



## CHAPTER 9

# Managing System Hardware

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This chapter provides details on how to manage system hardware other than services and switching modules and how to monitor the health of the switch. It includes the following sections:

- [Displaying Switch Hardware Inventory, page 9-1](#)
- [Running Compact Flash Tests, page 9-4](#)
- [Updating the CompactFlash Firmware, page 9-6](#)
- [Displaying the Switch Serial Number, page 9-9](#)
- [Displaying Power Usage Information, page 9-10](#)
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## Displaying Switch Hardware Inventory

Use the **show inventory** command to view information on the field replaceable units (FRUs) in the switch, including product IDs, serial numbers, and version IDs. See [Example 9-1](#).

### **Example 9-1** Displays the Hardware Inventory

```
switch# show inventory
NAME: "Chassis", DESCR: "MDS 9506 chassis"
PID: DS-C9506 , VID: 0.104, SN: FOX0712S00T

NAME: "Slot 3", DESCR: "2x1GE IPS, 14x1/2Gbps FC Module"
PID: DS-X9302-14K9 , VID: 0.201, SN: JAB081405AF

NAME: "Slot 4", DESCR: "2x1GE IPS, 14x1/2Gbps FC Module"
PID: DS-X9302-14K9 , VID: 0.201, SN: JAB081605A5

NAME: "Slot 5", DESCR: "Supervisor/Fabric-1"
PID: DS-X9530-SF1-K9 , VID: 4.0, SN: JAB0747080H
```

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```
NAME: "Slot 6", DESCR: "Supervisor/Fabric-1"
PID: DS-X9530-SF1-K9      , VID: 4.0, SN: JAB0746090H
```

```
NAME: "Slot 17", DESCR: "MDS 9506 Power Supply"
PID: DS-CAC-1900W       , VID: 1.0, SN: DCA07216052
```

```
NAME: "Slot 19", DESCR: "MDS 9506 Fan Module"
PID: DS-6SLOT-FAN      , VID: 0.0, SN: FOX0638S150
```

Use the **show hardware** command to display switch hardware inventory details. See [Example 9-2](#).



**Note**

To display and configure modules, see [Chapter 10, "Managing Modules."](#)

**Example 9-2 Displays the Hardware Information**

```
switch# show hardware
Cisco Storage Area Networking Operating System (SAN-OS) Software
TAC support: http://www.cisco.com/tac
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The copyright for certain works contained herein are owned by
Cisco Systems, Inc. and/or other third parties and are used and
distributed under license.
```

Software

```
BIOS:      version 1.0.8
loader:    version 1.1(0.114)
kickstart: version 1.3(4a)
system:    version 1.3(4a)
```

```
BIOS compile time:      08/07/03
kickstart image file is: bootflash:///boot-17r
kickstart compile time: 10/25/2010 12:00:00
system image file is:   bootflash:///isan-17r
system compile time:    10/25/2020 12:00:00
```

Hardware

```
RAM 1024592 kB
```

```
bootflash: 1000944 blocks (block size 512b)
slot0:      0 blocks (block size 512b)
```

```
172.22.90.21 uptime is 7 days 4 hours 48 minute(s) 2 second(s)
```

```
Last reset at 272247 usecs after Thu Sep 11 21:47:05 1980
Reason: Reset Requested by CLI command reload
System version: 1.3(4a)
```

```
This supervisor carries Pentium processor with 1024592 kB of memory
Intel(R) Pentium(R) III CPU at family with 512 KB L2 Cache
Rev: Family 6, Model 11 stepping 1
```

```
512K bytes of non-volatile memory.
1000944 blocks of internal bootflash (block size 512b)
```

```
-----
Chassis has 9 slots for Modules
-----
```

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```
Module in slot 1 is empty

Module in slot 2 is empty

Module in slot 3 is empty

Module in slot 4 is empty

Module in slot 5 is ok
  Module type is "Supervisor/Fabric-1"
  No submodules are present
  Model number is DS-X9530-SF1-K9
  H/W version is 1.0
  Part Number is 73-7523-06
  Part Revision is A0
  Manufacture Date is Year 6 Week 47
  Serial number is JAB064705E1
  CLEI code is CNP6NT0AAA

Module in slot 6 is empty

Module in slot 7 is empty

Module in slot 8 is empty

Module in slot 9 is empty

-----
Chassis has 2 Slots for Power Supplies
-----

PS in slot A is ok
  Power supply type is "1153.32W 110v AC"
  Model number is WS-CAC-2500W
  H/W version is 1.0
  Part Number is 34-1535-01
  Part Revision is A0
  Manufacture Date is Year 6 Week 16
  Serial number is ART061600US
  CLEI code is

PS in slot B is ok
  Power supply type is "1153.32W 110v AC"
  Model number is WS-CAC-2500W
  H/W version is 1.0
  Part Number is 34-1535-01
  Part Revision is A0
  Manufacture Date is Year 5 Week 41
  Serial number is ART0541003V
  CLEI code is

-----
Chassis has one slot for Fan Module
-----

Fan module is ok
  Model number is WS-9SLOT-FAN
  H/W version is 0.0
  Part Number is 800-22342-01
  Part Revision is
  Manufacture Date is Year 0 Week 0
  Serial number is
  CLEI code is
```

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## Running Compact Flash Tests

In Cisco SAN-OS Release 3.1(3), you can run the CompactFlash CRC checksum test to identify if the CompactFlash firmware is corrupted and needs to be updated. By default, the CompactFlash CRC checksum test is enabled to automatically run in the background every seven days (you can change the automatic test interval by using the **system health module cf-crc-check frequency** command in configuration mode). You can run the test on demand by using the **system health cf-crc-check module** CLI command in EXEC mode. To turn the automatic testing off, use the **no system health module cf-crc-check** command in configuration mode.

The CompactFlash CRC checksum test can check if CompactFlash is corrupted on the following modules:

- DS-X9016
- DS-X9032
- DS-X9302-14K9
- DS-X9308-SMIP
- DS-X9304-SMIP
- DS-X9530-SF1-K9

This section includes the following tasks:

- [Running the CompactFlash CRC Checksum Test On Demand, page 9-4](#)
- [Enabling and Disabling the Automatic CompactFlash CRC Checksum Test, page 9-4](#)
- [Setting the CompactFlash CRC Checksum Test Interval, page 9-5](#)
- [Enabling and Disabling Failure Action at the Failure of a CompactFlash Checksum Test, page 9-5](#)
- [Displaying the Frequency and Status of the CompactFlash CRC Checksum Test, page 9-5](#)

### Running the CompactFlash CRC Checksum Test On Demand

To run the CompactFlash CRC checksum test, use the **system health cf-crc-check module** command in EXEC mode.

```
switch# system health cf-crc-check module number
```

Where *number* indicates the slot in which the identified module resides. For example:

```
switch(config)# system health cf-crc-check module 4
```

### Enabling and Disabling the Automatic CompactFlash CRC Checksum Test

By default, the CompactFlash CRC Checksum test is enabled to automatically run in the background. You can disable the automatic testing and then enable the testing at a later time. You can run the test on demand at any time by using the **system health cf-crc-check module** command in EXEC mode.

To enable automatic CompactFlash CRC checksum testing, use the **system health module cf-crc-check** command in configuration mode.

```
switch# system health module number cf-crc-check
```

Where *number* indicates the slot in which the identified module resides. For example:

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```
switch(config)# system health module 4 cf-crc-check
```

To disable automatic CompactFlash CRC checksum testing, use the **no system health module cf-crc-check** command in EXEC mode.

```
switch(config)# no system health module number cf-crc-check
```

## Setting the CompactFlash CRC Checksum Test Interval

To set the CompactFlash CRC checksum test interval, use the **system health module cf-crc-check frequency** command in configuration mode.

To set the CompactFlash CRC checksum test interval, follow these steps:

	Command	Purpose
Step 1	switch# <b>config t</b>	Enters configuration mode.
Step 2	switch(config)# <b>system health module number cf-crc-check frequency number</b> switch(config)#	Configures the CompactFlash CRC checksum test interval in days. The default interval is 7 days.

## Enabling and Disabling Failure Action at the Failure of a CompactFlash Checksum Test

You can use the **system health module cf-crc-check failure-action** command to prevent the Cisco SAN-OS software from taking any action if a CompactFlash failure is determined while running the CRC checksum test and the failed CompactFlash is isolated from further testing. By default, this feature is enabled in all switches in the Cisco MDS 9000 Family. A failure action is controlled at the module level.

Use the **system health module cf-crc-check failure-action** command in configuration mode to enable the CompactFlash CRC checksum test failure action for a module.

To enable the CompactFlash CRC checksum test failure action, follow these steps:

	Command	Purpose
Step 1	switch# <b>config t</b>	Enters configuration mode.
Step 2	switch(config)# <b>system health module number cf-crc-check failure-action</b> switch(config)#	Enables the CompactFlash CRC checksum test failure action for a specified module.

To disable the CompactFlash CRC checksum test failure action, use the **no system health module cf-crc-check failure-action** command in configuration mode.

## Displaying the Frequency and Status of the CompactFlash CRC Checksum Test

To display the frequency and status of the CompactFlash CRC checksum test for a specific module, use the **show system health module** command in EXEC mode.

```
switch# show system health module 5
```

```
Current health information for module 5.
```

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Test	Frequency	Status	Action
Bootflash	10 Sec	Running	Enabled
EOBC	5 Sec	Running	Enabled
Loopback	5 Sec	Running	Enabled
CF checksum	1 Day	Running	Enabled
CF re-flash	30 Days	Running	Enabled

## Updating the CompactFlash Firmware

In Cisco SAN-OS Release 3.1(3), you can update the CompactFlash firmware on selected modules. By default, the firmware update feature is enabled to automatically update the firmware every 30 days (you can manually set the firmware update intervals by using the **system health module cf-re-flash frequency** command in configuration mode). You can also update the firmware on demand by using the **system health cf-re-flash module** command in EXEC mode.

Firmware updates can be enabled on the following modules:

- DS-X9016
- DS-X9032
- DS-X9302-14K9
- DS-X9308-SMIP
- DS-X9304-SMIP
- DS-X9530-SF1-K9

This section includes the following tasks:

- [Updating the CompactFlash Firmware On Demand, page 9-6](#)
- [Enabling and Disabling the CompactFlash Firmware Update, page 9-7](#)
- [Setting the CompactFlash Firmware Update Interval, page 9-7](#)
- [Enabling and Disabling Failure Action at the Failure of a CompactFlash Firmware Update, page 9-7](#)
- [Displaying the Frequency and Status of CompactFlash Updates, page 9-8](#)

## Updating the CompactFlash Firmware On Demand

To update the CompactFlash firmware on demand, use the **system health cf-re-flash module** command in EXEC mode.

```
switch# system health cf-re-flash module number
```

Where *number* indicates the slot in which the identified module resides. For example:

```
switch(config)# system health cf-re-flash module 4
```

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## Enabling and Disabling the CompactFlash Firmware Update

By default, the CompactFlash firmware is updated automatically every 30 days. You can disable the automatic update and then enable the automatic update at a later time. You can update the CompactFlash firmware on demand at any time by using the **system health cf-re-flash module** command in EXEC mode.

To enable automatic firmware updates, use the **system health module cf-re-flash** command in configuration mode.

```
switch(config)# system health module number cf-re-flash
```

Where *number* indicates the slot in which the identified module resides. For example:

```
switch(config)# system health module 4 cf-re-flash
```

To disable automatic firmware updates, use the **no system health module cf-re-flash** command in configuration mode.

```
switch(config)# no system health module number cf-re-flash
```

## Setting the CompactFlash Firmware Update Interval

To set the firmware update interval, use the **system health module cf-re-flash frequency** command in configuration mode. The default interval is every 30 days.

To set the firmware update interval, follow these steps:

	Command	Purpose
Step 1	switch# <b>config t</b>	Enters configuration mode.
Step 2	switch(config)# <b>system health module number cf-re-flash frequency number</b> switch(config)#	Configures the firmware update interval in days. The default interval is 30 days.

## Enabling and Disabling Failure Action at the Failure of a CompactFlash Firmware Update

You can use the **system health module cf-re-flash failure-action** command to prevent the Cisco SAN-OS software from taking any action if a CompactFlash failure is determined while updating the CompactFlash firmware. By default, this action is taken if a failure is determined and the failed CompactFlash is isolated from further testing. A failure action is controlled at the module level.

Use the **system health module cf-re-flash failure-action** command in configuration mode to enable the CompactFlash firmware update failure action for a module.

To enable the CompactFlash CRC checksum test failure action, follow these steps:

	Command	Purpose
Step 1	switch# <b>config t</b>	Enters configuration mode.
Step 2	switch(config)# <b>system health module number cf-re-flash failure-action</b> switch(config)#	Enables the CompactFlash CRC firmware update failure action for a specified module.

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To disable the CompactFlash CRC firmware update test failure action, use the **no system health module cf-re-flash failure-action** command in configuration mode.

## Displaying the Frequency and Status of CompactFlash Updates

To display the frequency and status of the flash updates for a specific module, use the **show system health module** command in EXEC mode.

```
switch# show system health module 5
```

Current health information for module 5.

Test	Frequency	Status	Action
Bootflash	10 Sec	Running	Enabled
EOBC	5 Sec	Running	Enabled
Loopback	5 Sec	Running	Enabled
CF checksum	1 Day	Running	Enabled
CF re-flash	30 Days	Running	Enabled

## Displaying CompactFlash CRC Test and Firmware Update Statistics

To display the CompactFlash CRC checksum test and the flash update statistics, use the **show system health statistics** command in EXEC mode.

```
switch# show system health statistics
```

Test statistics for module 2

Test Name	State	Frequency	Run	Pass	Fail	CFail	Errs
Bootflash	Running	10s	28316	28316	0	0	0
EOBC	Running	5s	56632	56632	0	0	0
Loopback	Running	5s	56618	56618	0	0	0
CF checksum	Running	2d	2	2	0	0	0
CF re-flash	Running	30d	1	1	0	0	0

Test statistics for module 5

Test Name	State	Frequency	Run	Pass	Fail	CFail	Errs
Bootflash	Running	10s	28314	28314	0	0	0
EOBC	Running	5s	56629	56629	0	0	0
Loopback	Running	5s	56614	56614	0	0	0
CF checksum	Running	1d	4	4	0	0	0
CF re-flash	Running	30d	1	1	0	0	0

Test statistics for module 7

Test Name	State	Frequency	Run	Pass	Fail	CFail	Errs
InBand	Running	5s	56643	56643	0	0	0
Bootflash	Running	10s	28323	28323	0	0	0
EOBC	Running	5s	56643	56643	0	0	0
Management Port	Running	5s	56643	56643	0	0	0



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```
Test statistics for module 8
-----
Test Name          State          Frequency  Run    Pass    Fail CFail Errs
-----
InBand             Running        5s         56624  56624   0      0      0
Bootflash          Running        10s        28317  28317   0      0      0
EOBC               Running        5s         56624  56624   0      0      0
-----

Test statistics for module 13
-----
Test Name          State          Frequency  Run    Pass    Fail CFail Errs
-----
Bootflash          Running        10s        28304  28304   0      0      0
EOBC               Running        5s         56608  56608   0      0      0
Loopback           Running        5s         56608  56608   0      0      0
-----
```

## Displaying the Switch Serial Number

The serial number of your Cisco MDS 9000 Family switch can be obtained by looking at the serial number label on the back of the switch (next to the power supply), or by executing the operating system **show sprom backplane 1** command.

```
switch# show sprom backplane 1
DISPLAY backplane sprom contents:
Common block:
  Block Signature : 0xabab
  Block Version   : 2
  Block Length    : 156
  Block Checksum  : 0x106f
  EEPROM Size     : 512
  Block Count     : 3
  FRU Major Type  : 0x6001
  FRU Minor Type  : 0x0
  OEM String      : Cisco Systems, Inc.
  Product Number  : DS-C9506
  Serial Number : FOX0712S007
  Part Number     : 73-8697-01
  Part Revision   : 01
  Mfg Deviation   : 0
  H/W Version     : 0.1
  Mfg Bits        : 0
  Engineer Use    : 0
  snmpOID         : 9.12.3.1.4.26.0.0
  Power Consump   : 0
  RMA Code        : 0-0-0-0
Chassis specific block:
...
```



### Note

If you are installing a new license, use the **show license host-id** command to obtain the switch serial. See [Chapter 3, “Obtaining and Installing Licenses,”](#) for further information.

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## Displaying Power Usage Information

Use the **show environment power** command to display the actual power usage information for the entire switch. In response to this command, power supply capacity and consumption information is displayed for each module. See [Example 9-3](#).



### Note

In a Cisco MDS 9500 Series switch, power usage is reserved for both supervisors regardless of whether one or both supervisor modules are present.

### Example 9-3 Displays Power Management Information

```
switch# show environment power
```

```
-----
PS  Model                Power      Power      Status
   (Watts)      (Amp @42V)
-----
1   DS-CAC-2500W         1153.32   27.46      ok
2   WS-CAC-2500W         1153.32   27.46      ok
```

```
Mod Model                Power      Power      Power      Power      Status
  Requested Requested  Allocated Allocated
  (Watts)   (Amp @42V) (Watts)   (Amp @42V)
-----
1   DS-X9032             199.92    4.76       199.92    4.76      powered-up
4   DS-X9032             199.92    4.76       199.92    4.76      powered-up
5   DS-X9530-SF1-K9     126.00    3.00       126.00    3.00      powered-up
6   DS-X9530-SF1-K9     126.00    3.00       126.00    3.00      powered-up
9   DS-X9016             220.08    5.24       220.08    5.24      powered-up
```

```
Power Usage Summary:
```

```
-----
Power Supply redundancy mode:                redundant

Total Power Capacity                          1153.32 W

Power reserved for Supervisor(s) [-]         252.00 W
Power reserved for Fan Module(s) [-]         0.00 W
Power currently used by Modules[-]           619.92 W

-----
Total Power Available                          281.40 W
-----
```

## Power Supply Configuration Modes

Switches in the MDS 9000 Family have two redundant power supply slots. The power supplies can be configured in either redundant or combined mode.

- Redundant mode—Uses the capacity of one power supply only. This is the default mode. In case of power supply failure, the entire switch has sufficient power available in the system.

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- Combined mode—Uses the combined capacity of both power supplies. In case of power supply failure, the entire switch can be shut down (depends on the power used) causing traffic disruption. This mode is seldom used, except in cases where the switch has two low power supply capacities but a higher power usage.



**Note** The chassis in the Cisco MDS 9000 Family uses 1200 W when powered at 110 V, and 2500 W when powered at 220 V.

To configure the power supply mode, follow these steps:

	Command	Purpose
<b>Step 1</b>	switch# <b>confi g t</b>	Enters configuration mode.
<b>Step 2</b>	switch(config)# <b>power redundancy-mode combined</b> switch(config)#	Configures combined power supply mode.
	switch(config)# <b>power redundancy-mode redundant</b> switch(config)#	Reverts to the redundant (default) power supply mode.



**Note** See the Use the **show environment power** command to view the current power supply configuration.

## Power Supply Configuration Guidelines

Follow these guidelines when configuring power supplies:

1. When power supplies with different capacities are installed in the switch, the total power available differs based on the configured mode, either redundant or combined:

- a. Redundant mode—the total power is the lesser of the two power supply capacities. For example, suppose you have the following usage figures configured:

Power supply 1 = 2500 W  
 Additional power supply 2 = not used  
 Current usage = 2000 W  
 Current capacity = 2500 W

Then the following three scenarios differ as specified (see [Table 9-1](#)):

**Scenario 1:** If 1800 W is added as power supply 2, then power supply 2 is shut down.

**Reason:** 1800 W is less than the usage of 2000 W.

**Scenario 2:** If 2200 W is added as power supply 2, then the current capacity decreases to 2200 W.

**Reason:** 2200 W is the lesser of the two power supplies.

**Scenario 3:** If 3000 W is added as power supply 2, then the current capacity value remains at 2500 W.

**Reason:** 2500 W is the lesser of the two power supplies.

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**Table 9-1 Redundant Mode Power Supply Scenarios**

Scenario	Power Supply 1 (W) <sup>1</sup>	Current Usage (W)	Insertion of Power Supply 2 (W)	New Capacity (W)	Action Taken by Switch
1	2500	2000	1800	2500	Power supply 2 is shut down.
2	2500	2000	2200	2200	Capacity becomes 2200 W.
3	2500	2000	3300	2500	Capacity remains the same.

1. W = Watts

- b. Combined mode—the total power is twice the lesser of the two power supply capacities.

For example, suppose you have the following usage figures configured:

Power supply 1 = 2500 W

Additional Power supply 2 = not used

Current Usage = 2000 W

Current capacity = 2500 W

Then, the following three scenarios differ as specified (see [Table 9-2](#)):

**Scenario 1:** If 1800 W is added as power supply 2, then the capacity increases to 3600 W.

**Reason:** 3600 W is twice the minimum (1800 W).

**Scenario 2:** If 2200 W is added as power supply 2, then the current capacity increases to 4400 W.

**Reason:** 4400 W is twice the minimum (2200 W).

**Scenario 3:** If 3000 W is added as power supply 2, then the current capacity increases to 5000 W.

**Reason:** 5000 W is twice the minimum (2500 W).

**Table 9-2 Combined Mode Power Supply Scenarios**

Scenario	Power Supply 1 (W) <sup>1</sup>	Current Usage (W)	Insertion of Power Supply 2 (W)	New Capacity (W)	Action Taken by Switch
1	2500	2000	1800	3600	Power is never shut down. The new capacity is changed.
2	2500	2000	2200	4400	
3	2500	2000	3300	5000	

1. W = Watts

2. When you change the configuration from combined to redundant mode and the system detects a power supply that has a capacity lower than the current usage, the power supply is shut down. If both power supplies have a lower capacity than the current system usage, the configuration is not allowed. Several configuration scenarios are summarized in [Table 9-3](#).

**Scenario 1:** You have the following usage figures configured:

Power supply 1 = 2500 W

Additional Power supply 2 = 1800 W

Current Usage = 2000 W

Current mode = combined mode (so current capacity is 3600 W)

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You decide to change the switch to redundant mode. Then power supply 2 is shut down.

**Reason:** 1800 W is the lesser of the two power supplies and it is less than the system usage.

**Scenario 2:** You have the following usage figures configured:

Power supply 1 = 2500 W

Additional Power supply 2 = 2200 W

Current Usage = 2000 W

Current mode = combined mode (so current capacity is 4400 W).

You decide to change the switch to redundant mode. Then the current capacity decreases to 2200 W.

**Reason:** 2200 W is the lesser of the two power supplies.

**Scenario 3:** You have the following usage figures configured:

Power supply 1 = 2500 W

Additional Power supply 2 = 1800 W

Current Usage = 3000 W

Current mode = combined mode (so current capacity is 3600 W).

You decide to change the switch to redundant mode. Then the current capacity decreases to 2500 W and the configuration is rejected.

**Reason:** 2500 W is less than the system usage (3000 W).

**Table 9-3 Combined Mode Power Supply Scenarios**

Scenario	Power Supply 1 (W) <sup>1</sup>	Current Mode	Current Usage (W)	Power Supply 2 (W)	New Mode	New Capacity (W)	Action Taken by Switch
1	2500	combined	2000	1800	N/A	3600	This is the existing configuration.
	2500	N/A	2000	1800	redundant	2500	Power supply 2 is shut down
2	2500	combined	2000	2200	N/A	4400	This is the existing configuration.
	2500	N/A	2000	2200	redundant	2200	The new capacity is changed.
3	2500	combined	3000	1800	N/A	3600	This is the existing configuration.
	2500	N/A	3000	1800	redundant	N/A	Rejected, so the mode reverts to combined mode.

1. W = Watts

## About Crossbar Management

Cisco MDS SAN-OS Release 3.0(1) and later supports two types of hardware for the Cisco MDS 9500 Series Directors: Generation 1 and Generation 2.

*Generation 1* consists of all hardware supported by Cisco SAN-OS prior to Release 3.0(1), including the following:

- Cisco MDS 9506 and 9509 Director chassis
- Supervisor-1 module

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- 32-port 2-Gbps Fibre Channel switching module
- 16-port 2-Gbps Fibre Channel switching module
- 8-port IP Storage Services (IPS-8) module
- 4-port IP Storage Services (IPS-4) module
- Storage Services Module (SSM)
- 14/2-port Multiprotocol Services (MPS-14/2) module

*Generation 2* consists of all new hardware supported by Cisco SAN-OS Release 3.0(1) and later, including the following:

- Cisco MDS 9513 Director chassis
- Supervisor-2 module
- 48-port 4-Gbps Fibre Channel switching module
- 24-port 4-Gbps Fibre Channel switching module
- 12-port 4-Gbps Fibre Channel switching module
- 4-port 10-Gbps Fibre Channel switching module

The Cisco MDS 9500 Series Directors running Cisco MDS SAN-OS 3.0(1) or later support the following types of crossbars:

- Integrated crossbar—Located on the Supervisor-1 and Supervisor-2 modules. The Cisco MDS 9506 and 9509 Directors only use integrated crossbars.
- External crossbar—Located on an external crossbar switching module. Cisco MDS 9513 Directors require external crossbar modules.

## Operational Considerations When Removing Crossbars

You can mix and match Generation 1 and Generation 2 hardware on the Cisco MDS 9500 Series Directors running Cisco MDS SAN-OS 3.0(1) or later without compromising the integrity and availability of your SANs based on Cisco MDS 9500 Series Directors.

To realize these benefits, you must consider the following operational requirements when *removing* crossbars for maintenance activities:

- [Graceful Shutdown of a Crossbar, page 9-14](#)
- [Backward Compatibility for Generation 1 Modules in Cisco MDS 9513 Directors, page 9-15](#)

### Graceful Shutdown of a Crossbar

You must perform a graceful shutdown of a crossbar (integrated or external) before removing it from the MDS 9500 Series Director.

- You must enter the EXEC mode **out-of-service xbar** command for a graceful shutdown of external crossbar modules in a Cisco MDS 9513 Director.

**out-of-service xbar slot**

Where *slot* indicates the external crossbar module slot number.

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**Note** To reactivate the external crossbar module, you must remove and reinsert or replace the crossbar module.

- You must enter the EXEC mode **out-of-service module** command for a graceful shutdown of integrated crossbars on the supervisor module in a Cisco MDS 9506 or 9509 Director.

**out-of-service module** *slot*

Where *slot* indicates the chassis slot number on either the Supervisor-1 module or the Supervisor-2 module in which the integrated crossbar resides.



**Note** To reactivate the integrated crossbar, you must remove and reinsert or replace the Supervisor-1 module or Supervisor-2 module.



**Caution**

Taking the crossbar out-of-service may cause a supervisor switchover.

## Backward Compatibility for Generation 1 Modules in Cisco MDS 9513 Directors

To provide backward compatibility for a Generation 1 module in a Cisco MDS 9513 chassis, the active and backup Supervisor-2 modules are associated to a specific crossbar module. The Supervisor-2 module in slot 7 is associated with crossbar module 1 and Supervisor-2 module in slot 8 is associated with crossbar module 2. You must plan for the following operational considerations before removing crossbar modules:

- Whenever a crossbar module associated with the active Supervisor-2 module goes offline or is brought online in a system that is already online, a stateful supervisor switchover occurs. This switchover does not disrupt traffic. Events that cause a crossbar module to go offline include the following:
  - Out-of-service requests
  - Physical removal
  - Errors
- Supervisor-2 module switchovers do *not* occur if the crossbar switching module associated with the *backup* Supervisor-2 module goes offline.



**Note**

Supervisor-2 module switchovers do *not* occur when removing crossbar switch modules on a Cisco MDS 9513 that only has Generation 2 modules installed.

## About Module Temperature

Built-in, automatic sensors are provided in all switches in the Cisco MDS 9000 Family to monitor your switch at all times.

Each module (switching and supervisor) has four sensors: 1 (outlet sensor), 2 (intake sensor), 3 (onboard sensor), and 4 (onboard sensor). Each sensor has two thresholds (in degrees Celsius): minor and major.

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**Note**

A threshold value of -127 indicates that no thresholds are configured or applicable.

- Minor threshold—When a minor threshold is exceeded, a minor alarm occurs and the following action is taken for all four sensors:
  - System messages are displayed.
  - Call Home alerts are sent (if configured).
  - SNMP notifications are sent (if configured).
- Major threshold—When a major threshold is exceeded, a major alarm occurs and the following action is taken.
  - For sensors 1, 3, and 4 (outlet and onboard sensors):
    - System messages are displayed.
    - Call Home alerts are sent (if configured).
    - SNMP notifications are sent (if configured).
  - For sensor 2 (intake sensor):
    - If the threshold is exceeded in a switching module, only that module is shut down.
    - If the threshold is exceeded in an active supervisor module with HA-standby or standby present, only that supervisor module is shut down and the standby supervisor module takes over.
    - If you do not have a standby supervisor module in your switch, you have an interval of 2 minutes to decrease the temperature. During this interval the software monitors the temperature every five (5) seconds and continuously sends system messages as configured.

**Tip**

To realize the benefits of these built-in, automatic sensors on any switch in the Cisco MDS 9500 Series, we highly recommend that you install dual supervisor modules. If you are using a Cisco MDS 9000 Family switch without dual supervisor modules, we recommend that you immediately replace the fan module if even one fan is not working.

## Displaying Module Temperature

Use the **show environment temperature** command to display temperature sensors for each module (see [Example 9-4](#) and [Example 9-5](#)).

### **Example 9-4** Displays Temperature Information for Generation 1 Hardware

```
switch# show environment temperature
-----
Module  Sensor  MajorThresh  MinorThres  CurTemp  Status
        (Celsius) (Celsius)    (Celsius)
-----
2       Outlet  75           60          35       ok
2       Intake  65           50          33       ok
5       Outlet  75           60          44       ok
5       Intake  65           50          36       ok
6       Outlet  75           60          42       ok
6       Intake  65           50          35       ok
```



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```

7      Outlet  75      60      33      ok
7      Intake  65      50      30      ok

9      Outlet  75      60      34      ok
9      Intake  65      50      39      ok

```

**Example 9-5 Displays Temperature Information for Generation 2 Hardware**

```

switch# show environment temperature
-----
Module   Sensor      MajorThresh  MinorThres  CurTemp     Status
        (Celsius)  (Celsius)   (Celsius)
-----
1        Outlet1    75           60          33          ok
1        Outlet2    65           50          30          ok
1        Intake1    65           50          30          ok
1        LcFwdUp   65           50          35          ok
1        LcFwdDn   65           50          39          ok
1        FC-MAC  65           50          34          ok

6        Outlet1    75           60          33          ok
6        Outlet2    65           50          30          ok
6        Intake1    65           50          30          ok
6        Crosbar  65           50          35          ok
6        Arbiter  65           50          39          ok
6        CPU      65           50          34          ok

```

## About Fan Modules

Hot-swappable fan modules (fan trays) are provided in all switches in the Cisco MDS 9000 Family to manage airflow and cooling for the entire switch. Each fan module contains multiple fans to provide redundancy. The switch can continue functioning in the following situations:

- One or more fans fail within a fan module—Even with multiple fan failures, switches in the Cisco MDS 9000 Family can continue functioning. When a fan fails within a module, the functioning fans in the module increase their speed to compensate for the failed fan(s).
- The fan module is removed for replacement—The fan module is designed to be removed and replaced while the system is operating without presenting an electrical hazard or damage to the system. When replacing a failed fan module in a running switch, be sure to replace the new fan module within five minutes.



**Tip**

If one or more fans fail within a fan module, the Fan Status LED turns red. A fan failure could lead to temperature alarms if not corrected immediately.

The fan status is continuously monitored by the Cisco MDS SAN-OS software. In case of a fan failure, the following action is taken:

- System messages are displayed.
- Call Home alerts are sent (if configured).
- SNMP notifications are sent (if configured).

Use the **show environment fan** command to display the fan module status (see [Example 9-6](#)).

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**Example 9-6 Displays Chassis Fan Information**

```
switch# show environment fan
-----
Fan           Model           Hw           Status
-----
Chassis      DS-9SLOT-FAN    1.2         ok
PS-1         --              --          ok
PS-2         --              --          absent
```

The possible Status field values for a fan module on the Cisco MDS 9500 Series switches are as follows:

- If the fan module is operating properly, the status is ok.
- If the fan is physically absent, the status is absent.
- If the fan is physically present but not working properly, the status is failure.

On the Cisco MDS 9513 Director, the front fan module has 15 fans. If the front fan module (DS-13SLT-FAN-F) State field contains “failure” in the **show environment fan** command output, it also displays the numbers of the failing fans (see [Example 9-7](#)).

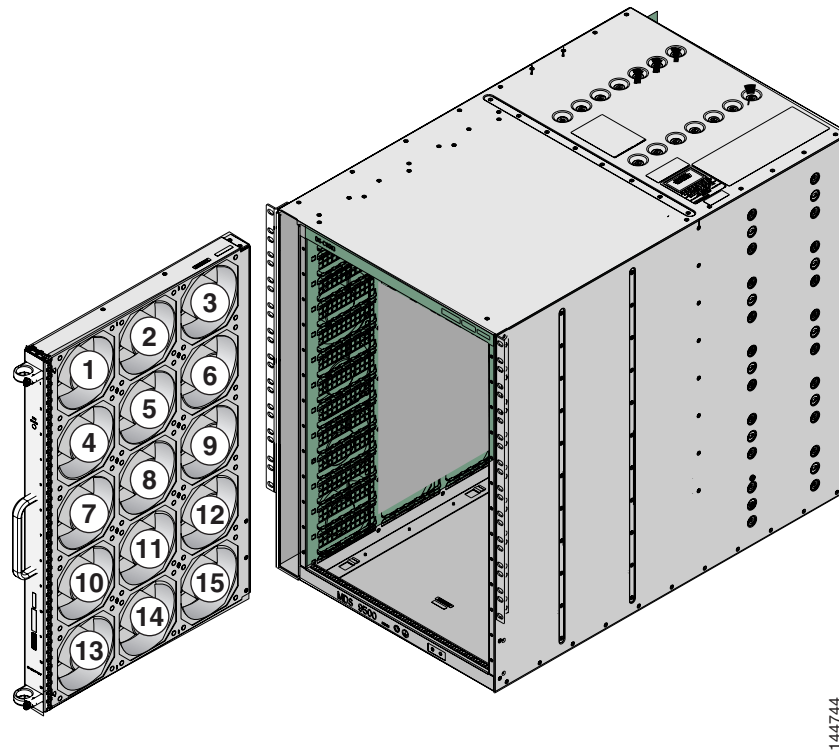
**Example 9-7 Displays Cisco MDS 9513 Front Fan Module Failure**

```
switch# show environment fan
-----
Fan           Model           Hw           Status
-----
Chassis      DS-13SLT-FAN-F  0.3         failure 3 5 6 13
Chassis      DS-13SLT-FAN-R  0.3         ok
PS-1         --              --          ok
PS-2         --              --          ok
```

[Figure 9-1](#) shows the numbering of the fans in the front fan module on the Cisco MDS 9513 Director.

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Figure 9-1 Cisco MDS 9513 Front Fan Module Numbering



The rear fan module (DS-13SLT-FAN-R) on the Cisco MDS 9513 Director has only two fans. If a fan in the rear fan module fails, the State field in the **show environment fan** command output only displays “failure” and not the failing fan number (see [Example 9-8](#)).

**Example 9-8 Displays Cisco MDS 9513 Rear Fan Module Failure**

```
switch# show environment fan
-----
Fan           Model           Hw           Status
-----
Chassis      DS-13SLT-FAN-F  0.3         ok
Chassis      DS-13SLT-FAN-R  0.3         failure
PS-1         --              --          ok
PS-2         --              --          ok
```

## About Clock Modules

All switches in the Cisco MDS 9000 Family have two clock modules—Module A (primary) and Module B (redundant). The clock modules are designed, tested, and qualified for mission-critical availability with a mean time between failures (MTBF) of 3,660,316 hours. This translates to a potential failure every 365 years. Additionally, Cisco MDS 9000 Family switches are designed to automatically switch to the redundant clock module should the active clock module fail.

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**Tip**

We recommend that the failed clock module be replaced during a maintenance window.

Use the **show environment clock** command to display the status for both clock modules (see [Example 9-9](#)).

**Example 9-9 Displays Chassis Clock Information**

```
switch# show environment clock
-----
Clock          Model          Hw          Status
-----
A              DS-C9500-CL   0.0        ok/active
B              DS-C9500-CL   0.0        ok/standby
```

## Displaying Environment Information

Use the **show environment** command to display all environment-related switch information.

**Example 9-10 Displays All Environment Information**

```
switch# show environment
Clock:
-----
Clock          Model          Hw          Status
-----
A              Clock Module   1.0        ok/active
B              Clock Module   1.0        ok/standby

Fan:
-----
FAN            Model          Hw          Status
-----
Chassis        DS-2SLOT-FAN   0.0        ok
PS-1           --             --          ok
PS-2           --             --          absent

Temperature:
-----
Module  Sensor  MajorThresh  MinorThres  CurTemp  Status
        (Celsius) (Celsius)    (Celsius)
-----
1       1       75           60          32       ok
1       2       65           50          32       ok
1       3       -127        -127        43       ok
1       4       -127        -127        39       ok

Power Supply:
-----
PS  Model          Power      Power      Status
   (Watts)    (Amp @42V)
-----
1   PWR-950-AC     919.38    21.89     ok
2   --             --        --        absent

Mod Model          Power      Power      Power      Power      Status
   Requested Requested  Allocated Allocated
   (Watts)    (Amp @42V) (Watts)    (Amp @42V)
-----
1   DS-X9216-K9-SUP 220.08    5.24     220.08    5.24     powered-up
```

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```
Power Usage Summary:
-----
Power Supply redundancy mode:          redundant
Total Power Capacity                   919.38  W
Power reserved for Supervisor(s)[-]   220.08  W
Power reserved for Fan Module(s)[-]    0.00   W
Power currently used by Modules[-]     0.00   W
-----
Total Power Available                  699.30  W
-----
```

## Default Settings

Table 9-4 lists the default hardware settings.

**Table 9-4**      **Default Hardware Parameters**

Parameters	Default
Power supply mode	Redundant mode.

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