Chapter 5
Managing and Monitoring the System

5

This chapter describes the EXEC commands you use to monitor, manage, and troubleshoot general system processes and conditions on your network server. These include:

- System memory allocator and buffer pools
- System configuration and processes
- Stack utilization
- System error message logs
- Temperature and voltage readings on the AGS+ router

This chapter also provides a general overview of these system tasks:

- Using the **debug** commands to troubleshoot network problems
- Testing connectivity
- Tracing routes
- Testing the system

See the chapters containing information about the interfaces and the protocols supported by Cisco software for descriptions of the interface-specific and protocol-specific debugging and monitoring commands.

Most of the network management commands are executed at the privileged-level prompt, although there is a subset of monitoring commands that you may enter at the user-level prompt.

At the end of the chapter is an alphabetically arranged summary of the commands described in this chapter.

Monitoring System Processes

Use the EXEC show commands to display data structures, configuration parameters, and usage statistics for the network server. To list all the available **show** command options, enter this command at the EXEC prompt.

show ?

Two different lists will be displayed, one at the user-level prompt, and one at the enabled, privileged-level prompt. The lists include a summary of the command function, for easy reference. See the chapter "First-Time Startup and Basic Configuration" for the procedure to enter these levels.

Displaying Buffer Pool Statistics

The network server has one pool of queuing elements and five pools of packet buffers of different sizes. For each pool, the network server keeps counts of the number of buffers outstanding, the number of buffers in the free list, and the maximum number of buffers allowed in the free list. To display statistics for the buffer pools on the network server, use the **show buffers** command. Enter this command at the EXEC prompt:

> **show buffers** [*interface*]

The optional argument *interface* causes a search of all buffers that have been associated with that interface for longer than one minute. The contents of these buffers are printed to the screen. This option is useful in diagnosing problems where the input queue count on an interface is consistently nonzero.

Following is sample output without the optional *interface* argument. Table 1-1 describes the fields seen.

```
Buffer elements:
     250 in free list (250 max allowed)
     10816 hits, 0 misses, 0 created
Small buffers, 104 bytes (total 120, permanent 120):
     120 in free list (0 min, 250 max allowed)
     26665 hits, 0 misses, 0 trims, 0 created
Middle buffers, 600 bytes (total 90, permanent 90):
     90 in free list (0 min, 200 max allowed)
     5468 hits, 0 misses, 0 trims, 0 created
Big buffers, 1524 bytes (total 90, permanent 90):
     90 in free list (0 min, 300 max allowed)
     1447 hits, 0 misses, 0 trims, 0 created
Large buffers, 5024 bytes (total 0, permanent 0):
     0 in free list (0 min, 100 max allowed)
     0 hits, 0 misses, 0 trims, 0 created
Huge buffers, 12024 bytes (total 0, permanent 0):
     0 in free list (0 min, 30 max allowed)
     0 hits, 0 misses, 0 trims, 0 created

0 failures (0 no memory)
```

Table 1-1   Show Buffers Field Descriptions

Field	Description
Buffer elements	Blocks of memory used in internal operating system queues
Small buffers Middle buffers Big buffers Large buffers Huge buffers	Blocks of memory used to hold network packets
hits	Count of successful attempts to allocate a buffer when needed
misses	Count of allocation attempts which failed for lack of a free buffer in the pool
created	Count of new buffers created
trims	Count of buffers destroyed
in free list	Number of buffers of a given type that are not currently allocated and are available for use
max allowed	The maximum number of buffers of a given type allowed in the system
failures	The total number of allocation requests that have failed for lack of a free buffer
no memory	Number of failures due to a lack of memory to create a new buffer

Displaying System Memory Statistics

To show statistics about the memory, use the **show memory** command. Enter this command at the EXEC prompt:

show memory

This command displays memory free pool statistics. These statistics include summary information about the activities of the system memory allocator, and a block-by-block listing of memory use. Sample output follows. Table 1-1 describes the fields; Table 1-1 lists the characteristics of each block of memory in the system.

```
          Head    Free Start   Total Bytes    Used Bytes      Free Bytes
Processor 148B8C     1D66B0       2847860         561252         2286608

Address   Bytes Prev.    Next    Free? PrevF    NextF   Alloc PC  What
148B8C     916 0         148F20                          7B8E       *Init*
14B27C     100 14AA94    14B2E0                          3F2FE      Logger
14B2E0     152 14B27C    14B378                          1DBC     Router Init
14B378     480 14B2E0    14B558   y   1CE270  1CA938  5E85A      IGRP Router
14B558     100 14B378    14B5BC                          57A8E    DECnet Input
14B5F8      72 14B5BC    14B640                          7B830     XNS Router
14B6BC      88 14B688    14B714                          C724C    Virtual Exec
```

Table 1-2   Show Memory Field Descriptions

Field	Description
Head	Hexadecimal address of the head of the memory allocation chain
Free Start	Hexadecimal address of the base of the free list
Total Bytes	Total amount of system memory
Used Bytes	Amount of memory in use
Free Bytes	Amount of memory not in use

Table 1-3   Characteristics of Each Block of Memory

Field	Description
Address	Hexadecimal address of block
Bytes	Size of block in bytes
Prev	Address of previous block (should match Address on previous line)
Next	Address of next block (should match address on next line)
Free?	Tells if the block is free
Alloc PC	Address of the system call that allocated the block
What	Name of process that owns the block

Displaying Active System Processes

To see information about the active processes, use the **show processes** command. Enter this command at the EXEC prompt:

show processes

Following is a partial display of the command output. Table 1-1 describes the fields.

```
PID Q T    PC Runtime (ms)   Invoked   uSecs   Stacks    TTY Process
  1 M E 17518        40072       830   48279  606/800     0 Net Background
  2 M E  5040          932        11   84727  486/800     0 Logger
 32 M E 4C390        73012      6141   11889  480/800     0 IGRP Router
  4 M E 22984          172       252     682  662/800     0 BOOTP Server
  5 H E  5040       100324     66619    1505  606/900     0 IP Input
  6 M E 21278        12188     22451     542  508/800     0 IP Protocols
  7 M E 32F32           32     10926       2  592/800     0 TCP Timer
  8 L E 33C1E          508        28   18142  576/800     0 TCP Protocols
  9 L E  5040         1104       935    1180  666/800     0 ARP Input
 10 L E  5040          352       458     768  674/800     0 Probe Input
 11 H E  5040         2636      9077     290  710/800     0 Net Input
 12 M T  2CF2        36976     49175     751  602/800     0 TTY Background
 13 H E  5040            0         2       0  852/900     0 DECnet Input
 14 M E 44AE4        21964     18029    1218  742/900     0 DECnet Routing
```

Table 1-4   Show Processes Field Descriptions

Field	Description
PID	Process ID
Q	Process queue priority (high, medium, low)
T	Scheduler test (Event, Time, Suspended)
PC	Current program counter
Runtime (ms)	CPU time the process has used, in milliseconds
Invoked	Number of times the process has been invoked
uSecs	Microseconds of CPU time for each invocation
Stacks	Low water mark/Total stack space available
TTY	Terminal that controls the process
Process	Name of process
CPU utilization	Provides a general idea of how busy the processor is. It is a ratio of the current idle time over the longest idle time. This information should be used as an estimate only.

Note: Because the network server has a 4-millisecond clock resolution, run times are considered reliable only after a large number of invocations or a reasonable, measured run time.

Displaying Memory Utilization

To show memory utilization, use the **show processes memory** command. Enter this command at the EXEC prompt:

show processes memory

The **show processes memory** command monitors the memory utilization of processes. The following is a display of sample output. Table 1-5 describes the fields.

```
Total: 2416588, Used: 530908, Free: 1885680
   PID  TTY  Allocated     Freed    Holding Process
     0    0     462708      2048     460660 *Init*
     0    0         76      4328 -     4252 *Sched*
     0    0      82732     33696      49036 *Dead*
     1    0       2616         0       2616 Net Background
     2    0          0         0          0 Logger
    21    0      20156        40      20116 IGRP Router
     4    0        104         0        104 BOOTP Server
     5    0          0         0          0 IP Input
     6    0          0         0          0 TCP Timer
     7    0        360         0        360 TCP Protocols
     8    0          0         0          0 ARP Input
     9    0          0         0          0 Probe Input
    10    0          0         0          0 MOP Protocols
```

```
     11    0            0              0       0 Timers
     12    0            0              0       0 Net Input

                                          530936 Total
```

Table 1-5   Show Processes Memory Field Descriptions

Field	Description
PID	Process ID.
TTY	Terminal that controls the process.
Allocated	Sum of all memory that process has requested from the system.
Freed	How much memory a process has returned to the system.
Holding	Allocated memory minus freed memory. A value can be negative when it has freed more than it was allocated.
Process	Process name.
Init	System initialization.
Sched	The scheduler.
Dead	Processes as a group that are now dead.
Total	Total amount of memory held.

Displaying Stack Utilization

To show stack utilization, use the **show stacks** command. Enter this command at the EXEC prompt:

show stacks

The **show stacks** command monitors the stack utilization of processes and interrupt routines. Its display includes the reason for the last system reboot. If the system was reloaded because of a system failure, a saved system stack trace is displayed. This information can be useful for analyzing crashes in the field.

Displaying the System Configuration

To display the contents of the nonvolatile memory, if present and valid, use the **show configuration** command. Enter this command at the EXEC prompt:

show configuration

The nonvolatile memory stores the configuration information in the network server in text form as configuration commands.

Displaying the Error Logging Conditions

To show the state of logging (syslog), use the **show logging** command. Enter this command at the EXEC prompt:

show logging

This command displays the state of syslog error and event logging, including host addresses, and whether console logging is enabled. This command also displays SNMP (Simple Network Management Protocol) configuration parameters and protocol activity. See the section "Redirecting System Error Messages" in the chapter "Configuring the System, for an explanation of how to configure message logging. Following is a sample output. Table 1-1 describes the fields.

```
Syslog logging: enabled
    Console logging: disabled
    Monitor logging: level debugging, 266 messages logged.
    Trap logging: level informational, 266 messages logged.
    Logging to 131.108.2.238

SNMP logging: disabled, retransmission after 30 seconds
    0 messages logged
```

Table 1-6   Show Logging Field Descriptions

Field	Description
Syslog logging	When enabled, system logging messages are sent to a UNIX host that acts as a syslog server; that is, it captures and saves the messages.
Console logging	If enabled, states the level; otherwise this field displays disabled.
Monitor logging	The minimum level of severity required for a log message to be sent to a monitor terminal (not the console).
Trap logging	The minimum level of severity required for a log message to be sent to syslog server.
SNMP logging	Shows whether SNMP logging is enabled and the number of messages logged, and the retransmission interval.

Displaying Protocol Information

To display the configured protocols, use the **show protocols** command. Enter this command at the EXEC prompt:

show protocols

The command shows the global and interface-specific status of any configured Level 3 protocol; for example, IP, DECnet, Novell, AppleTalk, and so forth. The following is sample output:

```
Global values:
  Internet Protocol routing is enabled
  DECNET routing is enabled
  XNS routing is enabled
  Appletalk routing is enabled
  X.25 routing is enabled
Ethernet 0 is up, line protocol is up
  Internet address is 131.108.1.1, subnet mask is 255.255.255.0
  Decnet cost is 5
  XNS address is 2001.AA00.0400.06CC
  AppleTalk address is 4.129, zone Twilight
Serial 0 is up, line protocol is up
  Internet address is 192.31.7.49, subnet mask is 255.255.255.240
Ethernet 1 is up, line protocol is up
  Internet address is 131.108.2.1, subnet mask is 255.255.255.0
  Decnet cost is 5
  XNS address is 2002.AA00.0400.06CC
  AppleTalk address is 254.132, zone Twilight
Serial 1 is down, line protocol is down
  Internet address is 192.31.7.177, subnet mask is 255.255.255.240
  AppleTalk address is 999.1, zone Magnolia Estates
```

Obtaining AGS+ System Temperature and Voltage Readings

Use the **show environment** command to display temperature and voltage information on the AGS+ console. The following is a sample of this command's usage and output:

show environment

Example:

```
Router#show environment
 Environmental controller firmware version 2.0
   Serial number is 00220846, calibrated on 2-14-92, by technician rma
   Internal temperature measured 34.3(C), shuts down at 43.0(C)
   Air flow appears good.
   +5 volt line measured at 5.061(V)
   +12 volt line measured at 12.120(V)
   -12 volt line measured at -11.936(V)
   -5 volt line measured at -4.986(V)
 Router#
```

Once a minute a routine is run that gets environmental measurements from the CSC-ENVM card and stores the **show environment** output into a buffer. This buffer is displayed on the console when **show environment** is invoked.

Receipt of the Automatic Warning Message

If a measurement exceeds desired margins, but has not exceeded fatal margins, a warning message is printed to the system console. The system software queries the CSC-ENVM card for measurements once a minute, but warnings for a given testpoint are printed at most once every four hours. If a measurement is out of line within a four-hour period, an automatic warning message appears on the console. As noted above, the user may query the CSC-ENVM using the **show environment** command at any time to determine if a measurement is at the warning tolerance.

Examples:

The following is an example of a message that displays on the system console when a measurement has exceeded an acceptable margin:

```
Router#
ENVIRONMENTAL WARNING: Air flow appears marginal.
```

The following is an example of a message that displays on the system console when a measurement has exceeded an acceptable margin. In this example, the internal temperature reading is given.

```
Router#
ENVIRONMENTAL WARNING: Internal temperature measured 41.3(C)
```

The following is an example of a message that displays on the system console when a voltage measurement has exceeded an acceptable margin:

```
Router#
ENVIRONMENTAL WARNING:  +5 volt testpoint measured 5.310(V)
```

Receipt of the Automatic Shutdown Message

If the CSC-ENVM card on the AGS+ chassis detects that any of its voltage or temperature testpoints has exceeded maximum margins, it does the following in this order:

Step 1: Saves the last measured values from each of the six testpoints to internal nonvolatile memory.

Step 2: Interrupts the system software and causes a shudown message to be printed on the system console.

Step 3: Shuts off the power supply after a few milliseconds of delay.

The following is the message the system displays if voltage or temperature exceed maximum margins:

Example:

```
Router#
SHUTDOWN: air flow problem
```

Refer to the *Modular Products Installation and Reference* publication for environmental specifications.

Displaying Reason for Last Environmental Shutdown

If a shutdown occurs due to detection of fatal environmental margins, the CSC-ENVM logs the last measured value from each of the six testpoints to internal nonvolatile memory. Only one set of measurements may be stored at any one time.

These testpoints may be displayed at any time with the **show environment last** command.

show environment last

Example:

```
Router#show environment last
Environmental controller firmware version 2.0
  Serial number is 3232, calibrated on 2-14-92, by technician rma
  Internal temperature measured 24.1(C), shuts down at 43.0(C)
  Air flow appears good.
  +5 volt line measured at 4.988(V)
  +12 volt line measured at 12.044(V)
  -12 volt line measured at -11.787(V)
  -5 volt line measured at -4.939(V)


LAST Environmental Shutdown Measurements:
  Internal temperature was 24.0(C)
  Air flow sensor was good
  +5 volt line was 4.990(V)
  +12 volt line was 9.900(V)*
  -12 volt line was -11.719(V)
  -5 volt line was -4.926(V)
Router#
```

The first block of data is equivalent to **show environment**, in that it displays the current measurements. The second block shows all the testpoint values at the time of the LAST environmental shutdown. An asterisk suffixes the testpoint that caused the failure. In the above example, we see that the +12 volt testpoint dropped to 9.900(V) to cause the shutdown.

Verifying Installation of Flash Memories and Displaying Flash Statistics

To verify that the CSC-MCI card or the CSC-ENVM card is properly connected to the CSC-MC+ card, use the **show flash** or **show flash all** commands. The **show flash** command displays the total amount of Flash memory present on the Flash card, the type of card connected to the Flash card, any files that may currently exist in Flash memory, and the amounts of Flash memory used and remaining. The **show flash all** command displays all the above information, but also shows all the information about each Flash memory device.

show flash
show flash all

Full details on Flash Memories are found in the chapter "Configuring the System."

Troubleshooting Network Operations

The network server includes software to aid in tracking down problems with the network server or with other hosts on the network. The privileged EXEC command **debug** enables the display of several classes of network events on the console terminal. The privileged **undebug** command turns off the display of these classes. The EXEC command **show debugging** displays the state of each debugging option.

> **show debugging**

See the section "Redirecting System Error Messages" in the chapter "Configuring the System" for an explanation of how to configure message logging.

Note: Debugging output is given high priority by the system. For this reason, debugging commands should be turned on only for troubleshooting specific problems, or during troubleshooting sessions with Cisco staff. Excessive debugging output can render the system unusable.

To list and briefly describe all the **debug** command options, enter the **debug ?** command at the privileged-level EXEC prompt.

> **debug ?**

This section provides an overview of how to use the debugging commands. See the interface and protocol-specific chapters for the **debug** command descriptions.

To turn on all system diagnostics, enter this command at the EXEC prompt:

> **debug all**

Its converse, the **undebug all** command, turns off all diagnostic output.

Testing Connectivity with the Ping Command

As an aid to diagnosing basic network connectivity, many network protocols support the *packet internet groper* (ping) program, which sends an echo request packet to an address, then awaits a reply. Results from this echo protocol can help in evaluating the path-to-host reliability, delays over the path, and whether the host can be reached or is functioning.

Note: Not all protocols require hosts to support pings, and for some protocols, the pings are Cisco-defined and are only answered by another Cisco router.

To implement this program, use the privileged EXEC command **ping**. When the **ping** command is entered, the system issues a prompt for one of the following protocol key-words—**appletalk**, **clns**, **ip**, **novell**, **pup**, or **xns.**

The default protocol is IP. After determining the protocol type, the **ping** command prompts for an address or host name, repeat count (default is 5), datagram size (default is 100 bytes), time-out interval (default is 2 seconds), and extended commands (default is none). The precise dialog varies from protocol to protocol.

If a host name or address is typed on the same line as the EXEC **ping** command, the default action is taken as appropriate for the protocol type of that name or address.

The **ping** command uses the exclamation point (!) and period (.) in its display. Each exclamation point indicates receipt of a reply. A period (.) indicates the network server timed out while waiting for a reply. Other characters may appear in the ping output display, depending on the protocol type. The output concludes with the success rate and minimum, average, and maximum round-trip times.

To abort a ping session, type the escape sequence (by default, Ctrl-^ X, which is done by simultaneously pressing the Ctrl, shift, and 6 keys, letting go, then pressing the X key).

Sample displays and tips for using these protocols are included in the chapters describing the protocols supported by the Cisco **ping** command.

Checking Routes with the Trace Command

The **trace** command is a useful debugging command that allows the network administrator to discover the routes packets will actually take when travelling to their destination. The **trace** command supports **ip**, **clns**, and **vines** route tracing.

> **trace** [*destination*]

To invoke a simple trace test, enter the destination address or host name on the command line. The default parameters for the appropriate protocol are assumed and the tracing action begins.

To use nondefault parameters and invoke an extended trace test, enter the command without a destination argument. You will be stepped through a dialog to select the desired parameters.

Typing the escape sequence (by default, Ctrl-^ X, which is done by simultaneously pressing the Ctrl, shift, and 6 keys, letting go, then pressing the X key) terminates a **trace** command. See the IP, ISO CLNS and VINES chapters for more information about using this command.

Writing System Configuration Information

This section describes the privileged **write** commands used to manage the system configuration information.

To erase the configuration information, use the following EXEC command. This command erases the configuration information in the nonvolatile memory. This command does not affect the configuration in use.

write erase

To copy the configuration to memory, use the following EXEC command. This command copies the current configuration information to the nonvolatile memory.

write memory

To copy the configuration to the network, use the following EXEC command. This command sends a copy of the current configuration information to a server host. You are prompted for a destination host and a file name.

write network

To write configuration on the terminal, use the following EXEC command. This command displays the current configuration information on the terminal.

write terminal

Testing the System

Included as part of the EXEC command set are commands that allow testing of system interfaces and memory.

Note: Use of these commands is not recommended, as they are intended to aid Cisco manufacturing staff in checking out system functionality.

To test the system interfaces, use this EXEC command:

test interfaces

The EXEC **test interfaces** command is intended for the factory checkout of network interfaces. It is not intended for diagnosing problems with an operational router. The **test interfaces** output does not report correct results if the router is attached to a "live" network. For each network interface that has an IP address that can be tested in loop back (MCI and cBus Ethernet and all serial interfaces), the **test interface** command sends a series of ICMP echoes. Error counters are examined to determine the operational status of the interface.

To test system memory, use this EXEC command:

test memory

The EXEC command **test memory** performs a test of Multibus memory, including the nonvolatile memory.

> ⚠️ ***Caution:*** The memory test will overwrite the contents of memory. You would need to rewrite nonvolatile memory after running this command. If you test Multibus memory (for example, the memory used by the CSC-R 4 Mbps Token Ring interfaces), you would need to reload the system to restore correct operation of the network interfaces.

16 Mbps Token Ring Card Test

To test the CSC-R16 16 Mbps Token Ring cards, use the **test sbe** EXEC command. The command syntax is:

test sbe

This test runs software diagnostics on 16 Mbps Token Ring interface cards that can be useful when analyzing hardware failures and suspected hardware failures. The command is not designed to be used on a system while the system is in use. This test should be used only at the direction of your Cisco technical support representative.

EXEC System Management Command Summary

This section lists all the EXEC system management and user commands in alphabetical order.

debug ?

Lists and briefly describes all the **debug** command options.

[un]debug all

Enables all diagnostic output. Its converse, the **undebug all** command, turns off all diagnostic output.

ping

Provides a diagnostic tool for testing connectivity. Results help evaluate path-to-host reliability, delays over the path, and whether the host is functioning.

show ?

Lists all the **show** command options. Two lists may be displayed: one at the user-level prompt, and one at the enabled, privileged-level prompt.

show buffers [*interface*]

Displays statistics for the buffer pools on the network server. The network server has one pool of queuing elements and five pools of packet buffers of different sizes. For each pool, the network server keeps counts of the number of buffers outstanding, the number of buffers in the free list, and the maximum number of buffers allowed in the free list. With the optional argument *interface*, this command searches all buffers that have been associated with the interface for longer than one minute.

show configuration

Displays the contents of the nonvolatile memory, if present and valid. The nonvolatile memory stores the configuration information in the network server in text form as configuration commands.

show debugging

Displays the current settings of the **debug** command options.

show environment

Displays temperature and voltage information on the AGS+ console.

show environment last

Displays the last measured value from each of six testpoints if a system shutdown occurs due to detection of fatal environmental margins. The CSC-ENVM logs to internal nonvolatile memory. Only one set of measurements may be stored at any one time.

show flash

Displays the total amount of Flash memory present on the Flash card, the type of card connected to the Flash card, any files that may currently exist in Flash memory, and the amounts of Flash memory used and remaining.

show flash all

Displays all the output of **show flash**, but also shows information about each Flash memory device.

show logging

Displays the state of syslog error and event logging, including host addresses and whether console logging is enabled. This command also displays SNMP configuration parameters and protocol activity.

show memory

Displays memory free pool statistics. These statistics include summary information about the activities of the system memory allocator, and a block-by-block listing of memory use.

show processes

Displays information about all active processes.

show processes memory

Displays information about memory utilization.

show protocols

Displays the global and interface-specific status of any configured Level 3 protocol.

show stacks

Monitors the stack utilization of processes and interrupt routines. Its display includes the reason for the last system reboot. If the system was reloaded because of a system failure, a saved system stack trace is displayed. This information can be useful to support staff for analyzing crashes in the field.

test interfaces

Intended for the factory checkout of network interfaces. It is not intended for diagnosing problems with an operational router.

test memory

Performs a destructive test of Multibus memory, including the nonvolatile memory.

test sbe

Tests the CSC-R16 16 Mbps Token Ring card.

trace [*destination*]

Allows the network administrator to discover the routes packets will actually take when travelling to their destination. The **trace** command supports IP, CLNS, and VINES route tracing. Typing the escape sequence terminates **trace**.

write erase

Erases the configuration information in the nonvolatile memory. This command does not affect the configuration in use.

write memory

Copies the current configuration information to the nonvolatile memory.

write network

Sends a copy of the current configuration information to a server host. You are prompted for a destination host and a file name.

write terminal

Displays the current configuration information.