMAT /SYSTEM

PARAMETERS *None.*

DESCRIPTION

See Section 3 for a full discussion of using SDA to analyze a running system.

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

EXAMPLE

```
$ ANALYZE/SYSTEM
```

This command invokes SDA to analyze the running system.

SDA COMMANDS

The commands described in the following section can be used in analyzing a system dump or the running system.

@ (Execute Procedure)
ATTACH
COPY
DEFINE
EVALUATE
EXAMINE
EXIT
FORMAT
HELP
READ
REPEAT
SEARCH
SET CPU
SET LOG
SET OUTPUT
SET PROCESS
SET RMS
SHOW CALL_FRAME
SHOW CLUSTER
SHOW CONNECTIONS
SHOW CPU
SHOW CRASH
SHOW DEVICE
SHOW EXECUTIVE
SHOW HEADER
SHOW LOCK
SHOW PAGE_TABLE
SHOW PFN_DATA
SHOW POOL
SHOW PORTS
SHOW PROCESS
SHOW RESOURCE
SHOW RMS
SHOW RSPID
SHOW SPINLOCKS
SHOW STACK
SHOW SUMMARY
SHOW SYMBOL
SPAWN
VALIDATE QUEUE

@ (Execute Procedure)

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 Procedure 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
EXIT
```

This command procedure first makes the file LASTCRASH.LIS the destination for output generated by subsequent SDA commands. Next, the command procedure sends to the file information about the crash and its context, a description of the process executing at the time of the process, the contents of the stack on which the crash occurred, and a list of the processes active on the CPU that crashed. Finally, it exits from SDA.

The procedure need not exit from the utility at the end of its execution. To continue using SDA interactively after the execution of a command procedure, omit the EXIT command from the file.

ATTACH

Switches control of your terminal from your current process to another process in your job.

FORMAT

ATTACH *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 current process's parent process. When you specify this qualifier, you cannot specify the **process-name** parameter.

EXAMPLES

1 `SDA> ATTACH/PARENT`

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

2 `SDA> ATTACH DUMPER`

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

COPY

Copies the contents of the dump file to another file.

FORMAT

COPY *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 SET DEFAULT command. You must at least supply the file name.

DESCRIPTION

Each time the system fails, the system copies the contents of physical memory and the hardware context of the current process (as directed by the DUMPSTYLE parameter) into the file SYS$SYSTEM:SYSDUMP.DMP (or the paging 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 (from within SYS$MANAGER:SYSTARTUP.COM) to execute the COPY command. This ensures that a copy of the dump file is made each time the system fails.

The COPY command does not affect the contents of SYS$SYSTEM:SYSDUMP.DMP.

If you are using the paging file (SYS$SYSTEM:PAGEFILE.SYS) as the dump file instead of SYSDUMP.DMP, you can use the COPY command to explicitly release the blocks of the paging file that contain the dump, thus making them available for paging. Although the copy operation succeeds nonetheless, the release operation requires that your process have change-mode-to-kernel (CMKRNL) privilege. Once the dump pages have been released from the paging file, the dump information in these pages may be lost. You should perform subsequent analysis upon the copy of the dump created by the COPY command.

EXAMPLE

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

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

DEFINE

Assigns a value to a symbol, or associates an SDA command with a terminal key.

FORMAT

DEFINE [*symbol-name [=] expression*
/KEY key-name command [/qualifier...]]

PARAMETERS

symbol-name

Name, containing from 1 to 31 alphanumeric characters, that identifies the symbol. See 5.2.4 for a description of SDA symbol syntax and a list of default symbols.

expression

Definition of the symbol's value. See Section 5.2 for a discussion of the components of SDA expressions.

key-name

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

Key Name	Key Designation
PF1	LK201, VT100, VT52 Red
PF2	LK201, VT100, VT52 Blue
PF3	LK201, VT100, VT52 Black
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
E4	LK201 Select
E5	LK201 Prev Screen
E6	LK201 Next Screen

Key Name	Key Designation
HELP	LK201 Help
DO	LK201 Do
F7 . . . F20	LK201 Function keys

command

SDA command the key is to be defined as. The command must be enclosed in quotation marks ("").

QUALIFIERS

/ECHO
/NOECHO

Determines whether the equivalence string is displayed on the terminal screen after the defined key has been pressed. The /NOECHO qualifier functions only with the /TERMINATE qualifier. The default is /ECHO.

/IF_STATE=(state-name, . . .)
/NOIF_STATE

Specifies a list of one or more states, one of which must be in effect for the key definition to be in effect. States are placed in effect by the /SET_STATE qualifier, a description of which appears below.

The **state-name** is an alphanumeric string, enclosed in quotation marks (""). By including several state names, you can define a key to have the same function in all the specified states. If you specify only one state name, you can omit the parentheses.

If you omit the /IF_STATE qualifier—or use /NOIF_STATE—the current state is used.

/KEY

Defines a key as an SDA command. Subsequently, you need only press the defined key and the RETURN key to issue the command. If you use the /TERMINATE qualifier as well, you need not press the RETURN key.

When you define some keys as SDA commands, you must press CTRL/V before those keys to execute the commands. This is because of the escape sequences these keys generate, and the way the terminal driver handles those escape sequences. The following keys, when defined as SDA commands, must be preceded by a CTRL/V.

Key Name	Key Designation
LEFT	Left arrow
RIGHT	Right arrow
F7 . . . F14	LK201 function keys

/SET_STATE=state-name

Causes the key being defined to cause a key state change rather than issue an SDA command. When you use the /SET_STATE qualifier, you supply the name of a key state in place of the **key-name** parameter. In addition, you must define the **command** parameter as a pair of quotation marks ("").

The key state can be any name you think appropriate. For example, you can define the PF1 key to set the state to *gold* and use the /IF_STATE=GOLD qualifier to allow two definitions for the other keys, one in the *gold* state and one in the nongold 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 the /TERMINATE qualifier is specified.

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 in order 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.

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

1

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

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

2

```
SDA>  DEFINE NEXT = @PC
SDA>  EXAMINE/INSTRUCTION NEXT
NEXT:   MOVL @00(R6),R0
```

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

3

```
SDA>  DEFINE VEC SCH$GL_PCBVEC
SDA>  EXAMINE VEC
SCH$GL_PCBVEC:  80B7D31C  ".0.."
```

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.

4

```
SDA>  DEFINE COUNT = 7
SDA>  DEFINE RESULT = COUNT * COUNT
SDA>  EVALUATE RESULT
Hex = 00000031   Decimal = 49       PR$_SBIS
                                                RESULT
```

The first DEFINE command assigns symbol COUNT the value 7. The second DEFINE command then defines RESULT to be the result of the evaluation of an arithmetic expression using the symbol COUNT. Evaluation of RESULT shows that system symbol PR$_SBIS has an equivalent value.

5

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

              7FFE8DD4  00001703     SGN$C_MAXPGFL+703
              7FFE8DD8  80127920
              7FFE8DDC  00000000
              7FFE8DE0  00000000
              7FFE8DE4  00000000
              7FFE8DE8  00000000
              7FFE8DEC  7FF743E4
              7FFE8DF0  7FF743CC

       SP =>  7FFE8DF4  8000E646     EXE$CMODEXEC+1EE
              7FFE8DF8  7FFEDE96     SYS$CMKRNL+006
              7FFE8DFC  03C00000
```

The DEFINE/KEY command defines PF1 as the SHOW STACK command. When the PF1 key is pressed, SDA displays the command and waits for a carriage return to be entered.

6

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

The DEFINE/KEY command defines PF1 as the SDA SHOW STACK command. The use of the /TERMINATE qualifier causes SDA to execute the SHOW STACK command without waiting for a carriage return to be entered.

7

```
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 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, the user must press PF1 before pressing PF3 to issue the SHOW STACK command. The /TERMINATE qualifier causes the command to execute as soon as the PF3 key is pressed.

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* | */PSL* | */PTE* | */SYMBOLS* } *expression*

PARAMETER

expression
SDA expression to be evaluated. Section 5.2 describes the components of SDA expressions.

QUALIFIERS

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

/PSL
Evaluates the specified expression in the format of a processor status longword.

/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
Specifies that *all* symbols that are known to be equal to the evaluated expression are to be listed in alphabetical order. The default behavior of the EVALUATE command displays only the first several such symbols.

DESCRIPTION

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 if the offset is small enough for the selected symbol to be considered useful.

EXAMPLES

1
```
SDA> EVALUATE -1
Hex = FFFFFFFF   Decimal = -1          PR$_XSID_N8NNN
```

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 = 00000001   Decimal = 1          ACP$V_SWAPGRP
                                      ACP$V_WRITECHK
                                      EVT$_EVENT
                                          .
                                          .
                                          .
```

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

3

```
SDA> DEFINE TEN = A
SDA> EVALUATE TEN
Hex = 0000000A   Decimal = 10         EXE$V_FATAL_BUG
                                      SGN$C_MINWSCNT
                                      TEN
```

The preceding 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 = 00000042      Decimal = 66
```

The preceding 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. Note that the fraction –1/4 is truncated to 0.

5

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

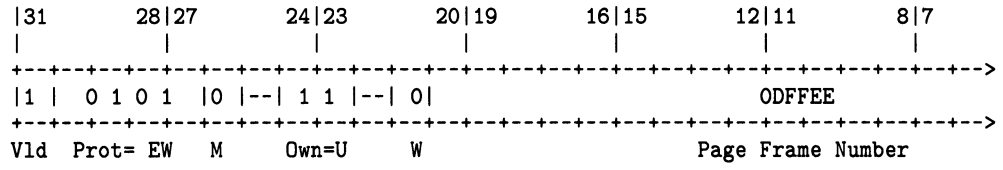
The preceding example shows the output of an EVALUATE/CONDITION command.

6

```
SDA> EVALUATE/PSL 04080009
        CMP TP FPD IS CURMOD PRVMOD IPL DV FU IV T N Z V C
         0   0  0   1  KERN   KERN   08  0  0  0 0 1 0 0 1
```

SDA interprets the entered value 04080009 as though it were a processor status longword (PSL) and displays the resulting field values of that longword.

7 SDA> EVALUATE/PTE ABCDFFEE



Page is Active and Valid

The EVALUATE/PTE command displays the expression ABCDFFEE as a page table entry (PTE) and labels the fields. It also describes the status of the page.

EXAMINE

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

FORMAT

EXAMINE *[/qualifier[,...]] [location]*

PARAMETER

location

Location in memory to be examined. A location can be represented by any valid SDA expression (see Section 5.2). To examine a range of locations, the following syntax is used:

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 4. Use of the /INSTRUCTION qualifier increases the default address as appropriate to the translation of the instruction. 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 parts of the writable system region, displaying the contents of memory in hexadecimal longwords. Do not specify parameters when you use this qualifier.

/CONDITION_VALUE

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

/INSTRUCTION

Translates the contents of the specified range of memory locations into VAX MACRO instruction format. If more than 16 bytes are specified in the range, /INSTRUCTION processing may skip some bytes at the beginning of the range to ensure that SDA is properly synchronized with the start of each instruction. This synchronization may be overridden by specifying the /NOSKIP qualifier.

The length of the instruction displayed varies according to the opcode and addressing mode. If SDA cannot decode a memory location, it issues the following message:

```
%SDA-E-NOINSTRAN, cannot translate instruction
```

When you use this qualifier with the EXAMINE command, SDA calculates subsequent default addresses by adding the length of the last instruction, including all operands, to the last address examined.

/NOSKIP

Causes the EXAMINE command not to skip any bytes in the range when translating the contents of memory into VAX MACRO instructions. The /NOSKIP qualifier causes the execution of the /INSTRUCTION qualifier by default.

/NOSUPPRESS

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

/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.

/PSL

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

/PTE

Interprets and displays the specified longword 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:  80002119  ".!.."
```

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

```
%SDA-E-NOTINPHYS, address : 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 columns of information:

- Each of the first four columns represents a longword of memory, the contents of which are displayed in hexadecimal format.
- The fifth column lists the ASCII value of each byte in each longword displayed in the previous four columns.
- The sixth 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.

For example:

```
SDA> EXAMINE 100:200

Virtual locations 00000100 through 000001FF are not in physical memory

0130011A 0120011B 0130011E 0110011F  ......0... ...0.     00000200
01200107 02300510 04310216 04210218  ..!...1...0... .     00000210
01100103 01100104 01200105 01200106  .. ... .........     00000220
```

Addresses 100_{16} through $1FF_{16}$ do not exist in memory, as the message indicates. SDA displays the contents of those addresses that do exist (200_{16} through 220_{16}).

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

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

Decoding Locations

You can translate the contents of memory locations into VAX MACRO 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.

If the specified range of locations does not begin on an instruction boundary, SDA skips bytes until it locates the next valid instruction, and issues the message

```
%SDA-W-INSKIPPED, unreasonable instruction stream - n bytes skipped
```

In this message, *n* represents the number of bytes that SDA could not translate.

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.

EXAMPLES

1

```
SDA> EXAMINE/SYSTEM
System Region Memory
--------------------
00040039 8FBC0010 00040038 8FBC0010  ....8.......9...      800000000
    .
    .
    .
```

The preceding example shows only the first two lines of the display generated by the EXAMINE/SYSTEM command. Note that in the dump the fifth byte from the right contains the value 38_{16}. The ASCII value of 38_{16}, the character 8, is represented in the fifth character from the left in column 5.

Likewise, the 13th byte from the right in the dump columns contains the value 39_{16}. The ASCII value of 39_{16} is 9, and 9 is represented in the ASCII column as the 13th character from the left.

2

```
SDA> EXAMINE/PSL G1268
        CMP TP FPD IS CURMOD PRVMOD IPL DV FU IV T N Z V C
         1   0  0   0  KERN   KERN   00  0  1  0 1 1 1 0 0
```

The preceding example shows the display produced by the EXAMINE/PSL command. The address of the longword examined is 80001268_{16}.

3

```
SDA> EXAMINE/PTE G775F480

 |31       28|27       24|23       20|19       16|15       12|11        8|7
 |           |           |           |           |           |           |
 +--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+-->
 |1 |  1 1 1 0  |1 |--| 0 0 |--| 0|                          00F0F4
 +--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+-->
 Vld  Prot= URKW M     Own=K     W                      Page Frame Number

           Page is Active and Valid
```

The EXAMINE/PTE command displays and formats the system page table entry at $8775F480_{16}$.

4

```
SDA> EXAMINE/TIME EXE$GQ_SYSTIME
18-FEB-1989 02:07:25.88
```

The EXAMINE/TIME command displays the formatted value of the system time quadword (EXE$GQ_SYSTIME).

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 displays a *screen overflow prompt* at the bottom of the screen:[5]

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

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

When the *SDA>* prompt is not immediately preceded by the screen overflow prompt, typing EXIT causes your process to cease executing the SDA utility.

[5] On hardcopy terminals, SDA does not display such a prompt.

FORMAT

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

FORMAT

FORMAT *[/qualifier] location*

PARAMETER

location

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

QUALIFIER

/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 of a data block, as described below. The **block-type** can be the symbolic prefix of any data structure defined by VMS.

DESCRIPTION

The FORMAT command performs the following actions:

- Characterizes a range of locations as a system data block
- Assigns, if possible, a symbol to each item of data within the block
- Displays all the data within the block

Normally, you use the FORMAT command without the /TYPE qualifier. Used in this manner, it examines the byte in the structure that contains the type of the structure. In most VMS data structures, this byte occurs at an offset of $0A_{16}$ into the structure. If this byte does not contain a valid block type, the FORMAT command halts with the message

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

However, if this byte does contain a valid block type, SDA checks the next byte (offset $0B_{16}$) for a secondary block type. When SDA has determined the type of block, it searches for the symbols that correspond to that type of block.

If SDA cannot find the symbols associated with the block type it has found (or you specified in the /TYPE qualifier), it issues the message

```
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. Most symbols that define VMS data structures are contained within SYS$SYSTEM:SYSDEF.STB. Thus, you would issue the command

```
SDA> READ SYS$SYSTEM:SYSDEF.STB
```

Certain VMS data structures do *not* contain a block type at offset $0A_{16}$. If this byte contains information other than a block type—or the byte does not contain a valid block type—SDA produces the message

```
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:

- The first column shows the virtual address of each item within the block.
- The second lists each symbolic name associated with a location within the block.
- The third shows the contents of each item in hexadecimal format.

EXAMPLE

```
SDA> READ SYS$SYSTEM:SYSDEF.STB
SDA> FORMAT 800B81F0
800B81F0   UCB$L_FQFL              80000F10
           UCB$L_RQFL
           UCB$W_MB_SEED
           UCB$W_UNIT_SEED
800B81F4   UCB$L_FQBL              800026A8
           UCB$L_RQBL
800B81F8   UCB$W_SIZE                 00E0
800B81FA   UCB$B_TYPE                   10
800B81FB   UCB$B_FLCK              07
800B81FC   UCB$L_ASTQFL            800F80E0
           UCB$L_FPC
           UCB$T_PARTNER
800B8200   UCB$L_ASTQBL            8002CF80
           UCB$L_FR3
800B8204   UCB$L_FIRST             8002CA00
           UCB$L_FR4
           UCB$W_MSGMAX
           UCB$W_MSGCNT
      .
      .
      .
```

The READ command loads into SDA's symbol table the symbols from SYS$SYSTEM:SYSDEF.STB needed for formatting system data structures. The FORMAT command displays the data structure that begins at $800B81F0_{16}$, 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 $800B8204_{16}$ has three designations: UCB$L_FIRST and UCB$L_FR4, alternative names for the longword; and the two subfields, UCB$W_MSGMAX and UCB$W_MSGCNT.

The contents of each field appear to the right of the symbolic name of the field. Thus, the contents of UCB$L_FIRST are $8002CA00_{16}$.

HELP

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

FORMAT

HELP *[command-name]*

PARAMETER

command-name

Command for which you need information.

You can also specify the following keywords in place of **command-name**:

Keyword	Function
CPU_CONTEXT	Describes the concept of CPU context as it governs the behavior of SDA in uniprocessor and multiprocessor environments
EXPRESSIONS	Prints a description of SDA expressions
INITIALIZATION	Describes the circumstances under which SDA executes an initialization file when first invoked
OPERATION	Describes how to operate SDA at your terminal and by means of the site-specific startup procedure
PROCESS_CONTEXT	Describes the concept of process context as it governs the behavior of SDA in uniprocessor and multiprocessor environments

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 those commands and topics for which you can request help, as follows:

```
  Information available:

  ATTACH      COPY        CPU_Context      DEFINE           EVALUATE   EXAMINE
  Execute_Command         EXIT        Expressions           FORMAT     HELP
  Initialization          Operation   Process_Context       READ       REPEAT
  SEARCH      SET         SHOW        SPAWN       Symbols   VALIDATE

Topic?
```

READ

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

FORMAT

READ { */EXECUTIVE directory-spec* | */RELOCATE=expression] filespec* }

PARAMETER

filespec

Name of the device, directory, and file that contains the object module from which you want to copy global symbols. The **filespec** defaults to *SYS$DISK:[default-dir]filename*.STB, where *SYS$DISK* and *[default-dir]* represent the disk and directory specified in your last SET DEFAULT command. You must specify a file name.

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. (See Table SDA–5 for a list of these images.)

The **directory-spec** is the name of the directory containing the loadable images of the executive; this parameter defaults to SYS$LOADABLE_IMAGES.

/RELOCATE=expression

Adds the value of **expression** to the value of each symbol in the symbol-table file to be read. You can use the /RELOCATE qualifier only if you also specify a **filespec**. The /RELOCATE qualifier is useful for examining images that are position independent and are loaded at a base of zero.

DESCRIPTION

The READ command symbolically identifies locations in memory for which the default symbol table (SYS$SYSTEM:SYS.STB) provides no definition. In other words, the required global symbols are located in modules that have been compiled and linked separately from the VMS executive.[6]

The object module file specified in the READ command can be one of the following:

- Output of a compiler or assembler (for example, an .OBJ file)
- Output generated by the linker qualifier /SYMBOL_TABLE (for example, an .STB file)

[6] SDA extracts no local symbols from the object module.

Most often the object module file is a file provided by VMS in directory SYS$SYSTEM or SYS$LOADABLE_IMAGES. Many SDA applications, for instance, need to load the definitions of system data structures by issuing a READ command specifying SYS$SYSTEM:SYSDEF.STB. Others require the definitions of specific global entry points within the executive image that are contained within those object modules included in the executive.

Table SDA–4 lists those object module files VMS provides in SYS$SYSTEM. Table SDA–5 lists those loadable images in SYS$LOADABLE_IMAGES that define locations within the VMS executive image.

Table SDA–4 Modules Containing Global Symbols Used by SDA

File	Contents
CLUSTRLOA.STB	Symbols for loadable VAXcluster management code
DCLDEF.STB	Symbols for the DCL interpreter
IMGDEF.STB	Symbols for the image activator
NETDEF.STB	Symbols for DECnet data structures
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

Table SDA–5 Modules Defining Global Locations Within the Executive Image

File	Contents
CPULOA.EXE	Processor-specific data and initialization routines
ERRORLOG.EXE	Error logging routines and system services
EVENT_FLAGS_AND_ASTS.EXE	Event flag and AST delivery routines and system services
EXCEPTION.EXE	Bugcheck and exception handling routines and those system services that declare condition and exit handlers
IMAGE_MANAGEMENT.EXE	Image activator and the related system services
IO_ROUTINES.EXE	$QIO system service, related system services (SYS$CANCEL, SYS$ASSIGN, etc.), and supporting routines
LMF$GROUP_TABLE.EXE	Data for valid, licensed product groups
LOCKING.EXE	Lock management routines and system services
LOGICAL_NAMES.EXE	Logical name routines and system services

Table SDA–5 (Cont.) Modules Defining Global Locations Within the Executive Image

File	Contents
MESSAGE_ROUTINES.EXE	System message routines and system services (including SYS$SNDJBC and SYS$GETTIM)
PAGE_MANAGEMENT.EXE	System pager, its supporting routines, and page management system services (including SYS$CRMPSC, SYS$CREDEL, and SYS$ADJSTK)
PRIMITIVE_IO.EXE	Console I/O routines
PROCESS_MANAGEMENT.EXE	Scheduler, report system event, and supporting routines and system services
RECOVERY_UNIT_SERVICES.EXE	Recovery unit system services
RMS.EXE	Global symbols and entry points for RMS
SECURITY.EXE	Security management routines and system services
SYSDEVICE.EXE	Mailbox driver and null driver
SYSGETSYI.EXE	Get System Information system service (SYS$GETSYI)
SYSLICENSE.EXE	Licensing system service (SYS$LICENSE)
SYSMSG.EXE	VMS system messages
SYSTEM_PRIMITIVES.EXE	Miscellaneous basic system routines, including those that allocate system memory, maintain system time, create fork processes, and control mutex acquisition
SYSTEM_SYNCHRONIZATION.EXE	Routines that enforce synchronization in a VMS multiprocessing system
WORKING_SET_ MANAGEMENT.EXE	Swapper, its supporting routines, and working set management system services

EXAMPLES

1

```
SDA>  READ SYS$SYSTEM:SYSDEF.STB
%SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYSEXE]SYSDEF.STB;1
```

The READ command causes SDA to add all the global symbols in SYS$SYSTEM: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>  EXAM/INST EXE$QIO+2;4
EXE$QIO+00002:  CHMK    #001F
EXE$QIO+00006:  RET
SDA>  EXAM/INST V_EXE$QIO
%SDA-E-BADSYM, unknown symbol "V_EXE$QIO"
SDA>  READ/RELOCATE=IO_ROUTINES SYS$LOADABLE_IMAGES:IO_ROUTINES.EXE
%SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]IO_ROUTINES.EXE;1
SDA>  EXAM/INST EXE$QIO+2;4
EXE$QIO+00002:  MOVZBL  04(AP),R3
EXE$QIO+00006:  CMPB    R3,#3F
SDA>  EXAM/INST V_EXE$QIO+2;4
V_EXE$QIO+00002:  CHMK    #001F
V_EXE$QIO+00006:  RET
```

This SDA session shows that the initial examination of the instructions at EXE$QIO+2 and EXE$QIO+6 produces the vector for the system service, not the system service code itself. The subsequent READ instruction brings into the SDA symbol table the global symbols defined for the system's I/O routines, including one that redefines the entry point of the system service to be the start of the routine EXE$QIO. Thus, the second examination of the same memory locations produces the first two instructions in the routine. The READ command creates a special symbol, V_EXE$QIO, that points to the system service vector.

3

```
SDA>  SHOW STACK
Process stacks (on CPU 01)
--------------------------
Current operating stack (KERNEL):

                7FF8F2B0  806BA870
                7FF8F2B4  7FF8F4C0
                7FF8F2B8  8016F33E     PAGE_MANAGEMENT+0053E
    .
    .
    .
SDA>  READ/RELOCATE=PAGE_MANAGEMENT SYS$LOADABLE_IMAGES:PAGE_MANAGEMENT.EXE
%SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]PAGE_MANAGEMENT.EXE;1
SDA>  SHOW STACK
Process stacks (on CPU 01)
--------------------------
Current operating stack (KERNEL):

                7FF8F2B0  806BA870
                7FF8F2B4  7FF8F4C0
                7FF8F2B8  8016F33E     MMG$LOCK_SYSTEM_PAGES+00188
    .
    .
    .
```

The initial SHOW STACK command contains an address that SDA resolves into an offset from the PAGE_MANAGEMENT module of the executive. 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 page management routine.

```
4  SDA>  READ/EXEC
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]RECOVERY_UNIT_SERVICES.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]RMS.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]CPULOA.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]LMF$GROUP_TABLE.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]SYSLICENSE.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]SYSGETSYI.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]SYSDEVICE.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]MESSAGE_ROUTINES.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]EXCEPTION.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]LOGICAL_NAMES.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]SECURITY.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]LOCKING.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]PAGE_MANAGEMENT.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]WORKING_SET_MANAGEMENT.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]IMAGE_MANAGEMENT.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]EVENT_FLAGS_AND_ASTS.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]IO_ROUTINES.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]PROCESS_MANAGEMENT.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]ERRORLOG.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]PRIMITIVE_IO.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]SYSTEM_SYNCHRONIZATION.EXE;1
   %SDA-I-READSYM, reading symbol table  SYS$COMMON:[SYS$LDR]SYSTEM_PRIMITIVES.EXE;1
```

This READ command brings all global symbols defined in the modules of SYS$SYSTEM:SYS.EXE (as listed in Table SDA–5) into the SDA symbol table. Included in its results is the work performed by the READ commands illustrated in the two previous examples. The READ/EXECUTIVE command, however, does not load those symbols contained in the tables described in Table SDA–4.

REPEAT

Repeats execution of the last command issued. On terminal devices, the KP0 key performs the same function as the REPEAT command.

FORMAT REPEAT

PARAMETERS *None.*

QUALIFIERS *None.*

DESCRIPTION

The REPEAT command is useful for stepping through a linked list of data structures, or for examining a sequence of memory locations.

EXAMPLES

```
1  SDA>  FORMAT @IOC$GL_DEVLIST
   8000B540   DDB$L_LINK              8000B898
   8000B544   DDB$L_UCB               8000B5E0
   8000B548   DDB$W_SIZE                0044
      .
      .
      .
   8000B554   DDB$B_NAME_LEN             03
              DDB$T_NAME              "OPA"
      .
      .
      .
   SDA>  FORMAT @.
   8000B898   DDB$L_LINK              8000BBE0
   8000B89C   DDB$L_UCB               8000B9E0
   8000B8A0   DDB$W_SIZE                0044
      .
      .
      .
   8000B8AC   DDB$B_NAME_LEN             03
              DDB$T_NAME              "MBA"
   SDA>  KP0
   8000BBE0   DDB$L_LINK              807F85C0
   8000BBE4   DDB$L_UCB               8000BC80
   8000BBE8   DDB$W_SIZE                0044
      .
      .
      .
   8000BBF4   DDB$B_NAME_LEN             03
              DDB$T_NAME              "NLA"
```

This series of FORMAT commands pursues the chain of device data blocks (DDBs) from the system global symbol IOC$GL_DEVLIST. The second FORMAT command is constructed such that it refers to the contents of the

address at the current location (see Section 5.2.4 for a discussion of SDA symbols). Subsequently, pressing the KP0 key—or issuing the REPEAT command—is sufficient to display each DDB in the device list.

2
```
SDA> SHOW CALL_FRAME
Call Frame Information
----------------------
        Call Frame Generated by CALLG Instruction

Condition Handler       7FFE7D78  00000000
SP Align Bits = 00      7FFE7D7C  00000000
   Saved AP             7FFE7D80  7FFE7DC0      CTL$GL_KSTKBAS+005C0
   Saved FP             7FFE7D84  7FFE7D94      CTL$GL_KSTKBAS+00594
    .
    .
    .
SDA> SHOW CALL_FRAME/NEXT_FP
Call Frame Information
----------------------
        Call Frame Generated by CALLS Instruction

Condition Handler       7FFE7D94  00000000
SP Align Bits = 00      7FFE7D98  20FC0000
   Saved AP             7FFE7D9C  7FFED024      CTL$GL_KSTKBAS+005E4
   Saved FP             7FFE7DA0  7FFE7DE4      SYSTEM_PRIMITIVES+020AA
    .
    .
    .
SDA> REPEAT
Call Frame Information
----------------------
        Call Frame Generated by CALLG Instruction

Condition Handler       7FFE7DE4  00000000
    .
    .
    .
```

The first SHOW CALL_FRAME displays the call frame indicated by the current FP value. Because the /NEXT_FP qualifier to the instruction displays the call frame indicated by the saved FP in the current call frame, you can use the REPEAT command to repeat the SHOW CALL_FRAME/NEXT_FP command and follow a chain of call frames.

SEARCH

Scans a range of memory locations for all occurrences of a specified value.

FORMAT

SEARCH *[/qualifier] range[=]expression*

PARAMETERS

range

Location in memory to be searched. A location can be represented by any valid SDA expression (see Section 5.2). 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

expression

Indication of the 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 5.2.

QUALIFIERS

/LENGTH= { ***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.

/STEPS= { ***QUADWORD*** | ***LONGWORD*** | ***WORD*** | ***BYTE*** }

Specifies the granularity of the search through the specified memory **range**. After the SEARCH command has performed the comparison between the value of **expression** and memory location, it adds the specified step factor to the address of the memory location to determine 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.

DESCRIPTION

SEARCH displays each location as each value is found.

EXAMPLES

1

```
SDA> SEARCH GB81F0;500 60068
Searching from 800B81F0 to 800B86F0 in LONGWORD steps for 00060068...
Match at 800B8210
SDA>
```

The SEARCH command finds the value 0060068 in the longword at 800B8210.

2

```
SDA> SEARCH/STEPS=BYTE 80000000;1000 6
Searching from 80000000 to 80001000 in BYTE steps for 00000006...
Match at 80000A99
SDA>
```

The SEARCH command finds the value 00000006 in the longword at 80000A99.

3

```
SDA> SEARCH/LENGTH=WORD 80000000;2000 6
Searching from 80000000 to 80002000 in LONGWORD steps for 0006...
Match at 80000054
Match at 800001EC
Match at 800012AC
Match at 800012B8
SDA>
```

The SEARCH command finds the value 0006 in the longword locations 80000054, 800001EC, 800012AC, and 800012B8.

SET CPU

Selects a processor to become the SDA current CPU.

FORMAT

SET CPU *cpu-id*

PARAMETER

cpu-id

Numeric value from 00_{16} to $1F_{16}$ indicating the identity of the processor to be made the current CPU. If you specify a value outside this range or a **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

None.

DESCRIPTION

When you invoke SDA to examine a system dump, the SDA current CPU context defaults to that of the processor that caused the system to fail. When analyzing a crash from a multiprocessing system, you may sometimes find it useful to examine the context of another processor in the configuration.

The SET CPU command changes the current SDA CPU context to that of the processor indicated by **cpu-id**. The CPU specified by this command becomes the current CPU for SDA until you exit from SDA or change SDA CPU context by issuing one of the following commands:

SET CPU **cpu-id**
SHOW CPU **cpu-id**
SHOW CRASH

The following commands also change SDA CPU context if the **name** or index number (**nn**) refers to a current process.

SET PROCESS **name**
SET PROCESS/INDEX=**nn**
SHOW PROCESS **name**
SHOW PROCESS/INDEX=**nn**

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, SDA process context is undefined and no process-specific information is available until you set SDA process context to that of a specific process.

See Section 4 for further discussion on the way in which SDA maintains its context information.

You cannot use the SET CPU command when examining the running system with SDA.

EXAMPLE

```
$ ANAL/CRASH SYS$SYSTEM:SYSDUMP.DMP
VAX/VMS System dump analyzer

Dump taken on 22-FEB-1989 14:22:17.66
NOBUFPCKT, Required buffer packet not present

SDA> SHOW CPU
CPU 01 Processor crash information
----------------------------------

CPU 01 reason for Bugcheck: NOBUFPCKT, Required buffer packet not present
   .
   .
   .
SDA> SHOW STACK
CPU 01 Processor stack
----------------------
Current operating stack (INTERRUPT):

        80DAFB4C    8018BC20
        80DAFB50    7FFC653E
   .
   .
   .
SDA> SET CPU 00
SDA> SHOW CPU
CPU 00 Processor crash information
----------------------------------

CPU 00 reason for Bugcheck: CPUEXIT, Shutdown requested by another CPU
   .
   .
   .
SDA> SHOW STACK
CPU 00 Processor stack
----------------------
Current operating stack (INTERRUPT):

        8016ABD8    00011F4C
        8016ABDC    00010F56
   .
   .
   .
SDA> SHOW CRASH
System crash information
------------------------
Time of system crash: 22-FEB-1989 14:22:17.66
   .
   .
   .
SDA> SHOW STACK
CPU 01 Processor stack
----------------------
Current operating stack (INTERRUPT):
```

```
80DAFB4C    8018BC20
80DAFB50    7FFC653E
```

The series of SHOW CPU and SHOW STACK commands that occurs in this example illustrates the switching of CPU context within an SDA session.

When SDA is first invoked, it is, by default, within the CPU context of the processor that caused the crash (CPU 01). This is illustrated by the first set of SHOW CPU and SHOW STACK commands.

The SET CPU 00 command explicitly changes SDA CPU context to that of CPU 00, as illustrated by the second sequence of SHOW CPU and SHOW STACK commands. Note that a SHOW CPU 00 command would have the same effect as the two commands SET CPU 00 and SHOW CPU, changing the SDA CPU context in addition to displaying the processor-specific information. Unlike the SHOW CPU **cpu-id** command, there is no display associated with the SET CPU **cpu-id** command.

Lastly, the SHOW CRASH command resets the SDA CPU context to that of the processor that caused the crash (CPU 01).

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 SET DEFAULT command. You must specify a file name.

QUALIFIERS

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.

There are the following differences 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 such that 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 all 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 LOG command does not record output from the HELP command in its log file. The SET OUTPUT command can record HELP output in its listing file.
- The SET LOG command does not record SDA error messages in its log file. The SET OUTPUT command can record SDA error messages in its listing file.
- The SET OUTPUT command generates 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.

Note that, if you have used the SET OUTPUT command to redirect output to a listing file, you cannot use a SET LOG command to direct the same output to a log file.

SET OUTPUT

Redirects output from SDA to the specified file or device.

FORMAT

SET OUTPUT *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 SET DEFAULT command. You must specify a file name.

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 it and the SET OUTPUT command.)

If you finish directing SDA commands to an output file and wish to return to interactive display, issue the following command:

```
SDA> SET OUTPUT TT
```

If you use the SET OUTPUT command to send the SDA output to a listing file, 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.

SET PROCESS

Selects a process to become the SDA current process.

FORMAT

SET PROCESS { *process-name* | */INDEX=nn* | */SYSTEM* }

PARAMETER

process-name

Name of the process to become the SDA current process. The **process-name** is a string containing up to 15 uppercase or lowercase characters; numerals, the dollar sign ($) character, and the underscore (_) character can also be included in the string. If you include characters other than these, you must enclose the entire string in quotation marks (" ").

QUALIFIERS

/INDEX=nn

Specifies the process to be made current by its index into the system's list of software process control blocks (PCBs). You can supply either of the following values for **nn**:

- The process index itself
- The process identification (PID) or extended PID longword, from which SDA extracts the correct index

To obtain these values for any given process, issue the SDA command SHOW SUMMARY.

/SYSTEM

Specifies that the system process be made the SDA current process. Each VMS system (uniprocessor or multiprocessor) uses a single system process control block (PCB) and process header (PHD) as dummy structures, located in system space, that record the system working set, global section table, global page table, and other systemwide data.

DESCRIPTION

When you issue an SDA command such as an EXAMINE command, 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, its process context defaults to that of the process that was current at the time of the crash. If the crash occurred on a VMS multiprocessing system, SDA sets the CPU context to that of the processor that crashed the system and the process context 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 **name** or /INDEX=**nn**. The process specified by this command becomes the current process for SDA until you exit from SDA or change SDA process context by issuing one of the following commands:

SET PROCESS/INDEX=**nn**
SET PROCESS **process-name**
SHOW PROCESS/INDEX=**nn**

In the analysis of a crash dump from a multiprocessing system, changing process context can involve a switch of CPU context as well. For instance, if you issue a SET PROCESS command for a process that is current on another CPU, SDA will automatically change its CPU context to that of the CPU on which that process is current. The following commands can have this effect if **process-name** or index number (**nn**) refers to a current process.

SET PROCESS **process-name**
SET PROCESS/INDEX=**nn**
SHOW PROCESS **process-name**
SHOW PROCESS/INDEX=**nn**

See Section 4 for further discussion on the way in which SDA maintains its context information.

EXAMPLES

1

```
SDA> SHOW PROCESS
Process index: 0012   Name: NETACP   Extended PID: 28C00092
------------------------------------------------------------

Process status:  00149001   RES,WAKEPEN,NOACNT,PHDRES,LOGIN

PCB address              800F1140    JIB address             801FDA00
PHD address              80477200    Swapfile disk address   01000F01
   .
   .
   .
```

2

```
SDA> SHOW SUMMARY
Current process summary
-----------------------

 Extended Indx Process name    Username    State Pri   PCB      PHD     Wkset
-- PID -- ---- --------------- ----------- ----- --- -------- -------- -----
 28C00080 0000 NULL                         COM    0 80002100 80001F88     0
 28C00081 0001 SWAPPER                      HIB   16 800023C8 80002250     0
 28C00483 0003 KLINGON         KLINGON      MWAIT  6 8010FEA0 803F8600   323
 28C00085 0005 ERRFMT          SYSTEM       COM   10 800B5A10 8061DA00    69
 28C00087 0007 OPCOM           SYSTEM       LEF    7 800C7000 80227A00    71
   .
   .
   .
```

```
3  SDA> SET PROCESS ERRFMT
   SDA> SHOW PROCESS
   Process index: 0005    Name: ERRFMT    Extended PID: 28C00085
   --------------
   Process status:  00040001    RES,PHDRES

   PCB address              800B5A10     JIB address              801E5C00
       .
       .
       .
```

The first SHOW PROCESS command shows the current process to be NETACP. The SHOW SUMMARY command shows the names of the other processes that exist. The SET PROCESS command sets the current process to ERRFMT, as shown by the second SHOW PROCESS command. Note that the SET PROCESS command could also have been issued as one of the following:

```
SDA>  SET PROCESS/INDEX=5

SDA>  SET PROCESS/INDEX=801E5C00
```

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. Table SDA–6 lists those keywords that may be used as options. The default **option** is **option=ALL:ALL,NOPIO**, designating for display by the SHOW PROCESS/RMS command all structures for all files related to the process's image I/O.

To list more than one option, enclose the list in parentheses and separate options by commas. 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".

QUALIFIERS

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 an indication of the information provided by various displays.) You can examine the options that are currently selected by issuing a SHOW RMS command.

Table SDA–6 SET RMS Command Keywords for Displaying Process RMS Information

Keyword	Meaning
[NO]ALL[:**ifi**][1]	All control blocks (default)
[NO]ASB	Asynchronous context 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 attributes block
[NO]FCB	File control block

[1]The optional parameter **ifi** is an internal file identification. The default **ifi** (**ALL**) is all the files the current process has opened.

Table SDA–6 (Cont.) SET RMS Command Keywords for Displaying Process RMS Information

Keyword	Meaning
[NO]FWA	File work area
[NO]GBDSUM	GBD summary page
[NO]GBSB	Global buffer synchronization block
[NO]GBD	Global buffer descriptor
[NO]GBH	Global buffer header
[NO]IDX	Index descriptor
[NO]IFAB[:**ifi**][1]	Internal FAB
[NO]IFB[:**ifi**][1]	Internal FAB
[NO]IRAB	Internal RAB
[NO]IRB	Internal RAB
[NO]JFB	Journaling file block
[NO]NAM	Name block
[NO]NWA	Network work area
[NO]PIO	Image I/O (NOPIO), the default, or process I/O (PIO)[2]
[NO]RAB	Record attributes 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

[1]The optional parameter **ifi** is an internal file identification. The default **ifi** (**ALL**) is all the files the current process has opened.

[2]Specifying the PIO option causes the SHOW PROCESS/RMS command to display the indicated structures for process-permanent file I/O.

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.

SHOW CALL_FRAME

Displays the locations and contents of the longwords representing a procedure call frame.

FORMAT

SHOW CALL_FRAME [*starting-address* | */NEXT_FP*]

PARAMETER

starting-address

Expression representing the starting address of the procedure call frame to be displayed. The default **starting-address** is the longword contained in the FP register of the SDA current process.

QUALIFIER

/NEXT_FP

Displays the procedure call frame starting at the address stored in the FP 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_FP qualifier to the command.

DESCRIPTION

Whenever a procedure is called using CALLG or CALLS instructions, information is stored on the stack of the calling routine in the form of a procedure call frame. Figure SDA–5 illustrates the format of a call frame.[7]

The SHOW CALL_FRAME command interprets the contents of the designated call frame and displays whether the call frame was generated by a CALLG or CALLS instruction. If it locates nonzero bits in the portion of the second longword that represents the upper byte of the processor status word (PSW), it presents a message that indicates the fault or trap in effect. For example:

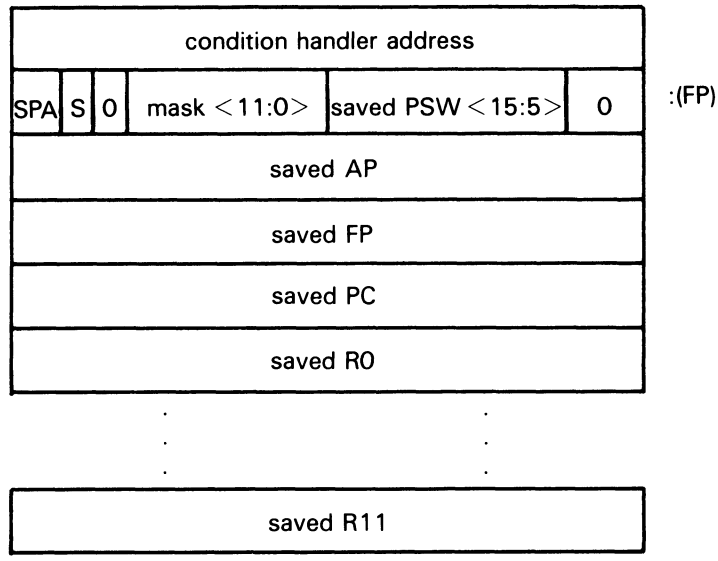
```
Nonzero PSW Bits (15:8) => Reserved Operand Fault on RET
```

SHOW_CALL_FRAME then produces four columns of information:

1. The components of the call frame.
2. The virtual addresses that are part of the call frame.
3. The contents of the longwords at these addresses.
4. A symbolic representation of the contents of each longword, if possible. SDA does not attempt to symbolize the second longword in the call frame (mask-PSW longword), which contains the register save mask and the processor status word (PSW).

[7] In Figure SDA–5, the second longword contains the stack pointer alignment (SPA) bits, which indicate the 0 to 3 bytes needed to align the frame to a longword boundary. The S bit is set if the frame resulted from a CALLS instruction; clear if it resulted from a CALLG instruction.

Figure SDA–5 Call Frame



The SHOW CALL_FRAME command follows this listing with an indication of how many bytes were used to align the call frame to a longword boundary.

For call frames generated by a CALLS instruction, the SHOW CALL_FRAME instruction displays the argument list to the call frame in three columns containing the virtual address of each item, its contents, and symbolic representation.

All valid procedure call frames begin on a longword boundary. If the specified address expression does not begin on a longword boundary, the call frame is invalid and the SDA displays the following message:

```
Invalid Call Frame:   Start Address Not On Longword Boundary
```

If you attempt to format an address that is not a call frame or is an invalid call frame (that is, bit 28 of the second longword is not zero), SDA displays the following message:

```
Invalid Call Frame:   Bit 28 is Set in "Mask-PSW" Longword
```

When using the SHOW CALL_FRAME/NEXT_FP command to follow a chain of call frames, SDA signals the end of the chain by the message

```
%SDA-E-NOTINPHYS, 00000000 : not in physical memory
```

This message indicates that the saved FP in the previous call frame has a zero value.

EXAMPLE

```
SDA> SHOW CALL_FRAME
Call Frame Information
----------------------
        Call Frame Generated by CALLG Instruction

Condition Handler       7FFE7D78  00000000
SP Align Bits = 00      7FFE7D7C  00000000
   Saved  AP            7FFE7D80  7FFE7DC0      CTL$GL_KSTKBAS+005C0
   Saved  FP            7FFE7D84  7FFE7D94      CTL$GL_KSTKBAS+00594
   Return PC            7FFE7D88  8015303F      EXCEPTION+0043F
Align Stack by 0 Bytes =>
SDA> SHOW CALL_FRAME/NEXT_FP
Call Frame Information
----------------------
        Call Frame Generated by CALLS Instruction

Condition Handler       7FFE7D94  00000000
SP Align Bits = 00      7FFE7D98  20FC0000
   Saved  AP            7FFE7D9C  7FFED024
   Saved  FP            7FFE7DA0  7FFE7DE4      CTL$GL_KSTKBAS+005E4
   Return PC            7FFE7DA4  801D58AA      MMG$IMGRESET+00066
        R2              7FFE7DA8  7FFE7DD0      CTL$GL_KSTKBAS+005D0
        R3              7FFE7DAC  7FFDB9F8
        R4              7FFE7DB0  8026C720
        R5              7FFE7DB4  7FFDBA00
        R6              7FFE7DB8  7FFE6300      CTL$A_DISPVEC+00500
        R7              7FFE7DBC  00000003
Align Stack by 0 Bytes =>
Argument List           7FFE7DC0  00000003
                        7FFE7DC4  7FFE7DD0      CTL$GL_KSTKBAS+005D0
                        7FFE7DC8  00000000
                        7FFE7DCC  00000000
SDA> SHOW CALL_FRAME/NEXT_FP
Call Frame Information
----------------------
        Call Frame Generated by CALLG Instruction

Condition Handler       7FFE7DE4  00000000
SP Align Bits = 00      7FFE7DE8  00000000
   Saved  AP            7FFE7DEC  7FFED024
   Saved  FP            7FFE7DF0  7FFECFF8
   Return PC            7FFE7DF4  8015303F      EXCEPTION+0043F
Align Stack by 0 Bytes =>
```

The SHOW CALL_FRAME commands in this SDA session follow a chain of call frames from that specified in the FP of the SDA current process.

SHOW CLUSTER

Displays information for all the nodes in a VAXcluster or a specific node in a VAXcluster from the viewpoint of the connection manager or from that of the system communications services (SCS).

FORMAT

SHOW CLUSTER { */CSID=csid* | */SCS* }

PARAMETERS

None.

QUALIFIERS

/CSID=csid

Displays VAXcluster information for a specific VAXcluster member node. The value **csid** is the cluster system identification number (CSID) of the node to be displayed.[8]

/SCS

Displays a view of the VAXcluster as seen by SCS.

DESCRIPTION

By default, the SHOW CLUSTER command provides a view of the VAXcluster from the perspective of the connection manager. When you use the /SCS qualifier, however, SHOW CLUSTER provides a view of the cluster from the perspective of the port driver or drivers.

VAXcluster as Seen by the Connection Manager

The SHOW CLUSTER command provides a series of displays.

The **VAXcluster 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 VAXcluster system blocks (CSB) currently in operation; there is one CSB assigned to each node of the VAXcluster. For each CSB, the **CSB list** displays the following information:

- Its address
- Name of the VAXcluster node it describes
- CSID associated with the node

[8] You can find the CSID for a specific node in a VAXcluster by examining the **CSB list** display of the SHOW CLUSTER command. Other SDA displays refer to a system's CSID. For instance, the SHOW LOCK command indicates where a lock is mastered or held by CSID.

- Number of votes (if any) provided by the node
- Its state[9]
- Its status[9]

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 VAXcluster 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), and 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 *VMS Show Cluster Utility Manual* for information about the flags for VAXcluster nodes.)

VAXcluster 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 VAXcluster member, HSC, UDA, 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.

[9] For information about the state and status of nodes, see the description of the ADD command in the *VMS Show Cluster Utility Manual*.

EXAMPLES

1 SDA> SHOW CLUSTER

```
VAXcluster data structures
--------------------------
                  --- VAXcluster Summary ---

        Quorum   Votes   Quorum Disk Votes   Status Summary
        ------   -----   -----------------   --------------
          2       3            1            quorum

                       --- CSB list ---

Address   Node    CSID      Votes   State     Status
-------   ----    ----      -----   -----     ------

803686F0  SOLLY   000100C8    1     open    member,qf_active
80368550  GUS     000100C9    1     open    member,qf_active
80367B90  DORIS   000100C5    1     open    member,qf_active

                --- Cluster Block (CLUB) 801C3F70 ---

Flags: 10080001 cluster,init,quorum

Quorum/Votes                  2/3    Last transaction code          02
Quorum Disk Votes               1    Last trans. number           1126
Nodes                           3    Last coordinator CSID    00000000
Quorum Disk             $255$DUA2    Last time stamp       26-MAR-1986
Found Node SYSID     0000000008A0                             18:52:32
Founding Time          3-DEC-1988    Largest trans. id        00000466
                         00:01:44    Resource Alloc. retry           0
Index of next CSID           00D2    Figure of Merit          00000000
Quorum Disk Cntrl Block  80334E00    Member State Seq. Num        0190
Timer Entry Address      00000000    Foreign Cluster          00000000
CSP Queue                   empty

        --- Cluster Failover Control Block (CLUFCB) 801C407C ---

Flags: 00000000

Failover Step Index      00000028    CSB of Synchr. System    803686F0
Failover Instance ID     00000466

        --- Cluster Quorum Disk Control Block (CLUDCB) 80334E00 ---

State: 0001 qs_not_ready
Flags: 0000

Iteration Counter               0             UCB address    00000000
Activity Counter                0             TQE address    80419F40
Quorum file LBN          00000000             IRP address    803665A0

        --- SOLLY Cluster System Block (CSB) 803686F0 ---

State: 01 open
Flags: 02020302 member,cluster,qf_active,selected,status_rcvd
```

```
Quorum/Votes        2/1    Next seq. number     0247    Send queue       00000000
Quor. Disk Vote       1    Last seq num rcvd    0314    Resend queue     00000000
CSID           000100C8    Last ack. seq num    0247    Block xfer Q.       empty
Eco/Version         0/12    Unacked messages        1    CDT address      801C28F0
Reconn. time   00000059    Ack limit               4    PDT address      801CEA20
Ref. count             2    Incarnation  18-DEC-1988    TQE address      00000000
Ref. time   18-DEC-1988                    08:52:20    SB address       8041B6E0
               08:53:58    Lock mgr dir wgt        1    Current CDRP     00000000
```

The preceding example shows the screen displays for the SHOW CLUSTER command. (Displays for nodes GUS and DORIS, similar to that for node SOLLY, are also included in the SHOW CLUSTER output but have been omitted from the preceding example.)

2 `SDA> SHOW CLUSTER /CSID=000100C8`

```
VAXcluster data structures
--------------------------
         --- SOLLY Cluster System Block (CSB) 803686F0 ---

State: 01 open
Flags: 02020302 member,cluster,qf_active,selected,status_rcvd

Quorum/Votes        2/1    Next seq. number     0247    Send queue       00000000
Quor. Disk Vote       1    Last seq num rcvd    0314    Resend queue     00000000
CSID           000100C8    Last ack. seq num    0247    Block xfer Q.       empty
Eco/Version         0/12    Unacked messages        1    CDT address      801C28F0
Reconn. time   00000059    Ack limit               4    PDT address      801CEA20
Ref. count             2    Incarnation  18-DEC-1988    TQE address      00000000
Ref. time   18-DEC-1988                    08:52:20    SB address       8041B6E0
               08:53:58    Lock mgr dir wgt        1    Current CDRP     00000000
```

The preceding example shows the use of the /CSID qualifier to obtain information about a specific node (in this instance, node SOLLY). The information displayed is identical to that shown for the specified node in the SHOW CLUSTER command.

3 `SDA> SHOW CLUSTER /SCS`

```
VAXcluster data structures
--------------------------

                --- SCS Listening Process Directory ---

Entry Address     Connection ID     Process Name          Information
-------------     -------------     ------------          -----------

  80419D60          08EE0000        SCS$DIRECTORY
  80419E20          08EE0001        VMS$VAXcluster

                  --- SCS Systems Summary ---

  SB Address      Node      Type       System ID         Paths
  ----------      ----      ----       ---------         -----

  8041A120       PINTO      HSC       00000000F10E          1
  8041AA20       DORIS      VMS       0000000008A9          1
  8041AB40       GUS        VMS       0000000008A1          1
  8041B6E0       SOLLY      VMS       0000000008A0          1
  8041D420       DODGER     HSC       00000000F00F          1
```

```
                  --- PINTO System Block (SB) 8041A120 ---

System ID           00000000F10E    Local software type          HSC
Max message size              66    Local software vers.        X301
Max datagram size             62    Local software incarn.   8355FE00
Local hardware type         HS50                             008DA59A
Local hardware vers. 022702220222   SCS poller timeout           000F
                     022202220222   SCS poller enable mask         01

                  --- Path Block (PB) 8041C400 ---

                Status:  0000

Remote sta. addr.     00000000000E    Remote port type             HSC
Remote state          00000000000E    Number of data paths           2
Remote hardware rev.      00000225    Cables state           A-OK B-OK
Remote func. mask         4F710200    Local state                 OPEN
Resetting port                0E    Port dev. name              PAB0
Handshake retry cnt.           1    SCS MSGBUF address       80390270
Msg. buf. wait queue       empty    PDT address              801CEA20

                  --- DORIS System Block (SB) 8041AA20 ---

System ID           0000000008A9    Local software type          VMS
Max message size             112    Local software vers.        V5.0
Max datagram size            576    Local software incarn.   A9D31760
Local hardware type         V780                             008DA59B
Local hardware vers. 010E0138207A   SCS poller timeout           000C
                     000030030E10   SCS poller enable mask         00

                  --- Path Block (PB) 80437E80 ---

                Status:  0000

Remote sta. addr.     000000000002    Remote port type            CI780
Remote state                  ENAB    Number of data paths           2
Remote hardware rev.      00040003    Cables state           A-OK B-OK
Remote func. mask         FFFFFF00    Local state                 OPEN
Resetting port                02    Port dev. name              PAB0
Handshake retry cnt.           1    SCS MSGBUF address       8036F0B0
Msg. buf. wait queue       empty    PDT address              801CEA20
```

The preceding example shows a subset of a typical output for the SHOW CLUSTER/SCS command. In this system, there are three VMS nodes (DORIS, GUS, and SOLLY), and there are two HSCs (PINTO and DODGER). After the summary information in the first two screen displays, specific information for each system block and its associated path block is shown.

SHOW CONNECTIONS

Displays information about all active connections between systems communications services (SCS) processes or a single connection.

FORMAT

SHOW CONNECTIONS *[/ADDRESS=cdt-address]*

PARAMETERS

None.

QUALIFIER

/ADDRESS=cdt-address

Displays information contained in the connection descriptor table (CDT) for a specific connection.[10]

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.

[10] 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 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.

EXAMPLES

1

```
SDA> SHOW CONNECTIONS
VAXcluster data structures
--------------------------

                    --- CDT Summary Page ---

CDT Address   Local Process     Connection ID     State       Remote Node
-----------   -------------     -------------     -----       -----------

 801C2670     SCS$DIRECTORY       08EE0000        listen
 801C2710     VMS$VAXcluster      08EE0001        listen
 801C27B0     VMS$VAXcluster      08FF0002        open         DORIS
 801C2850     VMS$DISK_CL_DRVR    08FD0003        open         PINTO
 801C28F0     VMS$VAXcluster      08EF0004        open         SOLLY
 801C2990     VMS$VAXcluster      08F00005        open         GUS

Number of free CDTs:  32

           --- Connection Descriptor Table (CDT) 801C2670 ---

State:  0001 listen          Local Process:        SCS$DIRECTORY
Blocked State:  0000

Local Con. ID   08EE0000   Datagrams sent    0   Message queue      empty
Remote Con. ID  78A30017   Datagrams rcvd    0   Send Credit Q.     empty
Receive Credit         0   Datagram discard  0   PB address      80438300
Send Credit            1   Messages Sent     0   PDT address     801CEA20
Min. Rec. Credit       0   Messages Rcvd.    0   Error Notify    8022B816
Pend Rec. Credit       0   Send Data Init.   0   Receive Buffer  00000000
Initial Rec. Credit    0   Req Data Init.    0   Connect Data    00000000
Rem. Sta.   00000000000C   Bytes Sent        0   Aux. Structure  00000000
Rej/Disconn Reason     0   Bytes rcvd        0
Queued for BDT         0   Total bytes map   0
Queued Send Credit     0
```

The preceding example shows the *CDT summary page,* and the first page of the detailed displays for each CDT.

2

```
SDA> SHOW CONNECTIONS /ADDRESS=801C27B0
VAXcluster data structures
--------------------------

           --- Connection Descriptor Table (CDT) 801C27B0 ---

State:  0002 open        Local Process:          VMS$VAXcluster
Blocked State:  0000     Remote Node::Process:   DORIS::VMS$VAXcluster

Local Con. ID   08FF0002   Datagrams sent     0   Message queue      empty
Remote Con. ID  33440003   Datagrams rcvd     0   Send Credit Q.     empty
Receive Credit         4   Datagram discard   0   PB address      80437E80
Send Credit            5   Messages Sent    267   PDT address     801CEA20
Min. Rec. Credit       0   Messages Rcvd.   289   Error Notify    80227950
Pend Rec. Credit       1   Send Data Init.    0   Receive Buffer  8039AF80
Initial Rec. Credit    5   Req Data Init.     0   Connect Data    80367C0C
Rem. Sta.   000000000002   Bytes Sent         0   Aux. Structure  80367B90
Rej/Disconn Reason     0   Bytes rcvd         0
Queued for BDT         0   Total bytes map    0
Queued Send Credit     0
```

The preceding example shows the use of the /ADDRESS qualifier to obtain information about a specific connection.

SHOW CPU

Displays information about the state of a processor at the time of the system failure.

FORMAT

SHOW CPU *[cpu-id]*

PARAMETER

cpu-id

Numeric value from 00 to $1F_{16}$ indicating the identity of the processor for which context information is to be displayed. If you specify a value outside this range or 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 CPU command performs an implicit SET CPU command, making the processor indicated by **cpu-id** the current CPU for subsequent SDA commands. (See the description of the SET CPU command and Section 4 for information on how this can affect the CPU context—and process context—in which SDA commands execute.)

QUALIFIERS

None.

DESCRIPTION

The SHOW CPU command displays crash information about the processor specified by **cpu-id** or, by default, the SDA current CPU, as defined in Section 4. You cannot use the SHOW CPU command when examining the running system with SDA.

The SHOW CPU command produces several displays. First, there is a brief description of the crash 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 processor, 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 processor at the time of the system failure

Next, the **general registers** display shows the contents of the processor's general purpose registers (R0 through R11), the AP, FP, SP, PC, and PSL at the time of the crash.

The **processor registers** display consists of the following three parts:

- Common processor registers
- Processor-specific registers
- Stack pointers and memory interconnect silos

The first section includes registers, common to all VAX processors, that are used by VMS to maintain the current process's virtual address space, system space, or other system functions. The following registers are among those displayed:

- Program region (P0 space) base register (P0BR)
- Program region length register (P0LR)
- Control region (P1 space) base register (P1BR)
- Control region length register (P1LR)
- System region (S0 space) base register (SBR)
- System region length register (SLR)
- Process control block base register (PCBB)
- System control block base register (SCBB)
- Asynchronous system trap level (ASTLVL)
- Software interrupt summary register (SISR)
- Internal clock control/status register (ICCS)
- System identification register (SID)

The second section of the **processor registers** display shows those registers that are specific to the type of VAX processor being examined. (The SHOW CRASH command displays the processor type.) The contents of the register display vary according to the type of processor involved in the crash and are used primarily in hardware diagnostics.

The final section of the display includes the five stack pointers: the interrupt stack pointer (ISP) and the four pointers of the kernel, executive, supervisor, and user stacks (KSP, ESP, SSP, and USP, respectively). Certain processors, such as the VAX 8800 and VAX 8600, also display the contents of the silos of their memory interconnects in this section.

The SHOW CPU command concludes with a listing of the spin locks, if any, owned by the processor at the time of the crash, reproducing some of the information given by the SHOW SPINLOCKS command. The spin lock display includes the following information:

- Name of the spin lock
- Address of the spin lock data structure (SPL)
- IPL and rank of the spin lock
- Number of processors waiting for this processor to release the spin lock

- Indication of the depth of this processor's ownership of the spin lock. A number greater than 1 indicates that this processor has nested acquisitions of the spin lock.

EXAMPLE

```
SDA> SHOW CPU
CPU 00 Processor crash information
---------------------------------

CPU 00 reason for Bugcheck: INVEXCEPTN, Exception while above ASTDEL or on interrupt stack

Process currently executing: NETACP

Current image file: $254$DUA200:[SYS6.SYSCOMMON.]<SYSEXE>NETACP.EXE;3

Current IPL: 8  (decimal)

General registers:

        R0  = 00000008   R1  = 00080000   R2  = 8047FC40   R3  = 000003AC
        R4  = 00000002   R5  = 8047FC40   R6  = 00000036   R7  = 00000000
        R8  = 00000000   R9  = 00000062   R10 = 7FFE7D70   R11 = 0000747C
        AP  = 0000BE34   FP  = 7FFE7DD0   SP  = 7FFE7D30   PC  = 80146682
        PSL = 00080009

Processor registers:

        P0BR   = 816EB600     SBR    = 01A6A800     ASTLVL = 00000004
        P0LR   = 00000C0C     SLR    = 00065600     SISR   = 00000000
        P1BR   = 80FFCE00     PCBB   = 008AF2A0     ICCS   = 00000041
        P1LR   = 001FFC5F     SCBB   = 01A62600     SID    = 067F014F

        ICR    = FFFFEDEA     REVR1  = 11121111     NMIFSR = 000C0000
        TODR   = 2B914C0F     REVR2  = FF00FF12     NMIEAR = 2243F830
        COR    = 00000001     CPUINFO= 000009F7

        ISP    = 8016AC00
        KSP    = 7FFE7D30
        ESP    = 7FFE9E00
        SSP    = 7FFEDE00
        USP    = 7FF8E590

NMI bus silo:

                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
```

```
               Spinlocks currently owned by CPU 00

IOLOCK8                              Address : 80185E50
Owner CPU ID     : 00                IPL     : 08
Ownership Depth  : 0001              Rank    : 14
CPUs Waiting     : 0000              Index   : 34

SDA>  EXAMINE R5
R5:  8047FC40   "@G."
SDA>  SHOW PROCESS
Process index: 000D   Name: NETACP   Extended PID: 33C0010D
-------------------------------------------------------------
Process status:  00148001   RES,NOACNT,PHDRES,LOGIN
   .
   .
   .
SDA>  SHOW CPU 01
CPU 01 Processor crash information
----------------------------------

CPU 01 reason for Bugcheck: CPUEXIT, Shutdown requested by another CPU

Process currently executing: no processes currently scheduled on this CPU

Current IPL: 31  (decimal)
   .
   .
   .
            No spinlocks currently owned by CPU 01

SDA>  EXAMINE R5
R5:  83ED5E00   ".^."
SDA>  SHOW PROCESS
%SDA-E-BADPROC, no such process
```

This SDA session illustrates the output of the SHOW CPU command in the analysis of a crash dump from a VAX 8800 multiprocessing system with two active processors. The first SHOW CPU command displays the crash information particular to CPU 00, which initially posted an INVEXCEPTN bugcheck from within process NETACP and then requested CPU 01 to take a bugcheck (CPUEXIT) as well. That the crash occurred at IPL 8 signifies, perhaps, that a driver fork process is involved.

The second instance of the SHOW CPU command (SHOW CPU 01) corroborates that CPU 01 was requested to crash by CPU 00.

Significantly, the second SHOW CPU command changes both the SDA current CPU context and current process context. The two EXAMINE R5 commands are executed under different CPU contexts as the values they produce differ. In the CPU context of CPU 00, the current process context is that of process NETACP. There is no current process on CPU 01; thus, SDA process context is initially undefined when its CPU context is changed to that of CPU 01.

SHOW CRASH

In the analysis of a system failure, displays information about the state of the system at the time of the failure. In the analysis of a running system, provides information identifying the system.

FORMAT

SHOW CRASH

PARAMETERS

None.

QUALIFIERS

None.

DESCRIPTION

The SHOW CRASH command has two different manifestations, depending upon whether it is issued within the analysis of a running system or within the analysis of a system failure.

In either case, if the SDA current CPU context is not that of the processor that signaled the bugcheck, the SHOW CRASH command performs an implicit SET CPU command to make that processor the SDA current CPU. (See the description of the SET CPU command and Section 4 for a discussion of how this can affect the CPU context—and process context—in which SDA commands execute.)

When used during the analysis of a *running system,* the SHOW CRASH command produces a display that describes the system and the version of VMS that it is running. The **system crash information** display contains the following information:

- Date and time that the ANALYZE/SYSTEM command was issued (entitled "Time of system crash" in the display)
- Name and version number of the operating system
- Major and minor IDs of the operating system
- Identity of the VAX system, including an indication of its VAXcluster membership
- CPU ID of the primary CPU
- Two bit masks indicating which processors in the system are active and which are available for booting, respectively

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.

The **system crash information** display in this context provides the following information:

- Date and time of the system crash.
- Name and version number of the operating system.

- Major and minor IDs of the operating system.
- Identity of the VAX system, including an indication of its VAXcluster membership and the location of the primary CPU in a multiprocessing configuration.
- CPU IDs of both the primary CPU and the CPU that initiated the bugcheck. In a VAX uniprocessor system, these IDs are identical.
- Two bit masks indicating which processors in the system are active and which are available for booting, respectively.
- For each active processor in the system, the name of the bugcheck that caused the 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 general purpose registers, processor-specific registers, stack pointers, and record of spin lock ownership. The first such screen presents information about the processor that caused the crash; others follow according to the numerical order of their CPU IDs.

EXAMPLES

1

```
$ ANALYZE/SYSTEM
VAX/VMS System analyzer

SDA> SHOW CRASH
System crash information
------------------------
Time of system crash: 25-FEB-1988 11:18:06.84

Version of system: VAX/VMS VERSION 5.0

System Version Major ID/Minor ID: 10/11

VAXcluster node: BIGTOP, a VAX 8800 - primary CPU (left) was booted

Primary CPU ID:  01

Bitmask of CPUs active/available:  00000003/00000003
SDA>  SHOW PROCESS
%SDA-E-BADPROC, no such process
```

When issued from within the analysis of a running system, the SHOW CRASH command displays the time the ANALYZE/SYSTEM command was issued as the "Time of system crash." The display indicates that the VAX system in use is a VAX 8800 multiprocessing system, the left CPU of which is the primary CPU. The bit mask indicates that there are two processors available and both are running.

Note that there is no defined SDA current process at this time.

```
2  $ ANALYZE/CRASH SYS$SYSTEM
   VAX/VMS System dump analyzer

   Dump taken on 23-FEB-1988 12:44:30.23
   INVEXCEPTN, Exception while above ASTDEL or on interrupt stack

   SDA> SHOW CRASH
   System crash information❶
   ------------------------
   Time of system crash: 23-FEB-1988 12:44:30.23

   Version of system: VAX/VMS VERSION 5.0
   System Version Major ID/Minor ID: 10/11

   VAXcluster node: MOOSE, a VAX 8800 - primary CPU (left) was booted

   Crash CPU ID/Primary CPU ID:  00/01

   Bitmask of CPUs active/available:  00000003/00000003

   CPU bugcheck codes:❷
      CPU 00 -- INVEXCEPTN, Exception while above ASTDEL or on interrupt stack
      1 other -- CPUEXIT, Shutdown requested by another CPU

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

   CPU 00 reason for Bugcheck: INVEXCEPTN, Exception while above ASTDEL or on interrupt stack❸

   Process currently executing on this CPU: NETACP❸

   Current image file: $254$DUA200:[SYS6.SYSCOMMON.][SYSEXE]NETACP.EXE;3

   Current IPL: 8  (decimal)❹

   General registers:

       R0  = 00000008   R1  = 00080000   R2  = 8047FC40   R3  = 000003AC
       R4  = 00000002   R5  = 8047FC40   R6  = 00000036   R7  = 00000000
       R8  = 00000000   R9  = 00000062   R10 = 7FFE7D70   R11 = 0000747C
       AP  = 0000BE34   FP  = 7FFE7DD0   SP  = 7FFE7D30   PC  = 80146682
       PSL = 00080009

   Processor registers:

       P0BR   = 816EB600     SBR    = 01A6A800     ASTLVL = 00000004
       P0LR   = 00000C0C     SLR    = 00065600     SISR   = 00000000
       P1BR   = 80FFCE00     PCBB   = 008AF2A0     ICCS   = 00000041
       P1LR   = 001FFC5F     SCBB   = 01A62600     SID    = 067F014F

       ICR    = FFFFEDEA     REVR1  = 11121111     NMIFSR = 000C0000
       TODR   = 2B914C0F     REVR2  = FF00FF12     NMIEAR = 2243F830
       COR    = 00000001     CPUINFO= 000009F7     MEMCSR0= 000700F0
            NBIA0 CSR0 = 00203810         NBIA1 CSR0 = 00000000

       ISP    = 8016AC00
       KSP    = 7FFE7D30
       ESP    = 7FFE9E00
       SSP    = 7FFEDE00
       USP    = 7FF8E590
```

```
NMI bus silo:

            00000000
            00000000
            00000000
            00000000
            00000000
            00000000
            00000000
            00000000
            00000000
            00000000
            00000000
            00000000
            00000000
            00000000
            00000000

          Spinlocks currently owned by CPU 00

IOLOCK8                              Address : 80185E50
Owner CPU ID      : 00               IPL     : 08
Ownership Depth   : 0001             Rank    : 14
CPUs Waiting      : 0000             Index   : 34

CPU 01 Processor crash information
----------------------------------

CPU 01 reason for Bugcheck: CPUEXIT, Shutdown requested by another CPU

Process currently executing on this CPU:   None

Current IPL: 31  (decimal)

General registers:

    R0  = 00000020   R1  = 00000000   R2  = 8000CA78   R3  = 80DAF000
    R4  = 80487000   R5  = 83ED5E00   R6  = 7FFA4188   R7  = 7FF28EB8
    R8  = 7FF28E68   R9  = 7FFA2808   R10 = 7FFA4000   R11 = 7FFE0070
    AP  = 7FF28D90   FP  = 7FF28D98   SP  = 80DAFBF8   PC  = 80765465
    PSL = 041F0000

Processor registers:

    P0BR   = 83EE8E00     SBR    = 01A6A800     ASTLVL = 00000004
    P0LR   = 000001C1     SLR    = 00065600     SISR   = 00000000
    P1BR   = 837FA600     PCBB   = 00BB62A0     ICCS   = 00000041
    P1LR   = 001FF935     SCBB   = 01A62600     SID    = 06FF014F

    ICR    = FFFFE7C1     REVR1  = 11121111     NMIFSR = 000C0000
    TODR   = 2B914C0F     REVR2  = FF00FF12     NMIEAR = 24080000
    COR    = 00000001     CPUINFO= 000009F7     MEMCSR0= 000700F0
         NBIA0 CSR0 = 00203810          NBIA1 CSR0 = 00000000

    ISP    = 80DAFBF8
    KSP    = 7FFE7E00
    ESP    = 7FFE9E00
    SSP    = 7FFED04E
    USP    = 7FF28D90
```

```
NMI bus silo:
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000
                00000000

              No spinlocks currently owned by CPU 01
```

This long display reflects the output of the SHOW CRASH command within the analysis of a system failure that occurred on a VAX 8800 multiprocessing system.

The first part of the display includes the following information:

❶ Identification of the system and the version of VMS it was running at the time of the crash

❷ Indication that the failed processor (CPU 00) was not the primary (CPU 01), but requested CPU 01 to take a CPUEXIT bugcheck. (CPU 01 was, in fact, idle at the time of the crash.)

The next part of the display shows information particular to CPU 00:

❸ CPU 00 encountered an INVEXCEPTN bugcheck while executing the NETACP process.

❹ Although the next step in the analysis may be to examine the interrupt stack of CPU 00, the fact that the failure occurred at IPL 8 may be grounds to suspect that an I/O driver is involved.

At the end of the example, SDA CPU context remains that of CPU 00; its current process context is that of the NETACP process.

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* }

PARAMETER

device-name

Device or devices for which data structures are to be displayed. There are several uses of the **device-name** parameter:

To display the structures for . . .	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 device type (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$).

In a VAXcluster environment, device information is displayed for each device in the VAXcluster with the specified **device-name**. You can limit the display to those devices that are on a particular node or HSC by specifying the node name or HSC name as part of the **device-name** (for example, GREEN$D or GREEN$DB).

QUALIFIER

/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 thus 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.

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 **DDB list** display to provide a brief summary of the devices for which it renders information in subsequent screens.

Information in the **DDB list** appears in six columns, the contents of which are as follows:

1. Address of the device data block (DDB)
2. Controller name
3. Name of the ancillary control process (ACP) or extended QIO processor (XQP) associated with the device
4. Name of the device driver
5. Address of the driver prologue table (DPT)
6. Size of the 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.

For a detailed explanation of I/O data structures displayed by SDA, consult the *VMS Device Support Manual*.

EXAMPLES

1

```
SDA> SHOW DEVICE VTA20
VTA20 ==> LTA20                          VT200_Series      UCB address:  8042E4C0

Device status:    00010110 online,bsy,deleteucb
Characteristics:  0C040007 rec,ccl,trm,avl,idv,odv
                  00000200 nnm

Owner UIC [000001,000004]   Operation count       5793   ORB address    8042E590
      PID         00010064   Error count             0   DDB address    80CEF2E0
Class/Type           42/6E   Reference count         2   DDT address    807696FB
Def. buf. size          80   BOFF                 0155   CRB address    80BC8B00
DEVDEPEND         180093A0   Byte count           0100   IRP address    80BE2B00
DEVDEPND2         7962100C   SVAPTE           804801C0   I/O wait queue    empty
FLCK/DLCK         00000012   DEVSTS               0000

                                 I/O request queue
                                 -----------------

STATE    IRP      PID    MODE CHAN  FUNC    WCB      EFN    AST      IOSB     STATUS

 C   80BE2B00  00010064  E    FFC0  C000  00000000  29  80127458  7FFA800C  0003
     nop bufio,func
```

This example reproduces the SHOW DEVICE display for a single device unit, VTA20. Whereas this display lists information from the UCB for VTA20, 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 sort of information, specify the **device-name** as VTA (for example, SHOW DEVICE VTA).

2

```
SDA> SHOW DEVICE DU
I/O data structures
-------------------
                          DDB list
                          --------

      Address    Controller     ACP       Driver      DPT    DPT size
      -------    ----------     ---       ------      ---    --------

      80D0B3C0   BLUES$DUA     F11XQP    DSDRIVER   807735B0  679D
      8000B2B8   RED$DUA       F11XQP    DSDRIVER   807735B0  679D
      80D0B9C0   RED$DUS       F11XQP    DSDRIVER   807735B0  679D
      80D08BA0   BIGTOP$DUA    F11XQP    DSDRIVER   807735B0  679D
      80D08AE0   TIMEIN$DUA    F11XQP    DSDRIVER   807735B0  679D
   .
   .
   .
Press RETURN for more.
   .
   .
   .
```

This excerpt from the output of the SHOW DEVICE DU command illustrates the format of the **DDB list** display. In this case, the **DDB list** concerns itself with those devices whose device type begins with DU (that is, DUA and DUS). It displays devices of these types attached to various HSCs (RED$ and BLUES$) and systems in a VAXcluster (BIGTOP$ and TIMEIN$).

Following the **DDB list**, SHOW DEVICE DU produces displays for each controller and each unit on each controller, as illustrated in the next example.

```
3  SDA>  SHOW DEVICE DUS
   I/O data structures
   -------------------
                              DDB list
                              --------

        Address     Controller      ACP       Driver      DPT    DPT size
        -------     ----------      ---       ------      ---    --------

        80D0B9C0     RED$DUS        F11XQP    DSDRIVER   807735B0  679D

   Controller: RED$DUS
   -------------------

                  --- LOVE System Block (SB) 80D0C500 ---

   System ID              00000000FFF2    Local software type          HSC
   Max message size                 66    Local software vers.         Y35Q
   Max datagram size                62    Local software incarn.   6DF9E6E0
   Local hardware type            HS50                             008FCC83
   Local hardware vers.  2722722221A3    SCS poller timeout           0002
                         000000272272    SCS poller enable mask         01

                  --- Path Block (PB) 80D0BEA0 ---

              Status:  0028

   Remote sta. addr.      00000000000B    Remote port type              HSC
   Remote state           00000000000B    Number of data paths            2
   Remote hardware rev.       00000225    Cables state            A-OK B-OK
   Remote func. mask          4F710200    Local state                  OPEN
   Resetting port                   05    Port dev. name               PAA0
   Handshake retry cnt.              1    SCS MSGBUF address       80BCD510
   Msg. buf. wait queue          empty    PDT address              803B38D0

               --- Device Data Block (DDB) 80D0B9C0 ---

   Driver name          DUDRIVER   Alloc. class        254   DDT address    80773640
   ACP ident                F11   SB address      80D0C500
   ACP class               PACK   UCB address     803B9C60

           ---  Primary Channel Request Block (CRB) 80BF7000 ---

   Reference count         17    Wait queue          empty    Aux. struct.    803B4150
   Due time          00012DCC    Timeout rout.    807743D1    Timeout link    8039E03C
   IDB address       80D0C440                                 Ctrl. init.     80773774
   ADP address       80BF7F70

               --- Driver Dispatch Table (DDT) 80773640 ---

   Errlog buf sz            0    Diag buf sz           104    FDT size            244
   Start I/O         80773B21    Register dump      return    FDT address     80773680
   Alt start I/O       return    Unit init         80775970   Mnt verify      80775BC2
   Cancel I/O        807763A7    Unsol int         80774602   Cloned UCB        return

   RED$DUS3                                  RA81              UCB address:  803B9C60

   Device status:    00021810 online,valid,unload,lcl_valid
   Characteristics:  1C4D4008 dir,fod,shr,avl,mnt,elg,idv,odv,rnd
                     000002A1 clu,mscp,srv,nnm
```

```
Owner UIC [100001,000063]   Operation count      55595   ORB address     803B9D90
      PID        00000000   Error count              0   DDB address     80D0B9C0
Alloc. lock ID   00010161   Reference count          3   DDT address     80773640
Alloc. class          254   Online count             2   VCB address     8044D940
Class/Type          01/15   BOFF                  0000   CRB address     80BF7000
Def. buf. size        512   Byte count            0A00   PDT address     803B38D0
DEVDEPEND        04E00E33   SVAPTE            835C7738   CDDB address    803B4150
DEVDEPND2        00000000   DEVSTS                0004   I/O wait queue    empty
FLCK/DLCK        00000012   RWAITCNT              0000

           --- Primary Class Driver Data Block (CDDB) 803B4150 ---

Status:              1040 alcls_set,bshadow
Controller Flags:    80D6 cf_shadw,cf_mlths,cf_this,cf_misc,cf_attn,cf_replc

Allocation class      254    CDRP Queue      80BD1170    DDB address     8000B2B8
System ID        0000FFF2    Restart Queue      empty    CRB address     80BF7000
                     0000    DAP Count              1    CDDB link       803C01C0
Contrl. ID       0000FFF2    Contr. timeout        75    PDT address     803B38D0
                 01010000    Reinit Count           0    Original UCB    00000000
Response ID      00000000    Wait UCB Count         0    UCB chain       803B89A0
MSCP Cmd status  FFFFFFFF

    *** I/O request queue is empty ***

           --- Volume Control Block (VCB) 8044D940 ---

Volume: VMSCMSMASTER     Lock name: VMSCMSMASTER
Status:  A0 extfid,system
Status2: 15 writethru,mountver,nohighwater
Shadow status: 21 shadmast,mvbegun

Mount count            1    Rel. volume            0    AQB address     80D0BAE0
Transactions           3    Max. files        111384    RVT address     803B9C60
Free blocks       205989    Rsvd. files            9    FCB queue       80BD87B0
Window size            7    Cluster size           3    Cache blk.      8044DA30
Vol. lock ID    00010167    Def. extend sz.        5    Shadow mem. FL  80CF5C40
Block. lock ID  01A50139    Record size            0    Shadow mem. BL  80CF5BE0
Shadow lock ID  00010168

        --- Shadow set $254$DUS3 member summary ---

Volume: JAZZLORE

Physical unit     Primary path      Secondary path    Member status
-------------     ------------      --------------    -------------
$254$DUA129       RED                 -- none --      Shadow set member
$254$DUA139       RED                 -- none --      Shadow set member

               --- ACP Queue Block (AQB) 80D0BAE0 ---

ACP requests are serviced by the eXtended Qio Processor (XQP)

Status: 14 defsys,xqioproc

Mount count            56    ACP type           f11v2    Request queue   00000000
                             ACP class              0

    *** ACP request queue is empty ***

RED$DUS5                              RA80              UCB address:  803B9DF0
```

```
Device status:    00021810 online,valid,unload,lcl_valid
Characteristics:  1C4D4008 dir,fod,shr,avl,mnt,elg,idv,odv,rnd
                  000002A1 clu,mscp,srv,nnm
    .
    .
    .
```

The previous example illustrates the output of the command SHOW DEVICE DUS command, where two shadow sets (RED$DUS3 and RED$DUS5) are associated with the HSC RED$. There is a controller display for RED$DUS, and a unit display for each of the two shadow sets.

SHOW EXECUTIVE

Displays the location and size of each loadable image that makes up the VMS executive.

FORMAT

SHOW EXECUTIVE

PARAMETERS

None.

QUALIFIERS

None.

DESCRIPTION

The VMS executive consists of a fixed portion and a loadable portion. The fixed portion is known as SYS$SYSTEM:SYS.EXE and consists of three parts:

- System service dispatch vectors
- Universal executive routine vectors
- Globally referenced data cells

The loadable portion consists of a number of independent images that perform the work of the VMS operating system.

The SHOW EXECUTIVE command lists the location and size of each image within the loadable portion of the executive image. It can thus enable you to determine whether a given memory address falls within the range occupied by a particular loadable image. (Table SDA–5 describes the contents of each loadable image.)

By default, SDA displays each location within the loadable portion of the executive as an offset from the beginning of one of the loadable images: for instance, EXCEPTION+00282. Similarly, those symbols that represent system services point to the vector region and not the system service's loadable code. When tracing the course of a system failure through the listings of modules contained within a given loadable 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 modules that make up the loadable portion of the executive image. See the description of the READ command for additional information.

The SHOW EXECUTIVE command usually shows all components of the executive image, as illustrated in the following example. In rare circumstances, you may obtain a partial listing. For instance, once 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. Later, if the system should fail sometime during initialization, it may not have been able to load some of the modules that appear above EXCEPTION in the SHOW EXECUTIVE display (see the following example).

EXAMPLE

```
SDA> SHOW EXECUTIVE
VMS Executive Layout
--------------------
```

Image	Base	End	Length
SYSMSG	8015AA00	80183600	00028C00
RECOVERY_UNIT_SERVICES	80211400	80212000	00000C00
RMS	80183600	801A7E00	00024800
CPULOA	801B2800	801B3200	00000A00
LMF$GROUP_TABLE	801B3800	801B3C00	00000400
SYSLICENSE	801B4000	801B5400	00001400
SYSGETSYI	801B5A00	801B7000	00001600
SYSDEVICE	801B7400	801B8A00	00001600
MESSAGE_ROUTINES	801B9000	801BB600	00002600
EXCEPTION	801CBA00	801D3E00	00008400
LOGICAL_NAMES	801D4600	801D6000	00001A00
SECURITY	801D6600	801D7C00	00001600
LOCKING	801D8200	801DA800	00002600
PAGE_MANAGEMENT	801DAE00	801E2600	00007800
WORKING_SET_MANAGEMENT	801E2E00	801E7200	00004400
IMAGE_MANAGEMENT	801E7C00	801EA400	00002800
EVENT_FLAGS_AND_ASTS	801EAA00	801EBE00	00001400
IO_ROUTINES	801EC400	801F2C00	00006800
PROCESS_MANAGEMENT	801F3200	801F9400	00006200
ERRORLOG	80204C00	80205600	00000A00
PRIMITIVE_IO	80205C00	80206C00	00001000
SYSTEM_SYNCHRONIZATION	80207000	80208C00	00001C00
SYSTEM_PRIMITIVES	80209200	8020C400	00003200

The SHOW EXECUTIVE command displays the location and length of the loadable images included in the VMS executive.

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; similarly, the ninth column, when read left to right, records the ASCII equivalent of the contents. (Note that the period character (.) in this column indicates an ASCII character that cannot be displayed.)

After it displays the contents of the first header block, the SHOW HEADER command displays the hexadecimal contents of the saved error log buffers.

See the *VAX/VMS Internals and Data Structures* manual for a discussion of the information contained in the dump file header.

EXAMPLE

```
SDA>  SHOW HEADER
Dump file header
----------------
7FF03944 7FFED04E . . . 000000C1 00000000  ........................N...D9.. 00000000
00000000 00000000 . . . 00040000 80185200  .R.............................. 00000020
00000000 00000000 . . . 00000000 00000000  ................................ 00000040
00020000 00000000 . . . 15000011 00000000  ................................ 00000060
414E454C 45480800 . . . 0000012C 00000000  ....,.....................GARNER 00000080
FE9E007F F74D7C0A . . . 00000000 00002020  ..........%.@.o41......M....... 000000A0
   .
   .
   .
Saved error log messages
------------------------
00000000 00000009 . . . 801D8739 00000300  ....9.......5.................. 801D8600
7B0090AC 2FCBCEC2 . . . 414E454C 45480800  ..GARNER  ..........&.zxcv.O... 801D8620
00202041 4E454C45 . . . 01080100 0000C30A  .A........d............GARNER  . 801D8640
   .
   .
   .
```

SHOW HEADER

The SHOW HEADER command displays the contents of the dump file's header from address $6B0_{16}$ to address $C90_{16}$. Ellipses indicate hexadecimal information omitted from the display.

SHOW LOCK

Displays information about all lock management locks in the system, or about a specified lock.

FORMAT

SHOW LOCK { *lock-id* | */ALL* }

PARAMETERS

lock-id
Name of a specific lock.

QUALIFIER

/ALL
Lists all locks that exist in the system. This is the default behavior of the SHOW LOCK command.

DESCRIPTION

The SHOW LOCK command displays the information described in Table SDA–7 for each lock management lock in the system, or for the lock indicated by **lock-id**. (Use the SHOW SPINLOCK command to display information about spin locks.) You can obtain a similar display for the locks owned by a specific process by issuing the appropriate SHOW PROCESS/LOCKS command. See the *VMS System Services Reference Manual* for additional discussion of the significance of this information.

You can display information about the resource to which a lock is queued by issuing the SHOW RESOURCE command specifying the resource's **lock-id**.

Table SDA–7 Contents of the SHOW LOCK and SHOW PROCESS /LOCKS Displays

Display Element	Description
Process Index[1]	Index into the PCB array to a pointer to the process control block (PCB) of the process that owns the lock
Name[1]	Name of the process that owns the lock
Extended PID[1]	Clusterwide identification of the process that owns the lock
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
Granted at	Lock mode at which the lock was granted
Sublocks	Identification numbers of the locks that the lock owns

[1]This display element is produced only by the SHOW PROCESS/LOCKS command.

Table SDA–7 (Cont.) Contents of the SHOW LOCK and SHOW PROCESS/LOCKS Displays

Display Element	Description
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.
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 VMS lock manager.
Length	Length of the resource name.
—	Processor access mode of the name space in which the resource block (RSB) associated with the lock resides.
—	Owner of the resource. Certain resources owned by the VMS operating system list "System" as the owner. Resources owned by a group have the number (in octal) of the owning group in this field.
—	Indication of whether the lock is mastered on the local system or is a process copy.

EXAMPLE

```
SDA> SHOW LOCK
Lock database
-------------

Lock id:  00010001   PID:    00000000   Flags:   NOQUEUE SYNCSTS SYSTEM
Par. id:  00000000   Granted at    EX             CVTSYS
Sublocks:        1
LKB:      80D0B8A0
Resource:       5F535953 24535953    SYS$SYS_  Status:  NOQUOTA
 Length   16   00000000 4C774449    IDwL....
 Exec. mode    00000000 00000000    ........
 System        00000000 00000000    ........
Local copy

Lock id:  00010004   PID:    00000000   Flags:   CONVERT SYNCSTS CVTSYS
Par. id:  00000000   Granted at    CR
Sublocks:       16
LKB:      80D091A0   BLKAST
Resource:       4D567624 42313146    F11B$vVM  Status:  NOQUOTA
 Length   18   20204E41 4A353153    S15JAN
 Kernel mode   00000000 00002020      ......
 System        00000000 00000000    ........
Local copy
```

```
Lock id:  00280009   PID:    00000000   Flags:   VALBLK  CONVERT SYNCSTS
Par. id:  00000000   Granted at    CR            NOQUOTA CVTSYS
Sublocks:        0
LKB:      80CDA880
Resource:       52414B5F 24535953    SYS$_KAR  Status:  MSTCPY
 Length   17   30415544 24455441    ATE$DUA0
 Kernel mode   00000000 0000003A    :.......
 System        00000000 00000000    ........
Master copy of lock 001C00F5 on system 000100A1
    .
    .
    .
SDA>  SHOW RESOURCE/LOCK=280009
Resource database
-----------------
Address of RSB:  80BD2150  Group grant mode:       CR
Parent RSB:      00000000  Conversion grant mode:  CR
Sub-RSB count:          0  BLKAST count:            0
Value block:   00000000 00000000 00000000 00000019   Seq. #:  0000002D
Resource:       52414B5F 24535953    SYS$_KAR
 Length   17   30415544 24455441    ATE$DUA0         CSID:  00000000
 Kernel mode   00000000 0000003A    :.......
 System        00000000 00000000    ........

Granted queue (Lock ID / Gr mode):
     00DA1269  CR       00280009  CR       0094054D  CR
     00270B9F  CR       00D70BFE  CR       000D0F4F  CR
     000D1017  CR       00601418  CR       01131450  CR
     000F1964  CR       000200DF  CR

Conversion queue (Lock ID / Gr/Rq mode):
     *** EMPTY QUEUE ***

Waiting queue (Lock ID / Rq mode):
     *** EMPTY QUEUE ***
```

This SDA session shows the output of the SHOW LOCK command for several locks. The SHOW RESOURCE command, executed for the last displayed lock, verifies that the lock is in the resource's granted queue, among many other locks given concurrent read (CR) access to the resource. (See Table SDA–13 for a full explanation of the contents of the display of the SHOW RESOURCE command.)

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 *[/qualifier[,...]] [range]*

PARAMETER

range

Range of virtual addresses for which SDA is to display page table entries. You can express a range using the following syntax:

m:n Range of virtual addresses from *m* to *n*

m;n Range of virtual addresses starting at *m* and continuing for *n* bytes

QUALIFIERS

/GLOBAL

Lists the global page table.

/SYSTEM

Lists the system page table.

/ALL

Lists both the global and system page tables. This is default behavior of SHOW PAGE_TABLE.

DESCRIPTION

For each virtual address displayed by the SHOW PAGE_TABLE command, the first six columns of the listing provide the associated page table entry and describe its location, characteristics, and contents (see Table SDA–8). SDA obtains this information from the system page table.

If the virtual page has been mapped to a physical page, the last nine columns of the listing include information from the page frame number (PFN) database (see Table SDA–9). Otherwise, the section is left blank.

SDA indicates pages are inaccessible by displaying the following message:

```
-------- n NULL PAGES
```

Here, *n* indicates the number of inaccessible pages.

Table SDA–8 Virtual Page Information in the SHOW PAGE_TABLE Display

Value	Meaning
ADDRESS	System virtual address that marks the base of the virtual page
SVAPTE	System virtual address of the page table entry that maps the virtual page
PTE	Contents of the page table entry, a longword that describes a system virtual page
Type	Type of virtual page. There are the following eight types:

Type	Meaning
VALID	Valid page (in main memory)
TRANS	Transitional page (between main memory and page lists)
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.

PROT	Protection: a code, derived from bits in the PTE, that designates the type of access (read and/or write) granted to processor access modes (kernel, executive, supervisor, or user)
Bits	Letters that represent the setting of a bit or a combination of bits in the PTE. These bits indicate attributes of a page. The following codes are listed:

Code	Meaning
M	Page has been modified.
L	Page is locked into a working set.
K	Owner can access the page in kernel mode.
E	Owner can access the page in executive mode.
S	Owner can access the page in supervisor mode.
U	Owner can access the page in user mode.

Table SDA–9 Physical Page Information in the SHOW PAGE_TABLE Display

Category	Meaning
PAGTYP	Type of physical page, one of the following six types:

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.
PPGTBL	Page is part of a process's page table.
GPGTBL	Page is part of a global page table.
GBLWRT	Page is part of a global, writable section.

LOC — Location of the page within the system, one of the following eight types:

Location	Meaning
ACTIVE	Page is in a working set.
MDFYLST	Page is in the modified page list.
FREELST	Page is in the free page list.
BADLST	Page is in the bad page list.
RELPEND	Release of the page is pending.
RDERROR	Page has had an error during an attempted read operation.
PAGEOUT	Page is being written into a paging file.
PAGEIN	Page is being brought into memory from a paging file.

STATE	Byte that describes the state of the physical page.
TYPE	Byte that describes the type of virtual page. The types in this column are the hexadecimal codes that stand for the page types that appear in column PAGTYP of this display, described previously.
REFCOUNT	Count of the processes that are referencing this PFN. If the value of REFCOUNT is nonzero, the page is used in at least one working set. If the value is zero, the page is not used in any working set.
BAK	Address of the backing store; location on a disk device to which pages can be written.
SVAPTE	Virtual address associated with this page frame. The two SVAPTEs indicate a valid link between physical and virtual address space.
FLINK	Forward link within PFN database that points to the next virtual page; this longword also acts as the count of the number of processes that are sharing this global section.
BLINK	Backward link within PFN database; also acts as an index into the working set list.

EXAMPLE

```
SDA> SHOW PAGE_TABLE


System page table
-----------------

ADDRESS  SVAPTE   PTE  TYPE  PROT  BITS PAGTYP   LOC STATE TYPE REFCNT BAK      SVAPTE    FLINK     BLINK
   .
   .
   .
8AD22E00 F8020725      VALID UR       K
8AD22E04 F8020726      VALID UR       K
8AD22E08 F8020727      VALID UR       K
8AD22E0C F8020728      VALID UR       K
8AD22E10 F8020729      VALID UR       K
8AD22E14 EC02072A      VALID UREW  M  K
8AD22E18 F402072B      VALID URKW  M  K
   .
   .
   .
8AD22FEC F801F10E      VALID UR       K SYSTEM ACTIVE  07   01     1 0040FFF8  8AD22FEC  00000000  00000258
8AD22FF0 F801F10F      VALID UR       K SYSTEM ACTIVE  07   01     1 0040FFF8  8AD22FF0  00000000  00000257
8AD22FF4 F801F173      VALID UR       K SYSTEM ACTIVE  07   01     1 0040FFF8  8AD22FF4  00000000  000004B1
8AD22FF8 F801F172      VALID UR       K SYSTEM ACTIVE  07   01     1 0040FFF8  8AD22FF8  00000000  00000301
8AD22FFC F801F17F      VALID UR       K SYSTEM ACTIVE  07   01     1 0040FFF8  8AD22FFC  00000000  000000F5
8AD23000 F801F17E      VALID UR       K SYSTEM ACTIVE  07   01     1 0040FFF8  8AD23000  00000000  00000174
8AD23004 7801EBC6      TRANS UR       K SYSTEM FREELST 00   01     0 0040FFF8  8AD23004  0000D38B  0001EBC7
   .
   .
   .
```

SHOW PFN_DATA

Displays information that is contained in the page lists and PFN database.

FORMAT

SHOW PFN_DATA *[pfn] [/qualifier]*

PARAMETER

pfn
Page frame number (PFN) of the physical page for which information is to be displayed.

QUALIFIERS

/ALL
Displays the free page list, modified page list, and bad page list. 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 high limit.

/FREE
Displays the free page list. SDA precedes the list with a count of the pages it contains, its low limit, and high limit.

/MODIFIED
Displays the modified page list. SDA precedes the list with a count of the pages it contains, its low limit, and high limit.

/SYSTEM
Displays the entire PFN database in order by page frame number, starting at PFN 0000.

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. Table SDA–10 lists the contents of the display.

Table SDA–10 Page Frame Number Information in the SHOW PFN_DATA Display

Item	Contents
PFN	Page frame number
PTE ADDRESS	System virtual address of the page table entry that describes the virtual page mapped into this physical 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
REFCNT	Number of references being made to this page
FLINK	Address of the next page in the list in which this virtual page currently resides
BLINK	Address of the previous page in the list in which this virtual page currently resides
TYPE	Type of virtual page, one of the following:

Code	Meaning
00	Process page
01	System page
02	Global, read-only page
03	Global, read/write page
04	Process page-table page
05	Global page-table page

STATE	State of the virtual page, the low nibble of which can be one of the following:

Code	Meaning
0	Page is on the free page list.
1	Page is on the modified page list.
2	Page is on the bad page list.
3	Release of the page to the free or modified page list is pending.
4	Error occurred as the page was being read from the disk.
5	Modified page writer is currently writing the page to the disk.
6	Page fault handler is currently reading the page from the disk.
7	Page is active and valid.

EXAMPLE

```
SDA> SHOW PFN_DATA
Free page list
--------------
Count:              225
Low limit:           57
High limit: 1073741824

PFN   PTE ADDRESS   BAK      REFCNT FLINK BLINK    TYPE        STATE
----  ----------- --------  ------ ----- -----  ----------  ----------
1329    8047AF3C  03002A83       0  1963 0000   00 PROCESS  00 FREELST
1963    8047AB10  03002A43       0  017C 1329   00 PROCESS  00 FREELST
017C    8047B3F8  03002A84       0  14B4 1963   00 PROCESS  00 FREELST
14B4    8047B464  03002A85       0  1529 017C   00 PROCESS  00 FREELST
1529    8047AA34  03002A87       0  1485 14B4   00 PROCESS  00 FREELST
1485    8047AC80  030010B3       0  1707 1529   00 PROCESS  00 FREELST
   .
   .
   .
```

The SHOW PFN_DATA command displays the information shown previously for the free page list, the modified page list, and the bad page list, and then all of the PFN database, including the first three lists.

SHOW POOL

Displays information about the disposition of memory, paged and nonpaged, including the lookaside lists (SRP, IRP, and LRP), nonpaged dynamic storage pool, and paged dynamic storage pool.

FORMAT

SHOW POOL [*/FREE* | */HEADER* | */SUMMARY* | */TYPE=block-type*] [*range* | */ALL* | */IRP* | */LRP* | */NONPAGED* | */PAGED* | */SRP*]

PARAMETERS

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 allocated pool, including the lookaside lists, nonpaged dynamic storage pool, and paged dynamic storage pool. This is the default behavior of the SHOW POOL command.

/FREE

Displays the entire contents, both allocated and free, of the specified region or regions of pool. You cannot use the /FREE qualifier when you use a **range** to indicate a region of pool to be displayed.

/HEADER

Displays only the first 16 longwords of each data block found within the specified region or regions of pool.

/IRP

Displays the contents of the I/O request packets (IRPs) currently in use.

/LRP

Displays the contents of the large request packets (LRPs) currently in use.

/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.

/SRP
Displays the contents of the small request packets (SRPs) currently in use.

/SUMMARY
Displays *only* an allocation summary for each specified region of pool.

/TYPE=block-type
Displays the blocks within the specified region or regions of pool that are of the indicated **block-type**. If SDA finds no blocks of that type in the pool region, it displays a blank screen, followed by an allocation summary of the region.

DESCRIPTION

The SHOW POOL command displays information about the contents of any specified region of pool in an 8-column format. The contents of the full display, from left to right, are listed as follows:

Column 1 contains the type of control block that starts at the virtual address in pool indicated in column 2. If SDA cannot interpret the block type, it displays a block type of "UNKNOWN." Column 3 lists the number of bytes (in decimal) of memory allocated to the block. The block size is fixed for SRPs, IRPs, and LRPs, and is variable in the paged and nonpaged pools.

The remaining columns contain a dump of the contents of the block, in 4-longword intervals, until the block is complete. Columns 4 through 7 display, from right to left, the contents in hexadecimal; column 8 displays, from left to right, the contents in ASCII. If the ASCII value of a byte is not a printing character, SDA displays a period character (.) instead.

For each region of pool it examines, the SHOW POOL command displays an allocation summary. This 4-column table lists, in column 2, the types of control block identified in the region and records the number of each in column 1. The last two columns represent the amount of the pool region occupied by each type of control block: column 3 records the total number of bytes and column 4 the percentage. The summary concludes with an indication of the number of bytes used within the particular pool region, as well as the number of bytes remaining. It provides an estimate of the percentage of the region that has been allocated.

EXAMPLES

1

```
SDA> SHOW POOL
IRP lookaside list
------------------
                    Dump of blocks allocated from IRP lookaside list

CIMSG   80BADE00   208
                     001000DA 003C0090 0000A900 00036FF0 .o........<....
                     D9B3001C 00000000 A0B5001D 35E60017 ...5............
                     41414141 00000600 65EA0004 00000600 .......e....AAAA
                     41414141 41414141 41414141 41414141 AAAAAAAAAAAAAAAA
   .
   .
   .
FCB     80BAE070   208
                     00000000 000700D0 80BAECA0 80BD9B30 0...............
                     00000000 00000000 80BAE080 80BAE080 ................
                     00000001 00000002 000C017B 00010000 ....{...........
                     00000001 00000003 0000023E 0000606C 1'..>...........
   .
   .
   .
IRP     80BAE140   208
                     000100D1 410A00C4 0015D9A0 0015D9A0 ..........A....
                     80431820 00000000 7FFA2808 80127458 Xt.......... .C.
                     80422450 1019FF80 7FFA2814 1C1D0032 2..........P$B.
                     61616161 80431820 00000000 000601B9 ........ .C.aaaa
   .
   .
   .
```

The SHOW POOL command lists the used contents of the IRP lookaside list, among which are the CI message block (CIMSG), file control block (FCB), and I/O request packet (IRP). When it completes the listing for the IRP lookaside list, it displays a summary of IRP allocation information.

The SHOW POOL command continues, displaying similar information for the other regions of pool—the LRP and SRP lookaside lists, nonpaged dynamic storage pool, and paged dynamic storage pool.

2

```
SDA>  SHOW POOL G0BADE00;260
Non-paged dynamic storage pool
------------------------------
                    Dump of blocks allocated from non-paged pool

CIMSG   80BADE00   144
                     001000DA 003C0090 0000A900 00036FF0 .o........<.....
                     D9B3001C 00000000 A0B5001D 35E60017 ...5............
                     41414141 00000600 65EA0004 00000600 .......e....AAAA
                     41414141 41414141 41414141 41414141 AAAAAAAAAAAAAAAA
                     41414141 41414141 41414141 41414141 AAAAAAAAAAAAAAAA
   .
   .
   .
```

```
UNKNOWN 80BADE90   112
                    41414141 41414141 41414141 41414141 AAAAAAAAAAAAAAAA
                    41414141 41414141 41414141 41414141 AAAAAAAAAAAAAAAA
                    41414141 41414141 41414141 41414141 AAAAAAAAAAAAAAAA
                    41414141 41414141 41414141 41414141 AAAAAAAAAAAAAAAA
   .
   .
   .
CIDG    80BADED0   144
                    807708BB 003B0090 0004D7E0 000008F0 ..........;...w.
                    61616161 61616161 61616161 016CE87C ..l.aaaaaaaaaaa
                    61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
                    61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
   .
   .
   .
UNKNOWN 80BADF60    64
                    61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
                    61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
                    61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
                    61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
   .
   .
   .
CIDG    80BADFA0   144
                    807708BB 003B0090 0003FFC0 0004B1B0 ..........;...w.
                    61616161 61616161 61616161 016CE94C L.l.aaaaaaaaaaa
                    61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
                    61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
   .
   .
   .
UNKNOWN 80BAE030    48
                    61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
                    61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
                    61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa

Summary of non-paged pool contents

    3  UNKNOWN   =      176  (29%)
    2  CIDG      =      288  (48%)
    1  CIMSG     =      144  (24%)

Total space used = 608 out of 608 total bytes, 0 bytes left

Total space utilization = 100%
```

The preceding example examines 608 (260_{16}) bytes of nonpaged pool, starting at address $80BADE00_{16}$, which happens to be the starting address of the CIMSG block listed in the previous example's output. SDA attempts to identify allocated blocks as it proceeds through the specified region of pool, and displays an allocation summary when it completes the listing.

3

```
SDA> SHOW POOL/FREE
IRP lookaside list
------------------
                    Dump of blocks allocated from IRP lookaside list

CIMSG   80BADE00   208
                     001000DA 003C0090 0000A900 00036FF0 .o..............
                     D9B3001C 00000000 A0B5001D 35E60017 ...5............
                     41414141 00000600 65EA0004 00000600 .......e....AAAA
                     41414141 41414141 41414141 41414141 AAAAAAAAAAAAAAAA
   .
   .
   .
[Free]  80BADED0   208
                     807708BB 003B0090 0004D7E0 000008F0 .........;...w.
                     61616161 61616161 61616161 016CE87C ..l.aaaaaaaaaaa
                     61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
                     61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
   .
   .
   .
[Free]  80BADFA0   208
                     807708BB 003B0090 0003FFC0 0004B1B0 .........;...w.
                     61616161 61616161 61616161 016CE94C Ll.aaaaaaaaaaa
                     61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
                     61616161 61616161 61616161 61616161 aaaaaaaaaaaaaaaa
   .
   .
   .
```

The SHOW POOL/FREE command produces a display similar in format and extent to that presented in Example 1. However, it displays the unallocated portions of pool in addition to those that are used.

4

```
SDA>  SHOW POOL/PAGED/HEADER
Paged dynamic storage pool
--------------------------
                    Dump of blocks allocated from paged pool

RSHT    8024FE00   528
                     802DC710 00380210 00000000 FFFFFF80 .........8...-.
LNM     80250010    96
                     8015B847 00400060 802D75A0 00000000 .....u-.‘.@.G...
LNM     80250070    48
                     8015B847 01400030 802500A0 802D7400 .t-...%.0.@.G...
LNM     802500A0    96
                     8015B847 02400060 802DC170 80250070 p.%.p.-.‘.@.G...
LNM     80250100    48
                     8015B847 00400030 802DC510 802E1B60 ‘.....-.0.@.G...
   .
   .
   .
```

The SHOW POOL/PAGED/HEADER command displays only the name of each block allocated from paged pool, its starting address, its size, and the first four longwords of its contents.

SHOW PORTS

Displays those portions of the port descriptor table (PDT) that are port independent.

FORMAT

SHOW PORTS *[/ADDRESS=pdt-address]*

PARAMETERS

None.

QUALIFIER

/ADDRESS=pdt-address

Displays the specified port descriptor table (PDT).[11]

DESCRIPTION

The SHOW PORTS command provides port-independent information from the port descriptor table (PDT) for those CI ports with full SCS connections. This information is used by all system communications services (SCS) port drivers.

Note that the SHOW PORTS command does *not* display similar information about UDA ports, BDA ports, and similar controllers.

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.

[11] You can find the **pdt-address** for any active connection on the system in the **PDT summary page** display of the SHOW PORTS command. In addition, CDT addresses are also stored in many individual data structures related to SCS connections: for instance in the path block displays of the SHOW CLUSTER/SCS command.

EXAMPLES

1

```
SDA> SHOW PORTS
VAXcluster data structures
--------------------------

              --- PDT Summary Page ---

 PDT Address          Type         Device          Driver Name
 -----------          ----         -------         -----------

  803B38D0             pa          PAA0            PADRIVER
  803CD6D0             pe          PEA0            PEDRIVER

              --- Port Descriptor Table (PDT) 803B38D0 ---

Type: 01 pa
Characteristics: 0000

Msg Header Size          32  Connect        807725A0  Recyclh_Msg_Buf  80772FEE
Max Xfer Bcnt       FFFFFFFF  Dealloc_Dg_Buf 807731E6  Request_Data     8077338D
DG Header Size           136  Disconnect     80772661  Send_Data        807733D6
Poller Sweep              21  Unmap          8077344A  Send_Dg_Buf      8077324A
Fork Block W.Q.        empty  Map            807732E5  Send_Msg_Buf     80773108
UCB Address          803B34F0  Map_Bypass     807732CC  Send_Cnt_Msg_Buf 8077310F
ADP Address          80BF7F70  Map_Irp        807732D5  Read_Count       8076FE90
Accept               807725ED  Map_Irp_Bypass 807732C4  Rls_Read_Count   8076FEFE
Alloc_Dg_Buf         807731D2  Queue_Dg_Buf   807731EC  Mreset           807722B7
Alloc_Msg_Buf        80772F69  Queue_Mult_Dgs 807731F4  Mstart           807722C1
Dealloc_Msg_Buf      80773047  Recycl_Msg_Buf 80772FF8  Stop_Vcs         80772304
Dealloc_Msg_Buf_Reg 8077305A  Reject         8077262C  Send_Dg_Reg      8077323D

              --- Port Descriptor Table (PDT) 803CD6D0 ---

Type: 03 pe
Characteristics: 0000

Msg Header Size          32  Connect        803C9DFC  Recyclh_Msg_Buf  803CA84A
    .
    .
    .
```

The SHOW PORTS command first lists the two SCS ports that exist within the VAXcluster and then displays information obtained from each port descriptor table (PDT).

```
2  SDA>  SHOW PORTS/ADDRESS=G3CD6D0
   VAXcluster data structures
   --------------------------

                --- Port Descriptor Table (PDT) 803CD6D0 ---

   Type: 03 pe
   Characteristics: 0000

   Msg Header Size          32  Connect        803C9DFC  Recyclh_Msg_Buf  803CA84A
      .
      .
      .

               --- Port Block 80B7CCA0 ---

   Status: 0001 authorize
   VC Count: 12
   Secs Since Last Zeroed: 77188

   SCXB Size              268              LCXB Size             1780
   SCXB Count              26              LCXB Count              30
   SCXB Max                26              LCXB Max                30
   SCXB Queue Empty      4553              LCXB Queue Empty         0
   No SCXB for ACK         47

   Bus   Error Count   Last Error     Time of Last Error
   ---   -----------   ----------   ----------------------
   0      0
   0      2             00390334    23-FEB-1988 12:43:14.99

               --- Virtual Circuit (VC) 803C0030 ---

   Remote System Name:  BLUES              Remote System ID:  AA-00-04-00-77-4C
   Local System ID:  223 (DF)              Status: 0005 open,path

   Msg Xmt                6  Msg Rcv           25736  Auth fail              0
     Unsequence           3    Unsequence          3  No RcvChan             0
     Sequence             0    Sequence            0  No XmtChan             0
     ReXmt                0    ReRcv               0  Ill ACK                0
     ACK                  0    ACK                 0  SeqMsg TMO             0
     Chan Cntl            3    Cache               0  Listen TMO             0
   Bytes Xmt            165    Ill Seq             0  CC HS TMO              0
                               Chan Cntl       25733  TR DFQ Empty           0
                               Bad Chksum          0  TR MFQ Empty           0
                               TR Short            0  CC DFQ Empty           0
                               CC Short            0  CC MFQ Empty           0
                               CC Bad ECO          0
                             Bytes Rcv       1182733

               --- Virtual Circuit (VC) 803DE9A0 ---

   Remote System Name:  GREENS             Remote System ID:  AA-00-04-00-79-4C
   Local System ID:  222 (DE)              Status: 0005 open,path
      .
      .
      .
```

The SHOW PORTS/ADDRESS command first provides a summary of port information obtained from the PDT located at $803CD6D0_{16}$. It then displays information from the associated port block and a screen describing each of its 12 virtual circuits.

SHOW PROCESS

Displays the software and hardware context of any process in the balance set.

FORMAT

SHOW PROCESS *[/qualifier[,...]]* [*ALL* | *process-name* | */INDEX=nn* | */SYSTEM*]

PARAMETERS

ALL

Shows information about all processes that exist in the system.

process-name

Name of the process for which information is to be displayed.[12]

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 ($) characters. If it contains any other characters, you must enclose the **process-name** in quotation marks (" ").

QUALIFIERS

/ALL

Displays all information shown by the following qualifiers: /PCB, /PHD, /REGISTERS, /WORKING_SET, /PROCESS_SECTION_TABLE, /PAGE_TABLES, and /CHANNEL.

/CHANNEL

Displays information about the I/O channels assigned to the process.

/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). You can supply either of the following values for **nn**:

- The process index itself
- The process identification (PID) or extended PID longword, from which SDA extracts the correct index

To obtain these values for any given process, issue the SDA command SHOW SUMMARY.

[12] Use of the **process-name** parameter, the /INDEX qualifier, or the /SYSTEM qualifier causes the SHOW PROCESS command to perform an implicit SET PROCESS command, making the indicated process the current process for subsequent SDA commands. (See the description of the SET PROCESS command and Section 4 for information on how this can affect the process context—and CPU context—in which SDA commands execute.)

/LOCKS
Displays the lock management locks owned by the current process.

The /LOCKS qualifier produces a display similar in format to that produced by the SHOW LOCKS command. See Table SDA–7 for additional information.

/P0
Displays the page tables for P0 space. See the description of the /PAGE_TABLES qualifier.

/P1
Displays the page tables for P1 space. See the description of the /PAGE_TABLES qualifier.

/PAGE_TABLES [range | /P0 | /P1]
Displays the page tables of the process's program (P0) and control (P1) regions, or, optionally, either page table or the page table entries for a **range** of addresses.

You can express a **range** using the following syntax:

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* pages, starting with page *m*

/PCB
Displays the information contained in the software process control block (PCB). This is the default behavior of the SHOW PROCESS command.

/PHD
Lists information included in the process header (PHD).

/PROCESS_SECTION_TABLE
Lists the information contained in the process section table (PST).

/REGISTERS
Lists the hardware context of the process, as reflected in the process's registers stored in the hardware PCB and—if the process is current on a processor in the VAX system—the processor's registers.

/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.

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 SDA–6 for a list of keywords that may be supplied 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.

/SYSTEM

Displays the system process control block.[13] The system PCB and process header (PHD) are dummy structures that are located in system space. These structures contain the system working set, global section table, global page table, and other systemwide data.

/WORKING_SET

Displays the process's working set list.

DESCRIPTION

The SHOW PROCESS command displays information about the process specified by **process-name**, the process specified in the /INDEX qualifier, 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 above. By default, the SHOW PROCESS command produces information about the SDA current process, as defined in Section 4.

The default of the SHOW PROCESS command provides information taken from the software process control block (PCB).[14] 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's 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 process's current scheduling state; in a VMS multiprocessing system, the display indicates the CPU ID of any process whose state is CUR.

The SHOW PROCESS/ALL command displays additional process-specific information, also provided by several of the individual qualifiers to the command.

[13] Use of the **process-name** parameter, the /INDEX qualifier, or the /SYSTEM qualifier causes the SHOW PROCESS command to perform an implicit SET PROCESS command, making the indicated process the current process for subsequent SDA commands. (See the description of the SET PROCESS command and Section 4 for information on how this can affect the process context—and CPU context—in which SDA commands execute.)

[14] This is the first display provided by the /ALL qualifier and the only display provided by the /PCB qualifier.

The **process header** display, also produced by the /PHD qualifier, provides information taken from the process header (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's use of the following resources:

- Process memory
- The pager
- The scheduler
- Asynchronous system traps
- I/O activity
- CPU activity

The **process registers** display, also produced by the /REGISTERS qualifier, describes the process's hardware context, as reflected in its registers.

There are two places where a process's hardware context is stored, as described below:

- If the process is currently executing on a processor in the VAX system (that is, in the CUR scheduling state), its hardware context is contained in that processor's registers. (That is, the process's 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 hardware context is stored in the part of the PHD known as the hardware PCB.

The **process registers** display first lists those registers stored in the hardware PCB ("Saved process registers"). If the process to be displayed is currently executing on a processor in the VAX system, the display then lists the processor's registers ("Active registers for the current process"). In each section, the display lists the registers in the following groups:

- General purpose registers (R0 through R11, the AP, FP, and PC)
- Stack pointers (KSP, ESP, SSP, and USP)
- Special-purpose registers (PC and PSL)
- Base and length registers (P0BR, P1BR, P0LR, and P1LR)

The **working set information** and **working set list** displays, also produced by the /WORKING_SET 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 the following information for each entry in the working set list:

Column	Contents
INDEX	Index into the working set list at which information for this entry can be found
ADDRESS	Virtual address of the page in the process address space that this entry describes
STATUS	Three columns that list the following status information: • Page type • Location of the page in physical memory • Indication of whether the page is locked into the working set

When SDA locates one or more unused working set entries, it issues the following message:

```
--- n empty entries
```

In this message, *n* is the number (in decimal) of contiguous, unused entries.

The **process section table information** and **process section table** displays, also produced by the /PROCESS_SECTION_TABLE qualifier, list each entry in the process section table (PST) and display the offsets to the first free entry and last used entry.

SDA displays the information listed in Table SDA–11 for each PST entry.

Table SDA–11 Process Section Table Entry Information in the SHOW PROCESS Display

Part	Definition
INDEX	Offset into the PST at which the entry is found. Because entries in the process section table begin at the highest location in the table, and the table expands toward lower addresses, the following expression determines the address of an entry in the table: $PHD + PSTBASOFF - INDEX$.
ADDRESS	Virtual address that marks the beginning of the first page of the section described by this entry.
PAGES	Length, in pages, of the process section.
VBN	Virtual block number, the number of the file's virtual block that is mapped into the section's first page.
CLUSTER	Cluster size used when faulting pages into this process section.
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.

The **P0 page table** and **P1 page table** displays, also produced by the /PAGE_TABLES qualifier, display listings of the process's page table entries in the same format as that produced by the SHOW PAGE_TABLE command (see Tables SDA–8 and SDA–9).

The **process active channels** display, the last produced by SHOW PROCESS /ALL and the only one produced by the /CHANNEL qualifier, displays the following information for each I/O channel assigned to the process:

Column	Contents
Channel	Number of the channel
Window	Address of the window control block (WCB) for the file if the device is a file-oriented device; zero otherwise
Status	Status of the device: "Busy" if the device has an I/O operation outstanding; 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 Table SDA–12.

Table SDA–12 Process I/O Channel Information in the SHOW PROCESS Display

Information Displayed[1]	Type of Process
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*.
dcuu:(file-id)filespec	SDA displays this information only when you are examining a dump. The *filespec* corresponds to the *file-id* on the device listed. If you are examining a dump from your own system, the *filespec* is probably valid. If you are examining a dump from another system, the *filespec* is probably meaningless in the context of your system.

[1] This table uses the following formulas to identify the information displayed:
dcuu:(file-id)filespec
where:
dcuu: is the name of the device.
file-id is the RMS file identification.
filespec is the full file specification, including directory name.

Table SDA–12 (Cont.) Process I/O Channel Information in the SHOW PROCESS Display

Information Displayed[1]	Type of Process
dcuu:(*file-id*)	The *file-id* no longer points to a valid *filespec*, as when you look at a dump from another system; or the process in which you are running SDA does not have enough privilege to translate the *file-id* into the corresponding *filespec*

[1]This table uses the following formulas to identify the information displayed:
dcuu:(*file-id*)*filespec*
where:
dcuu: is the name of the device.
file-id is the RMS file identification.
filespec is the full file specification, including directory name.

EXAMPLES

1 SDA> SHOW PROCESS

```
Process index: 001B   Name: PUTP1   Extended PID: 27E0011B
------------------------------------------------------------
Process status:  00044001   RES,BATCH,PHDRES

PCB address              803C7710    JIB address             806B9100
PHD address              81F5C400    Swapfile disk address   02002FA1
Master internal PID      0001001B    Subprocess count              0
Internal PID             0001001B    Creator internal PID    00000000
Extended PID             27E0011B    Creator extended PID    00000000
State                     CUR  00    Termination mailbox         0000
Current priority                3    AST's enabled               KES
Base priority                   3    AST's active                E
UIC                [00011,000176]    AST's remaining              39
Mutex count                     0    Buffered I/O count/limit     12/12
Waiting EF cluster              0    Direct I/O count/limit       18/18
Starting wait time       1B001C1C    BUFIO byte count/limit   31968/31968
Event flag wait mask     BFFFFFFF    # open files allowed left    90
Local EF cluster 0       20000001    Timer entries allowed left    9
Local EF cluster 1       C0000000    Active page table count       0
Global cluster 2 pointer 00000000    Process WS page count      1020
Global cluster 3 pointer 00000000    Global WS page count        233
```

The SHOW PROCESS command displays information taken from the software PCB of PUTP1, the SDA current process. According to the "State" field in the display, process PUTP1 is current on CPU 00 in the VMS multiprocessing system.

```
2  SDA>  SHOW PROCESS/ALL


Process index: 00AD   Name: GLOBE   Extended PID: 462002AD
------------------------------------------------------------

Process status:  02040001   RES,PHDRES

PCB address              8044E650    JIB address             806E0010
    .
    .
    .
Process header
--------------

First free P0 address      0007D600    Accumulated CPU time       00000559
Free PTEs between P0/P1     276902     CPU since last quantum          FFEE
First free P1 address      7FEF2200    Subprocess quota                   8
Free page file pages         24234     AST limit                         50
Page fault cluster size         16     Process header index            0020
Page table cluster size          2     Backup address vector       00003E12
Flags                         0002     WSL index save area         00003980
Direct I/O count               509     PTs having locked WSLs             5
Buffered I/O count             827     PTs having valid WSLs             20
Limit on CPU time         00000000     Active page tables                21
Maximum page file count      25600     Maximum active PTs                26
Total page faults             7589     Guaranteed fluid WS pages         20
File limit                      50     Extra dynamic WS entries         698
Timer queue limit               10     Locked WSLE counts array        1CD8
Paging file index         06000000     Valid WSLE counts array         2564

Saved process registers
-----------------------
R0   = 00000001    R1   = 00000000    R2   = 8000CA78    R3   = 8044E6A0
R4   = 8044E650    R5   = 00000000    R6   = 00000000    R7   = 00000003
R8   = 00001F60    R9   = 7FF9FB38    R10  = 7FF9FA08    R11  = 7FFE0070
AP   = 7FEF4AE4    FP   = 7FEF4AEC    PC   = 801622B4    PSL  = 03C00000
KSP  = 7FFE7E00    ESP  = 7FFE9E00    SSP  = 7FFED04E    USP  = 7FEF4AE4

P0BR = 82D43600    P0LR = 000003EB    P1BR = 82654E00    P1LR = 001FF792

Active registers for current process
------------------------------------
R0   = 00000001    R1   = 80002398    R2   = 00000000    R3   = 00000000
R4   = 7FFA05A0    R5   = 00000000    R6   = 0007D400    R7   = 00000010
R8   = 00001F60    R9   = 7FF9FB38    R10  = 7FF9FA08    R11  = 7FFE0070
AP   = 7FFE9D70    FP   = 7FFE9D58    PC   = 801620A5    PSL  = 01400000
KSP  = 7FFE7E00    ESP  = 7FFE9D58    SSP  = 7FFED04E    USP  = 7FEF4AE4

Working set information
-----------------------

First WSL entry          0074        Current authorized working set size   2048
First locked entry       00A6        Default (initial) working set size    512
First dynamic entry      00B9        Maximum working set allowed (quota)   2048
Last entry replaced      018C
Last entry in list       0561

Working set list
----------------

    INDEX   ADDRESS    STATUS

     0074  7FFE7C00     VALID PROCESS WSLOCK
     0075  7FFE7A00     VALID PROCESS WSLOCK
     0076  7FFE7800     VALID PROCESS WSLOCK
    .
    .
    .
```

```
Process section table information
---------------------------------

    Last entry allocated     FFA0
    First free PST entry     0000

Process section table
---------------------

INDEX  ADDRESS PAGES     WINDOW     VBN     CLUSTER  CHANNEL  REFCNT FLINK BLINK   FLAGS

 FFF8 00000200 0000000A  8082C400  00000002      0  7FFCCFD0    10    FFE8  FFF0
 FFF0 00001600 00000007  8082C400  0000000C      0  7FFCCFD0     0    FFF8  FFE8   WRT CRF
 FFE8 00002400 00000012  8082C400  00000013      0  7FFCCFD0    18    FFF0  FFF8
    .
    .
    .
P0 page table
-------------

ADDRESS  SVAPTE   PTE       TYPE  PROT BITS PAGTYP     LOC STATE TYPE REFCNT   BAK       SVAPTE FLINK BLINK

-------- 1 NULL PAGE

00000200 82D43604 F9804F73  VALID UR      U PROCESS ACTIVE  07   00     1   0040FFF8   82D43604 0000  0153
00000400 82D43608 F9806905  VALID UR      U PROCESS ACTIVE  07   00     1   0040FFF8   82D43608 0000  0154
00000600 82D4360C F9807569  VALID UR      U PROCESS ACTIVE  07   00     1   0040FFF8   82D4360C 0000  0155
    .
    .
    .
P1 page table
-------------

ADDRESS  SVAPTE   PTE       TYPE  PROT BITS PAGTYP     LOC STATE TYPE REFCNT   BAK       SVAPTE  FLINK BLINK

7FEF2400 82E52C48 21800000  DZERO UW      U
7FEF2600 82E52C4C 21800000  DZERO UW      U
7FEF2800 82E52C50 21800000  DZERO UW      U
    .
    .
    .

                    Process active channels
                    -----------------------

Channel  Window    Status  Device/file accessed
-------  ------    ------  --------------------
   0010  00000000          ROCK$DJA233:
   0020  8082C400          ROCK$DJA233:(1008,48490,0)
   0030  807F2260          LOVE$DUA200:(209,1,0)[V5COMMON.SYSLIB]SMGSHR.EXE;1 (section file)
   0040  00000000          VTA71:
   0050  00000000          VTA71:
   0060  807EFFE0          LOVE$DUA200:(195,1,0)[V5COMMON.SYSLIB]LIBRTL.EXE;1 (section file)
   0070  807EECC0          LOVE$DUA200:(199,1,0)[V5COMMON.SYSLIB]MTHRTL.EXE;1 (section file)
   0080  80838E80          LOVE$DUA200:(196,1,0)[V5COMMON.SYSLIB]LIBRTL2.EXE;1
   0090  807E4880          LOVE$DUA200:(210,1,0)[V5COMMON.SYSLIB]SORTSHR.EXE;1
   00A0  80818720          LOVE$DUA200:(191,1,0)[V5COMMON.SYSLIB]FDLSHR.EXE;1
   00B0  8083CFC0          LOVE$DUA200:(169,1,0)[V5COMMON.SYSLIB]CONVSHR.EXE;1
   00C0  8083DEC0          ROCK$DJA233:(1026,16,0)
```

The SHOW PROCESS/ALL command displays information taken from the software PCB of process GLOBE, and then proceeds to display the process header, the process's registers, the process section table, the P0 page table, the P1 page table, and information about the I/O channels owned by the process. These displays may also be obtained by the /PCB, /PHD, /REGISTERS, /PROCESS_SECTION_TABLE, /P0, /P1, and /CHANNEL qualifiers, respectively.

```
3   SDA>  SHOW PROCESS/LOCKS/INDEX=0A


Process index: 000A   Name: JOB_CONTROL   Extended PID: 4620010A
------------------------------------------------------------------
Lock data:

Lock id:  09960A0F   PID:    0001000A   Flags:   VALBLK  CONVERT SYNCSTS
Par. id:  00000000   Granted at    PW            SYSTEM
Sublocks:      100
LKB:      8082B0E0   BLKAST
Resource:      003C0248 24534D52    RMS$H.<.  Status:  ASYNC
 Length   26  444B4C4F 46020000    ...FOLKD
 Exec. mode    00202020 20202024    $       .
 System        00000000 00000000    ........
Local copy

Lock id:  043C0491   PID:    0001000A   Flags:   NOQUEUE
Par. id:  00000000   Granted at    EX
Sublocks:        0
LKB:      8083FAE0   BLKAST
Resource:      4C41434F 2443424A    JBC$ROCK  Status:
 Length   10  00000000 00002041    A ......
 User mode     00000000 00000000    ........
 System        00000000 00000000    ........
Local copy
    .
    .
    .
```

The SHOW PROCESS/LOCKS/INDEX=0A command displays information about the locks held by process JOB_CONTROL, whose PCB is at index 0A into the system's PCB list. This command implicitly makes JOB_CONTROL the SDA current process for subsequent commands that display process context information. It has no effect on SDA CPU context as JOB_CONTROL is not current on any processor in the VMS multiprocessing system.

SYSTEM DUMP ANALYZER
SHOW PROCESS

4 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> SHOW PROCESS/RMS
   .
   .
   .
Process index: 0032   Name: BEASSEM_MTHRTL_   Extended PID: 27200132
------------------------------------------------------------------------
IFAB Address: 7FF9C808  IFI: 0002       Organization: Sequential
------------

PRIM_DEV:       1C4D4108        DIR,FOD,SHR,AVL,ELG,IDV,ODV,RND
BKPBITS:        00080020        ACCESSED,NORECLK
BLN:            3A      58.             BID:            0B      11.
EFN:            00                      MODE:           03
IOS:            00000001                ASBADDR:        00000000
IOS2:           0000                    WAIT_Q_FLINK:   00000000
IOS4:           00000000                ARGLST:         7FF21418
ATJNLBUF:       00000000                WAIT_Q_BLINK:   00000000
FSBPTR:         00000000                AGENT_MODE:     03
SHR:            02      SHRGET
IRAB_LNK:       7FF9C958                CHNL:           00C0
FAC:            02      GET
ORGCASE:        00              Sequential
LAST_FAB:       00081FD0                NWA_PTR:        00000000
IFI:            0002                    ECHO_ISI:       0000
FWA_PTR:        7FF9CC00
BDB_FLNK:       7FF9CBB0                DEVBUFSIZ:      00000200    512.
BDB_BLNK:       7FF9CB60                RTDEQ:          0000          0.
RFMORG:         02              VAR
RAT:            02              CR
LRL:            004C          76.       HBK_DISK:       000C0000
FFB:            0084         132.       EBK_DISK:       000C0000
FSZ:            00             0.       BKS:            00            0.
DEQ:            0000           0.       MRS:            0000          0.
HBK:            0000000C      12.       GBC:            0000          0.
EBK:            0000000C
LAST_GOOD_EBK:  00000000       0.       LAST_GOOD_FFB:  0000          0.
RNS_LEN:        00000000                LOCK_BDB:       00000000
SFSB_PTR:       00000000                AVLCL:          0003          3.
GBSB_PTR:       00000000                AVGBPB:         0000          0.
PAR_LOCK_ID:    00000000
AS_DEV:         1C4D4108                BLBFLNK:        00000000
ASDEVBSIZ:      00000200                BLBBLNK:        00000000
GBH_PTR:        00000000                AI_JFB:         00000000
BI_JFB:         00000000                AT_JFB:         00000000
JOURNAL:        00             0.       BUFFER_OFFSET:  0000          0.
RUSB_LNK:       00000000                RU_ACTIVE:      00            0.
RUFB_LNK:       00000000                RU_HANDLE:      00000000
ATJNLBUF:       00000000                JNLBDB:         00000000
JNLFLG:         00
RECVRFLGS:      00
JNLFLG2:        00
EXTJNLBUF:      00000000                RLB_FL_FLINK:   7FF9C858

FAB Address:    00081FD0
-----------

BID:            03             3.
BLN:            50            80.
IFI:            0002
FOP:            00000000
STS:            00010001                ALQ:            0000000C
STV:            000000C0                DEQ:            0000
FAC:            02      GET
SHR:            02      SHRGET
CTX:            00000000                RTV:            00
ORG:            00      Sequential
RAT:            02      CR
```

```
RFM:            02      VAR
JOURNAL:        00
RU_FACILITY:    00
XAB:            0008235C                NAM:            000822D0
FNA:            00062894                DNA:            00000000
FNS:            2B                      DNS:            00
File name:      VMSTESTRESD$:[MTHRTL.SRC]MTH$ATAN2TST.B32;1
MRS:            0000                    MRN:            00000000
BLS:            0200          512.      BKS:            00            0.
FSZ:            00              0.      DEV:            4108
SDC:            1C4D4108                GBC:            0000          0.
ACMODES:        00

XABFHC Address: 0008235C
---------------

COD:            1D            29.       BLN:            2C            44.
NXT:            00082330                RVN:            0202
RFO:            02
ATR:            02      CR
LRL:            004C          76.
HBK:            0000000C                FFB:            0084
EBK:            0000000C                HSZ:            00
MRZ:            0000        0.          DXQ:            0000          0.
GBC:            0000        0.
SBN:            00000000

XABDAT Address: 00082330
---------------

COD:            12            18.       BLN:            2C            44.
NXT:            00000000                RVN:            0002
RDT:                                CDT:
    RDT0:       2AB640E0                    CDT0:       69508580
    RDT4:       008F8F1B                    CDT4:       008F8EEA
EDT:                                BDT:
    EDT0:       00000000                    BDT0:       00000000
    EDT4:       00000000                    BDT4:       00000000

NAM Address:    000822D0
-----------

BID:  02          2.        RFS:          00      NO_RFS
BLN:  60         96.
NOP:  00
WCC   00000000
FNB:  002030C7  PPF,NODE,QUOTED,GRP_MBR,WILD_DIR,
                        DIR_LVLS,WILD_UFD,WILD_SFD1,WILD_SFD3,WILD_SFD5
Expanded String:        ESL: 2B / ESS: FF @ ESA: 00091A98
                        VMSTESTRESD$:[MTHRTL.SRC]MTH$ATAN2TST.B32;1
Resultant String:       RSL: 2B / RSS: FF @ RSA: 00091A98
                        VMSTESTRESD$:[MTHRTL.SRC]MTH$ATAN2TST.B32;1
FID:    [1CA4,0003,0001]
NODE:   00/00091A98
DEV:    0D/00091A98     VMSTESTRESD$:
DIR:    0C/00091AA5     [MTHRTL.SRC]
NAME:   0C/00091AB1     MTH$ATAN2TST
TYPE:   04/00091ABD     .B32
VER:    02/00091AC1     ;1

CCB Address: 7FFCAD30
-----------

UCB:            80487E70                WIND:           80B7A1C0
STS:            00
AMOD:           02                      IOC:            0001
DIRP:           00000000
```

```
WCB Address: 80B7A1C0
-----------

WLFL:           804A2AA0                SIZE:           0060
WLBL:           804A2AA0                TYPE:           12
ACCESS:         01      READ
PID:            00010032                ORGUCB:         80487E70
ACON:           0001    NOWRITE
NMAP:           0005                    FCB:            804A2A90
RVT:            808F9140                LINK:           00000000
READS:          00000001                WRITES:         00000000
STVBN:          00000001                P1_COUNT:       0003
P1_LBN:         010C568E                P2_COUNT:       0001
P2_LBN:         010C5695

FCB Address: 804A2A90
-----------
FCBFL:          804BFBF0                SIZE:           00D0
FCBBL:          804788A0                TYPE:           07
EXFCB:          00000000                WLFL:           80B7A1C0
REFCNT:         0001            1.      ACNT:           0001            1.
WCNT:           0000            0.      LCNT:           0001            1.
TCNT:           0000            0.      ACCLKMODE:      03
STATUS:         0000
SEGN:           0000            0.      STVBN:          00000001
HDLBN:          0000CE22                STLBN:          00000000
FILESIZE:       0000000C                EFBLK:          0000000C
VERSIONS:       0000            0.      DIRINDX:        00000000
DIRSEQ:         0000                    ACCLKID:        00283A1F
LOCKBASIS:      01001CA4                TRUNCVBN:       00000000
CACHELKID:      00000000                HIGHWATER:      0000000D
HWM_UPDATE:     0000            0.      HWM_PARTIAL:    0000            0.
HWM_ERASE:      0000            0.      HWM_WAITFL:     804A2AF8
FID:            [1CA4,0003,0001]
                                        HWM_WAITBL:     804A2AF8
ORB
   FILEOWNER:   [007F,0009]             ACMODE:         FFFFFFFF/FFFFFFFF
    SYS_PROT:   0000EE0C
    OWN_PROT:   00000000
    GRP_PROT:   00000000
    WOR_PROT:   00000000
ACLFL:          00000000
ACLBL:          00000000

FWA Address: 7FF9CC00
-----------
FLAGS:          20C7F810
                06000003

PASSFLGS:       10      FNA_PASS
FLDFLGS:        F8      VERSION,TYPE,NAME,DIR,DEVICE
FLDFLGS:        C7      EXP_VER,EXP_TYPE,EXP_NAME,EXP_DIR,EXP_DEV
PARSEFLGS:      20
DIRFLGS:        03      DIR1,DIR2
DIRWCFLGS:      00
LNFLGS:         00
SLFLGS:         06      CONCEAL_DEV,ROOT_DIR

DIRTERM:        5D      "]"             ROOTERM:        5D      "]"
ESCSTRING:      00000000                ESCFLG:         00
ESCTYP:         00                      ESCIFI:         0000
BUFFLG:         00       0.             DIRBDB:         00000000
XLTMODE:        03                      XLTSIZE:        000C      12.
XLTBUFF1:       7FF9D600                XLTBUFF2:       7FF9D700
DEVBUFSIZ:      00000000                DEV_CLASS:      00000001
```

```
FIB:    00000040 / 7FF9CDF4
        ------------------------------------------------------------
        FIB fields within the FWA:

        WSIZE:          00              0.      WCC:            00000000
        ACCTL:          00000001        NOWRITE
        FID:            (1CA4,0003,0001)        DID:    (148B,0002,0001)
        NUMCTL:         0000
        EXCTL:          0000
        CNTRLFUNC:      0000    REWINDFIL
        EXSZ:           00000000                CNTRLVAL:       00000000
        EXVBN:          00000000                ALALIGN:        00
        ALOPTS:         00
        VERLIMIT:       7FFF                    ACLCTX:         00000000
        STATUS:         00000000
        ALT_ACCESS:     00000000
        ------------------------------------------------------------

UIC:            [0,0]                   LOOKUP:         00000000
DEVNODADR:      7FFE03F0                        PRO:            0000
LEVEL:          03      3.              UCHAR:          0000
DIRLEN:         0B      11.             SUBNODCNT:      00      0.
SWB_PTR:        00000000
SLBH_PTR:       7FF9C8F8                SLB_PTR:        7FF9C8F8
SLBH_FLINK:     7FF9C8F8                SLBH_BLINK:     7FF9C938
ITM_INDEX:      00010004 / 7FF9CCC4 / 00000000
ITM_ATTR:       00030004 / 7FF9CCCC / 00000000
ITM_STRING:     000200FF / 7FF9D600 / 7FF9CC9E
ITM_MAX_INDEX:  00070004 / 7FF9CCC8 / 00000000
ITM_END:        00000000
LOGNAM:         0000000B / 7FF9D600 ............
DIR:            00000030 / 7FF9D468 SRCRTLTDUA101:[000000]
NODE:           00000000 / 7FF9D3E9
DEVICE:         0000000B / 7FF9D1E9 $254$DUA101
CONCEAL_DEV:    0000000C / 7FF9D2E8 VMSTESTRESD$
CDIR1:          00000007 / 7FF9CF7E VMSTEST
CDIR2:          00000000 / 7FF9CFA5
CDIR3:          00000000 / 7FF9CFCC
CDIR4:          00000000 / 7FF9CFF3
CDIR5:          00000000 / 7FF9D01A
CDIR6:          00000000 / 7FF9D041
CDIR7:          00000000 / 7FF9D068
CDIR8:          00000000 / 7FF9D08F
DIR1:           00000006 / 7FF9CE46 MTHRTL
DIR2:           00000003 / 7FF9CE6D SRC
DIR3:           00000000 / 7FF9CE94
DIR4:           00000000 / 7FF9CEBB
DIR5:           00000000 / 7FF9CEE2
DIR6:           00000000 / 7FF9CF09
DIR7:           00000000 / 7FF9CF30
DIR8:           00000000 / 7FF9CF57
NAME:           00000012 / 7FF9D0B6 MTH$ATAN2TST.B32;1
TYPE:           00000003 / 7FF9D0C3 B32
RNS:            0000012E / 7FF9D0B6 MTH$ATAN2TST.B32;1
VERSION:        00000001 / 7FF9D0C7 1
SHRFIL:         0000000C / 7FF9D498 _$254$DUA101
AS_SHRFIL:      0000000C / 7FF9D4B8 _$254$DUA101
SHRFIL_LCK:     00000010 / 7FF9D4A8 .RES28JUN    ...
NODE1:          00000000 / 00000000
NODE2:          00000000 / 00000000
NODE3:          00000000 / 00000000
NODE4:          00000000 / 00000000
NODE5:          00000000 / 00000000
NODE6:          00000000 / 00000000
NODE7:          00000000 / 00000000
NODE8:          00000000 / 00000000

BI Journaling ACE:
(UNKNOWN=%X00,SIZE=%D0,FLAGS=%X0000,ACCESS=%X00000000,DATA)

AI Journaling ACE:
(UNKNOWN=%X00,SIZE=%D0,FLAGS=%X0000,ACCESS=%X00000000,DATA)

AT Journaling ACE:
(UNKNOWN=%X00,SIZE=%D0,FLAGS=%X0000,ACCESS=%X00000000,DATA)

RU Journaling ACE:
(UNKNOWN=%X00,SIZE=%D0,FLAGS=%X0000,ACCESS=%X00000000,DATA)
```

SYSTEM DUMP ANALYZER
SHOW PROCESS

```
IRAB Address: 7FF9C958  ISI: 0001
------------

IFAB_LNK:       7FF9C808
BKPBITS:        00000400        RAHWBH
BLN:            27          39.         BID:            0A          10.
EFN:            00                      MODE:           03
IOS:            00000000                ASBADDR:        7FF9CA00
IOS4:           00000000                ARGLST:         7FF21418
IRAB_LNK:       00000000                CURBDB:         00000000
LAST_RAB:       00081DA4                NXTBDB:         7FF9CBB0
JNLBDB:         00000000
RLB_FLINK:      7FF9C99C                WAIT_Q_FLINK:   00000000
RLB_BLINK:      7FF9C99C                WAIT_Q_BLINK:   00000000
ISI:            0001                    IDENT:          00000230
JNLFLG:         00
ATJNL_PTR:      00000000
RP_VBN:         00000000        0.      NRP_VBN:        00000001        1.
RP_OFF:         00000000        0.      NRP_OFF:        00000000        0.
CURVBN:         00000000        0.
CACHEFLGS:      01               LOCK
SRCHFLAGS:      0000
SPL_BITS:       00
STOPLEVEL:      00              0.
POS_INS:        0000            0.      SPLIT:          0000            0.
LST_REC:        00000000                PRT_VBN:        00000000        0.
SPLIT_1:        0000            0.      SPLIT_2:        0000            0.
OWNER_ID:       00010000                BCNT:           03              3.
OWN_ISI:        0001            1.      MBC:            0B             11.
RU_HANDLE:      00000000                MBF:            03              3
PPF_ISI:        01              1.      OWN_ID:         0000
MBC_P1:         0C             12.
TEMPO:          00000000                CSIZ:           0000            0.
ROVHDSZ:        0000            0.      RTOTLSZ:        0000            0.
PRE_CCTL:       00              0.      POST_CCTL:      00              0.
CURBLKADR:      00000000                PPF_STRLEN:     0000
ENDBLKADR:      00000000
PPF_STR:        00000000         ................


RAB Address:    00081DA4
-----------

BID:            01              1.      ISI:            0001
BLN:            44             68.
ROP:            00010600         RAH,WBH,LOC
CTX:            00000000                RAC:            00      SEQ
STS:            00000000                RFA:            00000000,0000
STV:            00010001
TMO:            00              0.      RHB:            00000000
USZ:            0084          132.      UBF:            00091F38
RSZ:            0000            0.      RBF:            00000000
KBF:            00000000                KSZ:            00              0.
PBF:            00000000                PSZ:            00              0.
KRF:            00              0.      MBC:            00              0.
MBF:            00              0.      BKT:            00000000
FAB:            00081FD0                DCT:            00000000
XAB:            00000000


ASB Address:    7FF9CA00
-----------

ARGCNT: 00              0.
ARGLST: 00000000                BID:            0D             13.
FABRAB: 00000000                BLN:            44             68.
ERR:    00000000                STKLEN:         00E0          224.
SUC:    00000000                STKSIZ:         0000            0.

R6:     00000000
R7:     00000000
R8:     00000000
R10:    00000000
R11:    00000000
```

```
Saved Stack:
------------

        SP =>  (STACK IS EMPTY)

                                BDB/GBPB Summary
                                ----------------
Address USERS SIZE  NUMB    VBN     BLB_PTR   ADDR    VAL   ID  FLGS
------- ----- ----  ----    ---     -------   ----    ---   --  ----

7FF9CBB0   0  6144  6144 00000001 00000000 7FFA0C00   0    BDB  IOP
7FF9CB10   0  6144     0 00000000 00000000 7FF9DC00   0    BDB
7FF9CB60   0  6144     0 00000000 00000000 7FF9F400   0    BDB
               3. BDBs were processed
               0. GBPBs were processed


BDB Address:    7FF9CBB0
------------

FLINK:          7FF9CB10                BID:            0C            12.
BLINK:          7FF9C850                BLN:            14            20.
FLGS:           04      IOP
USERS:          0000           0.       BLB_PTR:        00000000
CACHE_VAL:      00             0.       BUFF_ID:        0000           0.
SIZE:           1800        6144.       NUMB:           1800        6144.
ADDR:           7FFA0C00                VBN:            00000001
VBNSEQNO:       00000000                WAIT:           00000000
WK1:            00000000                CURBUFADR:      00000000
REL_VBN:        00             0.       PRE_CCTL:       00
ASB:            00000000
ALLOC_ADDR:     7FFA0C00                BI_BDB:         00000000
ALLOC_SIZE:     1800        6144        AI_BDB:         00000000
VAL_VBNS:       00             0.       POST_CCTL:      00
IOSB:           00000000                WAIT_Q_FLINK:   00000000
                00000000                WAIT_Q_BLINK:   00000000
REUSE_COUNT:    00000000


BDB Address:    7FF9CB10
------------

FLINK:          7FF9CB60                BID:            0C            12.
BLINK:          7FF9CBB0                BLN:            14            20.
FLGS:           00
USERS:          0000           0.       BLB_PTR:        00000000
CACHE_VAL:      00             0.       BUFF_ID:        0000           0.
SIZE:           1800        6144.       NUMB:           0000           0.
ADDR:           7FF9DC00                VBN:            00000000
VBNSEQNO:       00000000                WAIT:           00000000
WK1:            00000000                CURBUFADR:      00000000
REL_VBN:        00             0.       PRE_CCTL:       00
ASB:            00000000
ALLOC_ADDR:     7FF9DC00                BI_BDB:         00000000
ALLOC_SIZE:     1800        6144        AI_BDB:         00000000
VAL_VBNS:       00             0.       POST_CCTL:      00
IOSB:           00000000                WAIT_Q_FLINK:   00000000
                00000000                WAIT_Q_BLINK:   00000000
REUSE_COUNT:    00000000
```

```
BDB Address:    7FF9CB60
-----------

FLINK:          7FF9C850              BID:            0C          12.
BLINK:          7FF9CB10              BLN:            14          20.
FLGS:           00
USERS:          0000          0.      BLB_PTR:        00000000
CACHE_VAL:      00            0.      BUFF_ID:        0000          0.
SIZE:           1800       6144.      NUMB:           0000          0.
ADDR:           7FF9F400              VBN:            00000000
VBNSEQNO:       00000000              WAIT:           00000000
WK1:            00000000              CURBUFADR:      00000000
REL_VBN:        00            0.      PRE_CCTL:       00
ASB:            00000000
ALLOC_ADDR:     7FF9F400              BI_BDB:         00000000
ALLOC_SIZE:     1800          6144    AI_BDB:         00000000
VAL_VBNS:       00            0.      POST_CCTL:      00
IOSB:           00000000              WAIT_Q_FLINK:   00000000
                00000000              WAIT_Q_BLINK:   00000000
REUSE_COUNT:    00000000
    .
    .
    .
```

The SHOW PROCESS/RMS command displays those RMS data structures associated with the image files process GLOBE, the SDA current process, is accessing.

SHOW RESOURCE

Displays information about all resources in the system, or about a resource associated with a specific lock.

FORMAT

SHOW RESOURCE { */ALL* | */LOCKID=lock-id* }

PARAMETERS

None.

QUALIFIERS

/ALL

Displays information from all resource blocks (RSBs) in the system. This is the default behavior of the SHOW RESOURCE command.

/LOCKID=lock-id

Displays information on the resource associated with the lock with the specified **lock-id**.

DESCRIPTION

The SHOW RESOURCE command displays the information listed in Table SDA–13 for each resource in the system or the specific resource associated with the specified **lock-id**.

Table SDA–13 Resource Information in the SHOW RESOURCE Display

Field	Contents
Address of RSB	Address of the resource block (RSB) that describes this resource.
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.
Sub-RSB count	Number of RSBs of which this RSB is the parent. This field is 0 if the RSB has no sub-RSBs.

Table SDA–13 (Cont.) Resource Information in the SHOW RESOURCE Display

Field	Contents
Group grant mode	Indication of the most restrictive mode in which a lock on this resource has been granted. This field can contain the following values (shown in order from the least restrictive mode to the most restrictive):

Value	Meaning
NL	Null mode
CR	Concurrent-read mode
CW	Concurrent-write mode
PR	Protected-read mode
PW	Protected-write mode
EX	Exclusive mode

For information on conflicting and incompatible lock modes, see the *VMS System Services Reference Manual.*

Conversion grant mode	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.
BLKAST count	Number of locks on this resource that have requested a blocking AST.
Value block	Hexadecimal dump of the 16-byte block value block associated with this resource.
Sequence #	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.
CSID	Cluster system identification number (CSID) 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 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.
Length	Length in bytes of the resource name.

Table SDA–13 (Cont.) Resource Information in the SHOW RESOURCE Display

Field	Contents
—	Processor mode of the name space in which this RSB resides.
—	Owner of the resource. Certain resources, owned by the VMS operating system, list "System" as the owner. Locks owned by a group have the number (in octal) of the owning group in this field.
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.

EXAMPLES

1

```
SDA>  SHOW RESOURCE
Resource database
-----------------
Address of RSB:  807F6120  Group grant mode:       NL
Parent RSB:      806EA180  Conversion grant mode:  NL
Sub-RSB count:          0  BLKAST count:            0
Value block:   806CE510 00000000 00000002 00000002   Seq. #:  00000008
Resource:      09ED7324 42313146    F11B$s.
 Length   10   00000000 00000200    ........         CSID:  00020041
 Kernel mode   00000000 00000000    ........
 System        00000000 00000000    ........

Granted queue (Lock ID / Gr mode):
     006801AE  NL

Conversion queue (Lock ID / Gr/Rq mode):
     *** EMPTY QUEUE ***

Waiting queue (Lock ID / Rq mode):
     *** EMPTY QUEUE ***


Address of RSB:  807EB9E0  Group grant mode:       PW
Parent RSB:      00000000  Conversion grant mode:  EX
Sub-RSB count:          0  BLKAST count:            1
Value block:   00000000 00000003 00000000 0000FFF2   Seq. #:  0000027F Not valid
Resource:      32245F24 44414853    SHAD$_$2
 Length   16   3A31534A 44243435    54$DJS1:         CSID:  0002001A
 Kernel mode   00000000 00000000    ........
 System        00000000 00000000    ........

Granted queue (Lock ID / Gr mode):
     00020301  CR
```

```
Conversion queue (Lock ID / Gr/Rq mode):
     095B00F2  PW/EX

Waiting queue (Lock ID / Rq mode):
     054400BC  EX
    .
    .
    .
```

The SHOW RESOURCE command displays information taken from the RSBs of all resources in the system. For instance, the RSB at $807EB9E0_{16}$ is a parent block with no sub_RSBs. The most restrictive lock granted on this resource is in protected-write (PW) mode. There is a lock on the conversion queue waiting to be converted from PW mode to exclusive (EX) mode.

2

```
SDA>  SHOW PROCESS/LOCKS

Process index: 001C   Name: STARTQ   Extended PID: 4800011C
------------------------------------------------------------
Lock data:

Lock id:  0117054F   PID:    0001001C   Flags:   VALBLK  SYNCSTS SYSTEM
Par. id:  00000000   Granted at    PW             NOQUOTA
Sublocks:        0
LKB:      808091A0
Resource:       45527624 42313146    F11B$vRE  Status:  NOQUOTA
 Length   18   20205241 4D323053    S02MAR
 Kernel mode   00000000 00002020      ......
 System        00000000 00000000    ........
Process copy of lock 008209CF on system 0002001
    .
    .
    .
SDA>  SHOW RESOURCE/LOCKID=117054F
Resource database
-----------------
Address of RSB:  806BB050  Group grant mode:       NL
Parent RSB:      00000000  Conversion grant mode:  NL
Sub-RSB count:          4  BLKAST count:            0
Value block:   00960102 0000330B 000735AA 5A020005   Seq. #:  00006D9F
Resource:       45527624 42313146    F11B$vRE
 Length   18   20205241 4D323053    S02MAR           CSID:  0002001A
 Kernel mode   00000000 00002020      ......
 System        00000000 00000000    ........

Granted queue (Lock ID / Gr mode):
     0117054F  PW       00060545  CR

Conversion queue (Lock ID / Gr/Rq mode):
     *** EMPTY QUEUE ***

Waiting queue (Lock ID / Rq mode):
     *** EMPTY QUEUE ***
```

The SHOW PROCESS/LOCKS command lists all locks associated with the SDA current process, STARTQ. Its display is identical to that of the SHOW LOCK command, illustrated in Table SDA–7. The SHOW RESOURCE/LOCKID=117054F command determines that this particular lock is on the granted queue in protected-write mode for the resource at $806BB050_{16}$.

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 SDA–6.

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,CCB,WCB)
SDA>  SHOW RMS

RMS Display Options:  IFB,CCB,WCB
Display RMS structures for all IFI values.
```

The SET RMS command establishes the IFB, CCB, and WCB as the structures to be displayed when the SHOW PROCESS/RMS command is issued. The SHOW RMS command verifies this selection of RMS options.

SHOW RSPID

Displays information about response IDs (RSPIDs) of all SCS connections or, optionally, 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**.[15]

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).

[15] 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 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.

EXAMPLES

1

```
SDA>  SHOW RSPID
VAXcluster data structures
--------------------------

    --- Summary of Response Descriptor Table(RDT) 8037A4A8 ---

RSPID      CDRP Address     CDT Address     Local Process Name      Remote Node
-----      ------------     -----------     ------------------      -----------

04C30000     803917B0        8037AB50       VMS$DISK_CL_DRVR        SOWHAT
06260001     80804FA0        8037AF10       VMS$VAXcluster          WALKIN
0C390002     807E0460        8037AD30       VMS$VAXcluster          OLEO
   .
   .
   .
```

The SHOW RSPID command shows the response IDs that are currently open for all local connections in the VAXcluster.

2

```
SDA>  SHOW RSPID/CONNECTION=G37B7D0
VAXcluster data structures
--------------------------

    --- Summary of Response Descriptor Table(RDT) 8037A4A8 ---

RSPID      CDRP Address     CDT Address     Local Process Name      Remote Node
-----      ------------     -----------     ------------------      -----------

08B8001C     807F0300        8037B7D0       VMS$VAXcluster          METEOR
0915001D     807F08A0        8037B7D0       VMS$VAXcluster          METEOR
```

The SHOW RSPID/CONNECTION=G37B7D0 command displays only those RSPIDs in use that are associated with the SCS connection whose CDT is at address $8037B7D0_{16}$.

SHOW SPINLOCKS

Displays information taken from the data structures that provide system synchronization in a VMS multiprocessing environment.

FORMAT

SHOW SPINLOCKS *[/OWNED]* [*/BRIEF* | */FULL*] [*/DYNAMIC* | */STATIC*] [*name* | */ADDRESS=expression* | */INDEX=expression*]

PARAMETER

name

Name of the spin lock, fork lock, or device lock structure to be displayed. You can obtain the names of the static system spin locks and fork locks from Table SDA–14. Device lock names are of the form *[node$]lock*, where *node* optionally indicates the VAXcluster node name (allocation class) and *lock* indicates the device and controller identification (for example, HAETAR$DUA).

QUALIFIERS

/ADDRESS=expression

Displays the lock at the address specified in **expression**. You can use the /ADDRESS qualifier to display a specific device lock; however the name of the device lock is listed as "Unknown" in the display.

/BRIEF

Produces a condensed display of the lock information displayed by default by the SHOW SPINLOCKS command, including the following: address, spin lock name or device name, IPL or device IPL, rank, index, ownership depth, number of waiting CPUs, CPU ID of the owner CPU, and interlock status (depth of ownership).

/DYNAMIC

Displays information for all device locks in the system.

/FULL

Displays full descriptive and diagnostic information for each displayed spin lock, fork lock, or device lock.

/INDEX=expression

Displays the system spin lock whose index is specified in **expression**. You cannot use the /INDEX qualifier to display a device lock.

/OWNED

Displays information for all spin locks, fork locks, and device locks owned by the SDA current CPU. If a processor does not own any spin locks, SDA displays the following message:

```
No spinlocks currently owned by CPU xx
```

xx represents the CPU ID of the processor.

/STATIC

Displays information for all system spin locks and fork locks.

DESCRIPTION

The SHOW SPINLOCKS command displays status and diagnostic information about the VMS multiprocessing synchronization structures known as spin locks.

A *static spin lock* is a spin lock the data structure for which is permanently assembled into the system. Static spin locks are accessed as indexes into a vector of longword addresses called the *spin lock vector,* the address of which is contained in SMP$AR_SPNLKVEC. System spin locks and fork locks are static spin locks. Table SDA–14 lists the static spin locks.

A *dynamic spin lock* is a spin lock that is created based on the configuration of a particular system. One such dynamic spin lock is the device lock SYSGEN creates when configuring a particular device. This device lock synchronizes access to the device's registers and certain UCB fields. VMS creates a dynamic spin lock by allocating space from nonpaged pool, rather than assembling the lock into the system as it does in creating a static spin lock.

See the *VMS Device Support Manual* for a full discussion of the role of spin locks in maintaining synchronization of kernel mode activities in a VMS multiprocessing environment.

Table SDA–14 Static Spin Locks

Name	Description
QUEUEAST	Fork lock for queuing ASTs at IPL 6
FILSYS	Lock on file system structures
IOLOCK8	Fork lock for executing a driver fork process at IPL 8
PR_LK8	Primary CPU's private lock for IPL 8
TIMER	Lock for adding and deleting timer queue entries and searching the timer queue
JIB	Lock for manipulating job nonpaged pool quotas as reflected by the fields JIB$L_BYTCNT and JIB$L_BYTLM in the job information block (JIB)
MMG	Lock on VMS memory management, PFN database, swapper, modified page writer, and creation of per-CPU database structures
SCHED	Lock on process control blocks (PCBs), scheduler database, and mutex acquisition and release structures
IOLOCK9	Fork lock for executing a driver fork process at IPL 9
PR_LK9	Primary CPU's private lock for IPL 9
IOLOCK10	Fork lock for executing a driver fork process at IPL 10
PR_LK10	Primary CPU's private lock for IPL 10

Table SDA–14 (Cont.) Static Spin Locks

Name	Description
IOLOCK11	Fork lock for executing a driver fork process at IPL 11
PR_LK11	Primary CPU's private lock for IPL 11
MAILBOX	Lock for sending messages to mailboxes
POOL	Lock on nonpaged pool database
PERFMON	Lock for I/O performance monitoring
INVALIDATE	Lock for system space translation buffer (TB) invalidation
VIRTCONS	Lock for ownership of the virtual console
HWCLK	Lock 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	Lock for serializing access to fork-wait queue
MCHECK	Lock for synchronizing certain machine error handling
EMB	Lock for allocating and releasing error logging buffers

For each spin lock, fork lock, or device lock in the system, SHOW SPINLOCKS provides the following information:

- Name of the spin lock (or device name for the device lock)
- Address of the spin lock data structure (SPL)
- The owner CPU's CPU ID
- IPL at which allocation of the lock is synchronized on a local processor
- Number of nested acquisitions of the spin lock by the processor owning the spin lock ("Ownership Depth")
- Rank of the spin lock
- Number of processors waiting to obtain the spin lock
- Spin lock index
- Timeout interval for spin lock acquisition (in terms of 10 milliseconds)

SHOW SPINLOCKS/BRIEF produces a condensed display of this same information.

If the VAX system under analysis was executing with full-checking multiprocessing enabled (according to the setting of the MULTIPROCESSING system parameter), SHOW SPINLOCKS/FULL adds to the spin lock display the last eight 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.

EXAMPLES

1

```
SDA> SHOW SPINLOCKS
System static spinlock structures
---------------------------------
EMB                                 Address : 801B9EF8
Owner CPU ID      : None            IPL     : 1F
Ownership Depth   : 0000            Rank    : 00
CPUs Waiting      : 0000            Index   : 20
Timeout interval 002DC60

MCHECK                              Address : 801B9F48
Owner CPU ID      : None            IPL     : 1F
Ownership Depth   : 0000            Rank    : 01
CPUs Waiting      : 0000            Index   : 21
Timeout interval 002DC60
    .
    .
    .
IOLOCK8                             Address : 801BA538
Owner CPU ID      : 02              IPL     : 08
Ownership Depth   : 0001            Rank    : 14
CPUs Waiting      : 0000            Index   : 34
Timeout interval 002DC60
    .
    .
    .
System dynamic spinlock structures
----------------------------------
HAETAR$MBA                          Address : 801BA178
Owner CPU ID      : None            IPL     : 0B
Ownership Depth   : 0000            Rank    : 08
CPUs Waiting      : 0000            Index   : 37
Timeout interval 002DC60

HAETAR$NLA                          Address : 801BA178
Owner CPU ID      : None            IPL     : 08
Ownership Depth   : 0000            Rank    : 08
CPUs Waiting      : 0000            Index   : 37
Timeout interval 002DC60

HAETAR$PAA                          Address : 801BA538
Owner CPU ID      : 02              IPL     : 14
Ownership Depth   : 0001            Rank    : 14
CPUs Waiting      : 0000            Index   : 37
Timeout interval 002DC60
    .
    .
    .
```

This excerpt illustrates the default output of the SHOW SPINLOCKS command. Note that the fork lock IOLOCK8 is owned by the CPU whose CPU ID is 2. CPU 2 must be executing at at least IPL 8, which is the acquisition IPL of the fork lock. CPU 2 has no nested ownership of the fork lock. The rank of IOLOCK8 is 14_{16}, indicating that CPU 2 could not own any locks with a logical rank of 15_{16} or higher when it acquired IOLOCK8.

Similarly, while owning IOLOCK8, CPU 2 cannot obtain any additional spin locks with a logical rank of 14_{16} or below.

No CPUs are waiting for the fork lock; its index is 34_{16}.

2
```
SDA> SHOW SPINLOCKS/BRIEF
Address  Spinlock Name    IPL Rank Index Depth #Waiting  Owner CPU Interlock
-------------------------------------------------------------------------------
801B9EF8 EMB              1F   00    20   00     0000       None       Free
801B9F48 MCHECK           1F   01    21   00     0000       None       Free
801B9F98 MEGA             1F   02    22   00     0000       None       Free
801B9FE8 HWCLK            16   03    23   00     0000       None       Free
801BA038 VIRTCONS         14   04    24   00     0000       None       Free
801BA088 INVALIDATE       13   05    25   00     0000       None       Free
801BA0D8 PERFMON          0F   06    26   00     0000       None       Free
801BA128 POOL             0B   07    27   00     0000       None       Free
801BA178 MAILBOX          0B   08    28   00     0000       None       Free
801BA1C8 PR_LK11          0B   09    29   00     0000       None       Free
801BA218 IOLOCK11         0B   0A    2A   00     0000       None       Free
801BA268 PR_LK10          0A   0B    2B   00     0000       None       Free
801BA2B8 IOLOCK10         0A   0C    2C   00     0000       None       Free
801BA308 PR_LK9           09   0D    2D   00     0000       None       Free
801BA358 IOLOCK9          09   0E    2E   00     0000       None       Free
801BA3A8 SCHED            08   0F    2F   00     0000       None       Free
801BA3F8 MMG              08   10    30   00     0000       None       Free
801BA448 JIB              08   11    31   00     0000       None       Free
801BA498 TIMER            08   12    32   00     0000       None       Free
801BA4E8 PR_LK8           08   13    33   00     0000       None       Free
801BA538 IOLOCK8          08   14    34   01     0000         02         00
801BA588 FILSYS           08   15    35   00     0000       None       Free
801BA5D8 QUEUEAST         06   16    36   00     0000       None       Free

Address  Device Name     DIPL Rank Index Depth #Waiting  Owner CPU Interlock
-------------------------------------------------------------------------------
801BA178 HAETAR$MBA       0B   08    37   00     0000       None       Free
801BA178 HAETAR$NLA       08   08    37   00     0000       None       Free
801BA538 HAETAR$PAA       14   14    37   01     0000         02         00
8063C5C0 HAETAR$XEA       15   FF    37   00     0000       None       Free
8063C4A0 HAETAR$XGA       15   FF    37   00     0000       None       Free
8063C380 HAETAR$PEA       14   FF    37   00     0000       None       Free
8063AC40 HAETAR$TXA       15   FF    37   00     0000       None       Free
8063A520 HAETAR$LCA       15   FF    37   00     0000       None       Free
801BA538 HAETAR$CNA       08   14    37   01     0000         02         00
```

This excerpt illustrates the condensed form of the display produced in the previous example.

```
3  SDA> SHOW SPINLOCKS/OWNED
   System static spinlock structures
   ---------------------------------
   IOLOCK8                              Address : 801BA538
   Owner CPU ID     : 02                IPL     : 08
   Ownership Depth  : 0001              Rank    : 14
   CPUs Waiting     : 0000              Index   : 34
   Timeout interval 002DC60
      .
      .
      .
   System dynamic spinlock structures
   ----------------------------------
   HAETAR$PAA                           Address : 801BA538
   Owner CPU ID     : 02                IPL     : 14
   Ownership Depth  : 0001              Rank    : 14
   CPUs Waiting     : 0000              Index   : 34
   Timeout interval 002DC60

   HAETAR$CNA                           Address : 801BA538
   Owner CPU ID     : 02                IPL     : 08
   Ownership Depth  : 0001              Rank    : 14
   CPUs Waiting     : 0000              Index   : 34
   Timeout interval 002DC60

   HAETAR$NET                           Address : 801BA538
   Owner CPU ID     : 02                IPL     : 08
   Ownership Depth  : 0001              Rank    : 14
   CPUs Waiting     : 0000              Index   : 34
   Timeout interval 002DC60

   HAETAR$NDA                           Address : 801BA538
   Owner CPU ID     : 02                IPL     : 08
   Ownership Depth  : 0001              Rank    : 14
   CPUs Waiting     : 0000              Index   : 34
   Timeout interval 002DC60
      .
      .
      .
```

The SHOW SPINLOCKS/OWNED command shows all owned spin locks in the system.

4
```
SDA> SHOW SPINLOCKS/FULL
System static spinlock structures
---------------------------------
EMB                                 Address : 801B9EF8
Owner CPU ID     : None             IPL     : 1F
Ownership Depth  : 0000             Rank    : 00
CPUs Waiting     : 0000             Index   : 20
Timeout interval 002DC60

Spinlock EMB was last acquired or released from:
(Most recently)             80195146 ERL$WAKE+00089
       .                    801950EF ERL$WAKE+00032
       .                    80195146 ERL$WAKE+00089
       .                    801950EF ERL$WAKE+00032
       .                    80195146 ERL$WAKE+00089
       .                    801950EF ERL$WAKE+00032
       .                    80195146 ERL$WAKE+00089
(Least recently)            801950EF ERL$WAKE+00032
   .
   .
   .
Last release of multiple acquisitions occurred at:
                            801194F9 EXE$INSIOQ+00044
   .
   .
   .
IOLOCK8                             Address : 801BA538
Owner CPU ID     : 02               IPL     : 08
Ownership Depth  : 0001             Rank    : 14
CPUs Waiting     : 0000             Index   : 34
Timeout interval 002DC60

Spinlock IOLOCK8 was last acquired or released from:
(Most recently)             801BBE08 EXE$FORKDSPTH+0007E
       .                    80198EBF EXE$QIOACPPKT+00052
       .                    80198E7E EXE$QIOACPPKT+00011
       .                    80199BB2 IOC$CHECK_HWM+0032D
       .                    80182DE5 LCK$QUEUED_EXIT+0001D
       .                    80182884 LCK$AR_COMPAT_TBL+0007C
       .                    8018357E EXE$DEQ+00189
(Least recently)            80183428 EXE$DEQ+00033
   .
   .
   .
```

The SHOW SPINLOCKS/FULL command displays a list of the last eight PCs that have accessed the spin lock. For instance, the fork dispatcher contains the code that most recently acquired the fork lock.

SHOW STACK

Displays the location and contents of the four process stacks (of the SDA current process) and the interrupt stack (of the SDA current CPU).

FORMAT

SHOW STACK [*range* | */qualifier[,...]*]

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 virtual addresses from *m* to *n*

m;n Range of virtual addresses starting at *m* and continuing for *n* bytes

QUALIFIERS

/ALL

Displays the locations and contents of the four process stacks for the current SDA process and the interrupt stack for the SDA current CPU.

/EXECUTIVE

Shows the executive stack for the SDA current process.

/INTERRUPT

Shows the interrupt stack for the SDA current CPU.

/KERNEL

Shows the kernel stack for the SDA current process.

/SUPERVISOR

Shows the supervisor stack for the SDA current process.

/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 any other process made the SDA current process, the SHOW STACK command by default shows its current operating stack.

The various qualifiers to the command can display any of the four per-process stacks for the SDA current process, as well as the interrupt stack for the SDA current CPU.

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 4.

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 processor interrupt stack. If the interrupt stack is being displayed, SDA displays the CPU ID of the processor that owns it. Similarly, if the SDA current process is currently scheduled on a processor in the VAX system, SHOW STACK also specifies the CPU ID of the processor on which the process is scheduled.
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 virtual addresses that the operating system has allocated to the stack. The stack addresses are listed in a column that increases in increments of 4 bytes (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 address is not within FFF_{16} of the value of any existing symbol, this column is left blank.

If a stack is empty, the display shows the following:

```
SP =>  (STACK IS EMPTY)
```

EXAMPLE

```
SDA> SHOW STACK
Process stacks (on CPU 00)
--------------------------

Current operating stack (USER):

             7FF73278  200C0000
             7FF7327C  00001518      SGN$C_MAXPGFL+518
             7FF73280  7FF732F0
             7FF73284  000187A7      RMS$_ECHO+72E

       SP => 7FF73288  0000060A      BUG$_NOHDJMT+002
             7FF7328C  00000000
             7FF73290  00000003
             7FF73294  7FF73800
             7FF73298  7FF73800
```

The SHOW STACK command displays a user stack which was the current operating stack for a process scheduled on CPU 00. The data shown above the stack pointer may not be valid. The symbol to the right of the columns, BUG$_NOHDJMT+002, is the result of the SDA attempt to interpret the contents of the longword at the top of the stack as a symbol meaningful to the user. In this case the value on the stack and the value of BUG$_NOHDJMT are unrelated.

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]*

PARAMETERS

None.

QUALIFIER

/IMAGE
Causes SDA to display, if possible, the name of the image being executed within each process.

DESCRIPTION

The SHOW SUMMARY command displays the information in Table SDA–15 for each active process in the system.

Table SDA–15 Process Information in the SHOW SUMMARY Display

Column	Contents
Extended PID	32-bit number that uniquely identifies the process
Indx	Index of this process into the PCB array
Process name	Name assigned to the process
Username	Name of the user who created the process
State	Current state of the process, one of the following 14 states:

State	Meaning
COM	Computable and resident in memory
COMO	Computable, but outswapped
CUR	Currently executing[1]
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

[1]For a process in the CUR state executing in a multiprocessing environment, SDA indicates the CPU ID of the processor on which the process is current. This information, however, may not be accurate in SHOW SUMMARY displays produced in the analysis of a running system.

Table SDA–15 (Cont.) Process Information in the SHOW SUMMARY Display

Column	Contents	
	State	**Meaning**
	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	Waiting for a system resource (miscellaneous wait)
Pri	Current scheduling priority of the process	
PCB	Address of the process control block	
PHD	Address of the process header	
Wkset	Number (in decimal) of pages currently in the process's working set	

EXAMPLE

```
SDA> SHOW SUMMARY/IMAGE
Current process summary
-----------------------
Extended  Indx Process name    Username    State   Pri   PCB      PHD     Wkset
-- PID -- ---- --------------- ----------- ------- --- -------- -------- -----
 33C00101 0001 SWAPPER                      HIB      16 8000C3C0 8000C200     0
 33C00205 0005 _RTA5:           SIVAD       LEF       4 80482FE0 82120E00   293
 33C00106 0006 ERRFMT           SYSTEM      HIB       8 80432950 80DB4600   126
          $254$DUA200:[SYS6.SYSCOMMON.][SYSEXE]ERRFMT.EXE;1
 33C00107 0007 CACHE_SERVER     SYSTEM      HIB      16 80432AC0 81121E00   120
          $254$DUA200:[SYS6.SYSCOMMON.][SYSEXE]FILESERV.EXE;400
 33C00108 0008 CLUSTER_SERVER   SYSTEM      HIB      10 804331F0 81246600   313
          $254$DUA200:[SYS6.SYSCOMMON.][SYSEXE]CSP.EXE;300
    .
    .
    .
 33C0010D 000D NETACP           DECNET      CUR  00 10 8044C6D0 816D8600  1500
          $254$DUA200:[SYS6.SYSCOMMON.]<SYSEXE>NETACP.EXE;3
 33C0010E 000E EVL              DECNET      HIB       4 8044CD60 817FCE00    68
          $254$DUA200:[SYS6.SYSCOMMON.]<SYSEXE>EVL.EXE
    .
    .
    .
```

The SHOW SUMMARY/INDEX command describes all active processes in the VAX system at the time of the system failure. Note that the process NETACP is in the CUR state on CPU 00 of a VAX multiprocessor at the time of the failure.

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] symbol-name*

PARAMETER

symbol-name
Name of the symbol to be displayed. You must provide a **symbol-name**.

QUALIFIER

/ALL
Displays information on all symbols whose names begin with the characters specified in **symbol-name**.

DESCRIPTION

The SHOW SYMBOL/ALL command is useful for determining the names of symbols that belong to a symbol set, as illustrated in the following example.

EXAMPLE

```
SDA> SHOW SYMBOL G
G = 80000000 :  8FBC0FFC
```

The SHOW SYMBOL command evaluates the symbol G as 80000000_{16} and displays the contents of address 80000000_{16} as $8FBC0FFC_{16}$.

```
SDA>  SHOW SYMBOL/ALL BUG
Symbols sorted by name
----------------------
BUG$BUILD_HEADE 80002038 => 24A89F16        BUG$_CONSOLRX50 00000640 => 10A2020E
BUG$DUMP_REGIST 80002040 => 24A89F16        BUG$_CONTRACT   000000C0
BUG$FATAL       80002048 => 24A89F16        BUG$_CPUBUSYWAI 00000780 => 6501FB30
BUG$L_BUGCHK_FL 80004108 => 00000001        BUG$_CPUCEASED  000005E8 => 5EDD0000
BUG$L_FATAL_SPS 8000410C => 7FFE7C6C        BUG$_CPUEXIT    000006B8 => 218FD007
BUG$READ_ERR_RE 80002050 => 24A89F16        BUG$_CPUSANITY  00000778 => 8A031164
BUG$REBOOT      80002058 => 6E9E9F17        BUG$_CTERM      00000678 => 00000004
BUG$TABLE       8000D09E => 00280001        BUG$_CWSERR     00000698 => 004C414E
    .
    .
    .
```

The preceding 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.

SPAWN

Creates a subprocess of the process currently running SDA, copying the context of the current process to the subprocess and, optionally, executing within the subprocess a specified command.

FORMAT

SPAWN *[/qualifier[,...]] [command]*

PARAMETER

command

Name of the command that you want executed by the subprocess.

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. Once 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$OUTPUT when the subprocess completes processing or aborts. The default behavior is that such a message is not sent to SYS$OUTPUT.

/NOWAIT

Specifies that the system is not to wait until the subprocess is completed before allowing more commands to be specified. This qualifier allows you to specify new commands while the spawned subprocess is running. If you specify /NOWAIT, you should use /OUTPUT to direct the output of the subprocess to a file in order 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 commands to be specified.

/OUTPUT=filespec

Specifies an output file to which the results of the SPAWN operation are written. You should specify an output other than SYS$OUTPUT whenever you specify /NOWAIT to prevent output from the spawned subprocess from being displayed while you are specifying new commands. If you omit the /OUTPUT qualifier, output is written to the current SYS$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.

EXAMPLE

```
SDA>  SPAWN
$  MAIL
   .
   .
   .
$  DIR
   .
   .
   .
$  LO
   Process SYSTEM_1 logged out at 5-MAR-1989 15:42:23.59
SDA>
```

The previous example shows a general use of the SPAWN command to create a subprocess that issues DCL commands to invoke the Mail Utility and list the contents of a directory before logging off to return to the parent process executing SDA.

VALIDATE QUEUE

Validates the integrity of the specified queue by checking the pointers in the queue.

FORMAT

VALIDATE QUEUE *[address] [/SELF-RELATIVE]*

PARAMETER

address

Address of an element in a queue.

If you specify the period character (.) 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
```

QUALIFIER

/SELF_RELATIVE

Specifies that the selected queue is a self-relative queue.

DESCRIPTION

The VALIDATE QUEUE command uses the forward and 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 the VALIDATE QUEUE command is used 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
```

EXAMPLE

```
SDA>  VALIDATE QUEUE/SELF_RELATIVE IOC$GL_IRPFL
Queue is complete, total of 159 elements in the queue
```

The previous example validates the self-relative queue that is the IRP lookaside list. The validation is successful and determines that there are 159 IRPs in the list.

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VMS System Dump Analyzer Utility Manual
AA–LA87A–TE

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Reader's Comments

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Please use this postage-paid form to comment on this manual. If you require a written reply to a software problem and are eligible to receive one under Software Performance Report (SPR) service, submit your comments on an SPR form.

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Accuracy (software works as manual says)	☐	☐	☐	☐
Completeness (enough information)	☐	☐	☐	☐
Clarity (easy to understand)	☐	☐	☐	☐
Organization (structure of subject matter)	☐	☐	☐	☐
Figures (useful)	☐	☐	☐	☐
Examples (useful)	☐	☐	☐	☐
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